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This report presents the interim results of an Applied Research Project conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

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This basic report exists only in an electronic version.

Table of Contents

Figures

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Tables

Chapter 1

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 1 – Environment in European cities ("sustainability")

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1. Introduction

Urban systems emerge as distinct entities from the complex interactions among social, economic and cultural attributes, and information, energy and material stocks and flows that operate on different temporal and spatial scales. Such complexity poses a challenge to identify the causes of urban environmental problems and how to address them without causing greater deterioration.
Classically urban environmental issues have been addressed from the health perspective (e.g. air pollution or water). The Rio Conference in 1992 was a turning point towards the integration of sustainability into all policy fields. At European level it has been reflected in the Thematic Strategy on Urban Environment where urban environmental management is included as one of the four pillars, being the others urban transport, sustainable construction and urban design.

However, the diversity of factors acting at different scales poses a great challenge when analysing the sustainable dimension of urban areas in a large geographic area as Europe. Some of the constrains or complexities that we face today can be summarised as follows:

- Data availability. The increased capacity of computing and data availability from multiple sources has not yet been digested in a structured system that would make more efficient the use of existing resources. In that sense INSPIRE Directive is an important step towards an integrated and harmonised environmental information system, but still under development.
- New paradigms as quality of life, looking for a better integration between environment, planning, management and people's life requires closer cooperation between multiple disciplines (sociology, economy, biology,…).
- The need for a conceptual framework. Very often the limitations imposed by the data availability and new demands does not allow to test assumptions taken for granted.
- The availability of detailed studies at local level are important but does not provide –alone or uncoordinated, the basis to build robust theories.

The scope of this project is far beyond solving some of these questions. However, our hypothesis is that the spatial patterns of urban dynamics are key to understand the environemntal aspects of urban areas.

2. Literature review

Sustainability

Framing the concept

Sustainability has become a mainstream word extensivelly used, as if only mentioning it would solve the environmental problems. In particular the concept sustainable cities appear everywhere, but in many cases the conceptual or empirical basis is missed. Consequently it is very difficult to set targets and to get the right information to assess the evolution and trends. Moreover, very often the concept is used as an absolute attribute (sustainable/unsustainable) whereas it would be more pertinent to analyse sustainable/unsustainable process/trends.
The policy report European Sustainable Cities (1994,1996) called for an integrated ecosystems-based view of the city and emphasised, for example, demand-side

management, equity and efficiency in the use of resources and effective engagement with local communities and other stakeholders. Practical application of these ideas and further development of local sustainability approaches has been carried out through the European Sustainable Cities and Towns Campaign.
Although the integration of different disciplines (termodynamics, ecology and information theory) is still in a research phase, several factors have been identified as key components of sustainable systems:

- Rates of consumption of natural resources below certain thresholds;
- Maximisation of energy efficiency;
- Maintenance of ecosystem services;
- Maximisation of networks, diversity and information flow.

Taking some of these principles, three different approaches have been identifyied:

- **Ecological footprint**. The ecological footprint is a measure of the resources necessary to produce the goods that an individual or population consumes. Some authors criticise this approach because, among others, it does not take into account land degradation obscuring the effects of a larger sustainability problem. However, it has been a useful tool for communication as has been proven in London.
- **Urban metabolism**. The socio-economic metabolism approach conceptualizes the relationship between societies and their natural environment as a physical input–output process: materials and energy are extracted from the environment, processed within society, partly accumulated as socioeconomic stocks (e.g., buildings, infrastructure, durable consumer goods, etc.), and, finally, released into the environment, either as waste and emissions, or as deliberate discharges such as fertilizers or pesticides (Ayres and Simonis, 1994; Fischer-Kowalski, 1997; Matthews et al., 2000)
- **Environmental vectors or domains**. In this approach different compartments of the urban system are analysed considering their trends over time.

The problem of the first two approaches is the high data requirements reflected in that most of the studies focus in few, if not only one, cities or areas.
The environmental vectors also allows to emphasize the land dimension, beyond the city skirts, which is a central component of the hypothesis presented in the project:

- Environmental issues in the city
  - Air quality
  - Energy consumption
  - Land consumption
  - Quantity and quality of green areas
- Environment beyond the city border
  - Land consumption
  - Geographic estension of the impact of the city growth
  - Pressure on natural areas
  - Fragmentation

<u>Land resources</u>
Land, and soil, can be considered limited resources at human scale. The Soil Thematic Strategy identifies soil sealing by impervious surface as one of the main threats to soil conservation in Europe.
Loss of farmland and natural areas in the surrounding countryside, whilst the creation of greenspace within urban areas did not match the speed of urban growth (EEA, 2002). Moreover, there is an impact that extends far beyond of the city limits by the destruction of biotopes and fragmentation of eco-systems. It also increase the pressure on protected areas by increased air pollution.
These changes are characterized by a generalized **homogenization** of the existing traditional landscape diversity and the creation of largely chaotic patterns. Such a chaotic development is typical for complex systems and is also referred to as autonomous development (Antrop, 1998). New forms of land use are **not ecologically related** any more with the land and the place.

All these environmental issues are clearly related to the type and form of city growth. Moreover, once urban areas have sprawled it is very difficult to counteract its impact given the amount of energy needed to restore urban sealed areas.

Pollution

Despite the **progress** made in controlling local air pollution, urban areas show increasing signs of environmental stress and air quality is one of the major concerns (EEA, 2009). In the period 1997-2005, between 16 and 45 % of the urban population was potentially exposed to ambient air concentrations of PM10 higher than the EU limit value set for the protection of human health. There was no discernible trend over this period and differences between years were related to weatehr conditions (EEA 2007). Many European urban areas experience daily average PM10 concentrations higher than 50µg/m3 on more than the permitted 35 days per year. The highest urban concentrations were observed in cities in northern Italy (Po valley), Spain, Portugal, the Czech Republic, Poland, Hungary, Romania, Bulgaria, the Benelux countries, Greece, and the cities of the West Balkan countries.

For ozone (O3) there was considerable variation over the years. During most years, 20-25% of the urban population was exposed to concentrations above the target value. In 2003, a year with extremely high ozone concentrations due to specific meteorological conditions, the exposure to high concentrations increased to about 60%.

About a quarter of the urban population in north-western Europe, Romania and Bulgaria remain potentially exposed to concentrations above the NO2 limit value. The percentage of the urban population exposed to SO2 concentrations above the short-term limit values decreased to less than 1% and the EU limit value is thus close to being met (EEA, 2007).

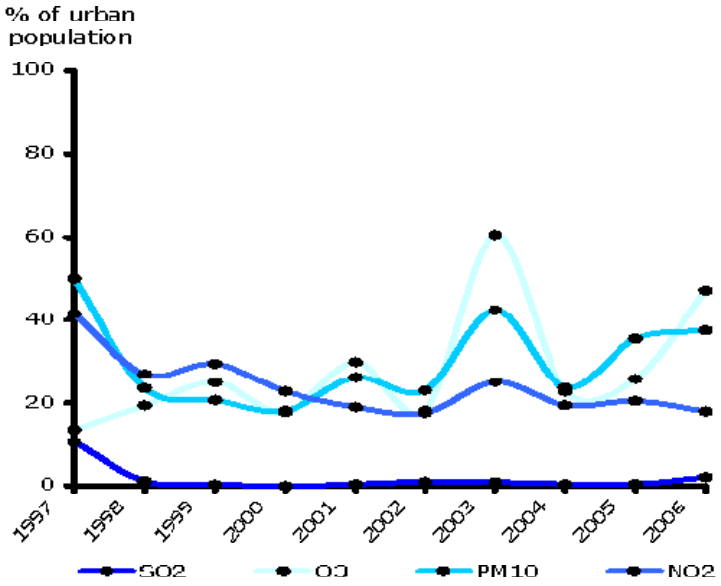


Figure 1. Percentages of the urban population in EEA member countries (except Turkey) exposed to air pollution above the limit and target values (AirBase)

As a result, the exceedance of air quality standards seriously increased respiratory and cardiovascular diseases, in particular with young children or elderly people. There seems to be a strong relation between the amount of heavy traffic and the health effects; epidemiological studies, for instance in the Netherlands show that more negative health effects such as lung diseases, coughing and heart diseases occur to people living in the vicinity of major roads (Hoek, 2002). In the European Union, the number of premature deaths that can be attributed to anthropogenic PM2.5 due to emissions from traffic and other sources is estimated to be about 350 000 for the year 2000 (CAFÉ 2005). These

health effects are linked to high economic losses in form of higher costs for medical treatments and losses for employers for sick workers.
While it is clear the linkage between air pollution and emission sources (road traffic, heating systems,…), the relationship between city form and air pollution is more complicated since it strongly depends on the selected area of study (districts, city center, metropolitan area,…) and type of contaminants. Moreover, local geographic and climate conditions can obscure other factors.
In a simulation study, Borrego et al. (2006) found that the highest emission rates were attribute to the so-called corridor city, i.e. cities characterized by growth in linear corridors with origin in the city centre, supported by high quality transport infrastructure (highways). The disperse city demonstrated the lowest emissions per area and the compact city was characterized by lower emission rates per inhabitant. It was concluded that, at regional level, compact cities with mixed land use provide better air quality compared to disperse cities with lower densities and segregated land use or network cities equipped with intensive transport structures.

Noise
European cities have become increasingly "noisy"; the noisy places became not necessarily louder, but there are less quiet places left. Today not only traffic noise, but also leisure and neighbourhood noise affects people since noise surrounds them nearly 24 hours a day. Detailed noise data across Europe is, however, hard to obtain. Different sources give the following picture:

- **Road traffic** is the dominant source of exposure in major urban areas. In 2006, the EU Thematic Strategy on the Urban Environment reported that exposure to continuous road traffic noise affected:
    - 160 million people in the EU-15 (40% of the population) at an "averaged" level above 55 dB(A)- associated with significant annoyance;
    - 80 million people (20% of the population) were exposed to continuous road traffic noise above 65 dB(A) - associated with cardiovascular effects;
- In 2002 the European Commission introduced the Environmental Noise relating to the assessment and management of environmental noise. From the currently available exposure data which only cover parts of the Member states, it can be seen
    - 56 % of the population living in cities is exposed at an "averaged" level above 55 dB(A)- associated with significant annoyance;
    - 35 % of the population living in cities is exposed is exposed to continuous road traffic noise above 65 dB(A) - associated with cardiovascular effects;

Persistent high levels of noise are associated to reading disabilities, memory and concentration loss, as well as to irreversible health effects such as heart attacks and strokes (Stansfeld et al. 2005, Babisch 2006 and Jarup et al., 2008), for instance in the Netherlands, yearly 20-150 people suffer from heart attacks caused by traffic noise (Houthuijs, 2008). It has also an economic impact as stated by Gjestland (2007): in Norway, the "cost" of one extremely annoyed person has been estimated to be approximately 1600 € per year -due to the linearity, the "cost" of a moderately annoyed person thus equals 800 € per year. Moreover, it has been observed that house prices decrease between 1.2 and 1.6% per dB in Denmark, and in Germany the price goes down by a 50% at 70 dB (European Commission, 2007)

Waste
One of the targets set in the 5th Environment Action Programme (EAP) was to reduce the generation of municipal waste per capita per year to the average 1985 EU level of 300kg by the year 2000 and then stabilise it at that level. Figure 2 shows that the target was far from ever being reached. The average amount of municipal waste generated per capita per year in many western European countries still exceeds 550kg.

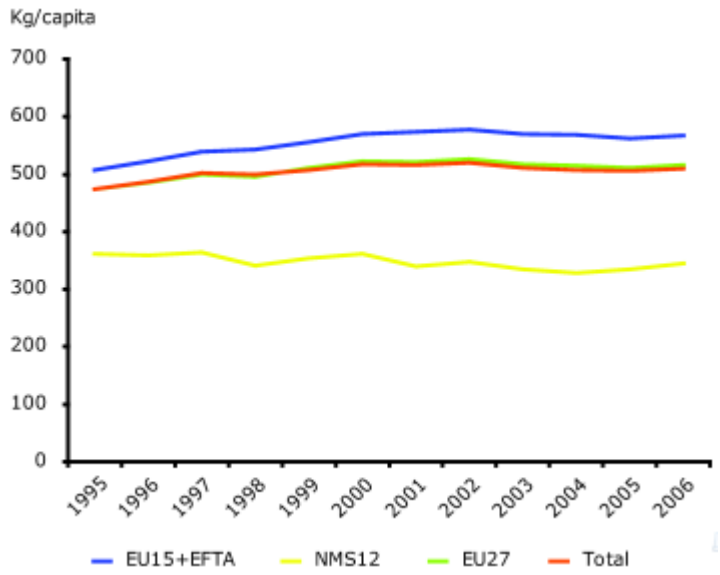


Figure 2. Municipal waste generation in Western Europe (EU-15 + EFTA), New Member States (NMS12), EU countries (EU-27) and total in Europe (total). Source: EEA, 2008

The target was not repeated in the 6th EAP. The Waste Framework Directive (2008/98/EC) rather includes a general target to break the link between economic growth and the environmental impacts associated with the generation of waste. Since generation of municipal waste per capita has stabilised in the EU since 2000 while GDP has increased by 13%, the generation of waste at least has been decoupled from economic growth across the EU. As a result, it is likely, though it does not necessarily follow, that the environmental impacts associated with municipal waste generation have also been decoupled from GDP.
Municipal waste generation rates in new Member States are lower than in western European countries and generation appears to have decreasing somewhat since the mid-nineties. This decrease occurred over a period with strong economic growth as well as growth of consumption expenditure. The causes of the decoupling and overall decreases in municipal waste generation per capita in EU-12 are not clear. Several countries of the region have reported that the reductions are only apparent caused by changes in measurement methods. Weighing of waste deliveries at landfills has been gradually introduced in EU-12 countries over the past decade. Previously the amounts were estimated according to volume. Since amounts of lightweight waste (e.g. packaging) are growing and amounts of heavy fractions (e.g. ash and slag) are decreasing, individual landfills may have overestimated weight of municipal waste in the years immediately prior to introduction of weighing, if based on even older waste composition data. This would lead to a sharp reduction in recorded weight following the introduction of direct weighing of waste. Since weighing has been introduced gradually these numerous sharp reductions would be smoothed out and appear as a gradual decrease in waste generation over a country or region.
Other trends, such as those in consumption patterns and waste collection methods (e.g. limited collection of bulky waste), may also have played a role. Reporting systems may also need further development, especially regarding the definition of municipal/non-municipal waste in some streams e.g. waste from small enterprises and services, bulky waste and packaging waste.

Urban sprawl, a key issue

Urban systems emerge as distinct entities from the complex interactions among social, economic and cultural attributes, and information, energy and material stocks and flows that operate on different temporal and spatial scales. Such complexity poses a challenge to identify the causes of urban environmental problems and how to address them without causing greater deterioration.

Urban sprawl, as opposed to compact city, has been recognised as one of the main problems of cities at the turning of the century for several reasons:

- Unsustainable loss of natural resources (Jenks et al., 1996; Williams et al., 2000; Jenks and Dempsey, 2005).
- Many social and ecological problems are side effects of urban sprawl (Burton, 2000; Jenks and Burgess, 2000).

Urban sprawl first appeared as an American phenomenon, but recent works well described the specificities of this problem in Europe (EEA, 2006; Couch et al. 2007). It can also be recognised that European institutions have been progressively including the urban environment in their agenda although the competence of urban issues lies at Member State level[1].

Working definition

A variety of urban forms have been covered by the term "urban sprawl" ranging from contiguous suburban growth, linear patterns of strip development, leapfrog and scattered development. In terms of urban form, sprawl is positioned against the ideal of the compact city, with high density, centralised development and a spatial mixture of functions, but what is considered to be sprawl ranges along a continuum of more compact to completely dispersed development. In any way it is important to recognise that urban sprawl is not merely an attribute, or **pattern**, of a city. Moreover, it should be considered as a **process of urban change** (Couch et al. 2005). Finally, urban sprawl can not be defined by a single parameter (Kasanko et al. 2006). Galster et al (2001) defines sprawl as a pattern of land use in an urbanised area that exhibits low levels of some **combination of eight distinct dimensions**: density, continuity, concentration, clustering, centrality, nuclearity, mixed uses and proximity. These eight attributes also combine two dimensions of the compacity/sprawl characterisation: physical and functional. The physical compactness refers to the spatial configuration of land use development within the city, the functional compactness to the density and the mix of daily activity

For the purpose of this work this eight dimensions will be considered whenever the information is available.

Urban sprawl in the past 50 years

One of the problems to understand urban sprawl in Europe is the lack of long time series of data. Availability of satellite images and computing capacities were big constrains until the end of 1980s. Consequently, most of the existing information for the period 1950 – 1990 relies on population data. In that sense the work developed under the MOLAND project is the best land cover data for the period 1950 – 2000 since it covers 28 cities.

The following tables summarise the main trends in Europe for the 1950-2000 period compiled from existing literature (Antrop 2004, Kasanko et al. 2006, Turok and Mykhnenko 2007, and Couch et al. 2007).

From the long term data it can be concluded:

- The largest urban land expansion in Europe started in the 1950s.
- The past **history** was reflected in **high diversity** of city attributes at the beginning of this period.
- Rapid changes during the last 50 years resulted from combined effects of increasing affluence, mass motorisation for the transport of persons and goods, the introduction

[1] By the early 1990s DG Environment had placed the issue of the urban environment on the EU policy agenda and later Communications from the European Commission in the second half of the 1990s sought to create an 'urban agenda' which moved urban problems and sustainable urban development up the EU policy agenda. An indication of this change has been that since 1998 most EU Presidencies have held Urban Forums of one sort or another. Indeed by the beginning of the Twenty First Century 'urban issues' had been incorporated into the Structural Funds (Objective 1 and 2) and the URBAN programme was well established along with a number of other urban related initiatives particularly associated with economic competitiveness and social exclusion. Later on urban issues have been mainstreamed and DG Environment has developed a 'Thematic Strategy on the Urban Environment' (2006) as part of the Community's 6th Environmental Action Framework.

of air transportation and the shift from manufacturing to services in urban economies caused a much more **dispersed**, **fragmented** and **low density** urban development. This development did affect existing functions and structures of many cities, in particular less attractive neighbourhoods and obsolete industrial and port areas suffered. Many cities experienced population loss.

- The process did not take place at the same time in all regions. Process in **Mediterranean cities** started later than Northern and Western Central Europe. Also Mediterranean cities were more compact and kept some of this attribute during the 1990s.
- By the end of the 1960s and 1970s a process of **revitalisation** started with new town and urban renewal efforts. Gradually, more investments were made in housing, businesses, infrastructure and public services. The revival is related to the emergence of a society and economy based on knowledge, information and creativity and an accompanied growing interest in urban life styles. But physical and socio-economic polarisation also increased and became a large scale urban problem.

Time-lag	Average annual city population growth rate[1]	Average annual growth of built-up areas (%)[2]	Trends in Western Europe
1950 - 1960		3.3 (1.1 – 8.4)	At the beginning of this period the number of growing cities was more than three times greater than the number of declining. Maximum peak of the growth of built-up areas Progressive decrease in the number of growing cities.
1960 - 1970	2.87		
1970 -1980	2.32	2.3 (0.5 – 6.1)	
1980 -1990	0.97	1.4 (0.4 – 2.5)	Period of stabilisation. Although the average rates decreased, the number of declining cities remained the same as in the late 1970s.
1990 - 2000	-0.13	*0.5* *(estimate from CLC for whole Europe)*	The differential between growing and declining cities narrowed steadily until the late-1990s, when cities fell below national trends and were actually declining on average. For the first time the number of declining cities was greater than the growing ones. The late 1990s was the worst period for European cities as a whole, with decline most widespread.
2000 - 2005	0.15		Resurgence (in general). There was a slight improvement in the first few years of the new millennium, although there were still more cities in relative decline than growing.

1 After Antrop 2004; 2 after Kasanko et al. 2006.

Table 1. Major trends in population and built-up areas in Western Europe (1950-2005)

Time-lag	North West Europe (+ Denmark)	Western Europe	Mediterranean	New Member States
1950 - 1960	Urban population: 75% Start process of suburbanisation	*High variability between cities and countries. No common pattern*.	Urban population: 45% Compact and densely populated	Urban population: 40% Compact cities by centralised planning and reliance on public transport. No suburbanisation process identified. High similarities in the structure of the cities.
1960 - 1970		Start process of suburbanisation in many cities.		
1970 - 1980	Revitalisation. Recovering the city centre in terms of both population and urbanisation.	Revitalisation. Recovering the city centre in terms of both population and urbanisation.		
1980 - 1990		Revitalisation. Recovering the city centre in terms of both population and urbanisation.	Increasing the process of sprawl.	Towards the end of 1980s start of political changes.
1990 - 2000	High rates of sprawl in Ireland. Denmark showed the lowest rates of sprawl.	Average rates of sprawl. Steadily growth of German cities.	Rapid increase of urban sprawl.	Post socialist period. Most cities are declining and sprawling. Romania and Poland show the highest shares of declining cities.
2000 - 2005	Continuous long-term decline in UK (Merseyside, Tyne and Greater Glasgow)	Growth of German cities at lower rates. Few German cities show continuous decline (Leipzig being a prototype of decline and sprawl).	Most of the Spanish and French cities show a continuous growth. Sprawl is still important in Spain.	Decline in most Polish cities.

Table 2. Major trends of urban dynamics in regions of Europe for the period 1950-2005.After Couch et al. (2007) and Turok and Mykhnenko (2007)

- Central planning, dominance of public transport and no land market determined a specific form o **compact** city in **former socialist countries**. Changes since the 1990s are explored in next section.
- Urban change is incremental: most of the physical fabric of cities survives for many decades if not for centuries. The social fabric is much more prone to change, but nevertheless, in general, changes only by a few percentages of change per year.
- There has been a process of **convergence** in most of the cities accelerated by the end of 1990s.

Improved statistical data (e.g. Urban Audit) and the availability of Corine Land Cover for the reference years 1990 and 2000 (2005 to come) explains why this section focus in the 1990s and early 2000s. The appearance of urban issues into the European agenda in the

1990s has facilitated the development of new initiatives for urban data collection at European level (see for example the GMES[2] programme and related Downstream Services). However, most of this information is not yet available.

During this period the growth of urban areas and associated urban infrastructure consumed more than 8 000 km^2, about the size of Luxembourg. This increase has been at higher speed than population change.

Combining land cover and population changes (1990-2000) with population density and percentage of urban land (2000) the following patterns emerged (Figure 1)[3]

- Regions with a **high level of urbanism** and relatively **slow to moderate (physical) growth** are mainly dominant in the Pentagon area (the area limited by London, Paris, Milan, Munich and Hamburg). The fastest urbanisation in north-west Europe is found here. This means that already highly urbanised regions in the European heartland have continued to grow relatively fast. Densification and dedensification are found side by side in this part of Europe.
- In most of southern Europe and in parts of north-western Europe, mainly in regions in Ireland, a **low to moderate level of urbanism** is present. A relatively **rapid physical growth with low densities** is dominant here. The most rapid urbanisation has occurred in regions in Spain, Portugal and Ireland. These are countries which experienced relatively strong economic growth and major infrastructure investments supported by the EU. Also some regions in the Netherlands, Italy and Greece have shown rapid urbanisation.
- In nearly all of Eastern Europe, but also in parts of central and north-western Europe - mainly in France and Great Britain and in some southern European regions in Spain, Italy and Greece – a **low level of urbanism** is linked to **limited physical growth**, mostly with low densities. Because this combination is primarily found in peripheral locations in Europe, the gap between peripheral, rural regions and more rapidly urbanising, urban regions is widened. At the same time, the divergence between most of Eastern Europe, and the more rapidly urbanising southern European regions and the Pentagon is increasing. However, a number of large cities in Eastern Europe belong to the first group, where there has been relative fast urban growth.

In conclusion, in Europe urbanisation generally leads to less dense urban areas, because dedensification is the most dominant form of urbanisation. Urbanisation in regions with a low level of urbanism is relatively limited, in contrast with urbanisation in regions with higher levels of urbanism. As a result, the differences in urbanism in the European Union are increasing.

Changes in Central and Eastern countries

Political changes occurred at the end of the 1980s and 1990s in the former socialist countries represent a special case because the factors that shaped cities in the previous period were very different from the rest of Europe. The centralised planning and the non-existence of land markets resulted in more compact cities compared to the western counterpart. By 2000 most of the cities were still below 100 000 inhabitants (25% between 100 000 and half a million, 6 between half a million an one million; and only 3 with more than one million -Budapest, Warsaw, Prague).

Although regional differences exist and the process has taken different pace depending on the cities, some commonalities have been found:

- General **decline in population** in the last decade except in Poland, Slovakia and Slovenia.
- **Privatisation** of the housing stock. After the transformation, a large number of the dwellings were sold to the inhabitants at low prices. As a consequence the

[2] GMES: Global Monitoring for Environment and Security (http://www.esa.int/esaLP/LPgmes.html)

[3] A similar approach was taken in ESPON Project 2.4.1 (2006) with similar results (Final Report, page 103).

new member states show the highest number of owner-occupied dwellings in Europe (96.7% in Lithuania in 2001). The exception is the Czech Republic (47% in 2001) that has never introduced such privatisation plans (vanKempen et al., 2005).
- Gradual **deterioration** of housing blocs as consequence of low income of many new owners, unable to repair and maintain the dwellings (Murie et al., 2005).
- Progressive deterioration of city centres. Increase of **pollution** because inadequate transport policies.
- Changes in the economic basis in the cities, increasing the opportunities in the **service sector**. However, the workers required for the service sector are not always those who have lost their job in another sector.
- **Commercial development** constitutes and important force that has substantially contributed to a massive reorganisation of land use patterns. Such development has been recognised as a tool of local economic regeneration and growth, often supported by government policies.
- Revitalisation of city centre has **raised the prices** in the inner city, becoming too expensive (e.g. Lithuania).
- Disparity in prices between capitals, more expensive and regional cities.

All these elements have lead to the current situation:
- Increased **suburbanisation and sprawl**, although most of the cities are still more compact than in the Western Europe. The acceleration of city sprawl is evident in Hungary, as well as in Poland and the Czech Republic.
- The situation is more dramatic in cities where sprawl has been combined with **decline** implying a strong environmental impact (e.g. Budapest).
- Social, and sometimes ethnic, **polarisation**.

The major constrains to further improve the situation in these countries are:
- **Brownfields**. Former industrial sites that have been abandoned and in most cases have serious problems of contamination. The cost of remediation of these sites is very high. It has been estimated that 40% of the Budapest area can be characterised as brownfield land (Baross 2007). The EC's Thematic Strategy on the Urban Environment1 recognises brownfield regeneration as a major means to achieve a sustainable urban environment
- Existing "**frozen land**" (Bertaud 2004): It consists either a) areas with "fuzzy" tenure, or b) areas owned by government but not occupied by a legitimate government function. This prevents their timely renovation or recycling.
- Residential estates of **high density panel housing** located in the suburbs.
- Weak and poorly maintained **infrastructure** which is inadequate to support the high residential densities found in the centre.

Drivers of urban sprawl

In order to systematise the existing literature on drivers of urban sprawl the following dimensions have been considered (Figure 2):
- **Scale**.
    - Macro level. Political and economic paradigms that shape the nature of the urban societies.
    - Meso level is where much of the discourse about the causes of urban sprawl can be found.
    - Micro level captures the decisions of individual actors in the urban system.
- **Demand and supply**. Very often the drivers focus on the demand side. However, recent studies in Germany showed that the supply side may be more important than demand alone (Dosch, 2008).
- **Domain**: society, economy, governance, transport and land. This categorisation is largely in line with the ESPON projects on polycentricity and economic change (ESPON, 2005), where the characteristics of urban development are related to

changes in the main functions of urban regions: population, transport, tourism, manufacturing, and knowledge and decision-making in the private and public sector. It also relates to the basic determinant blocks of regional competitive performance presented in the current project.

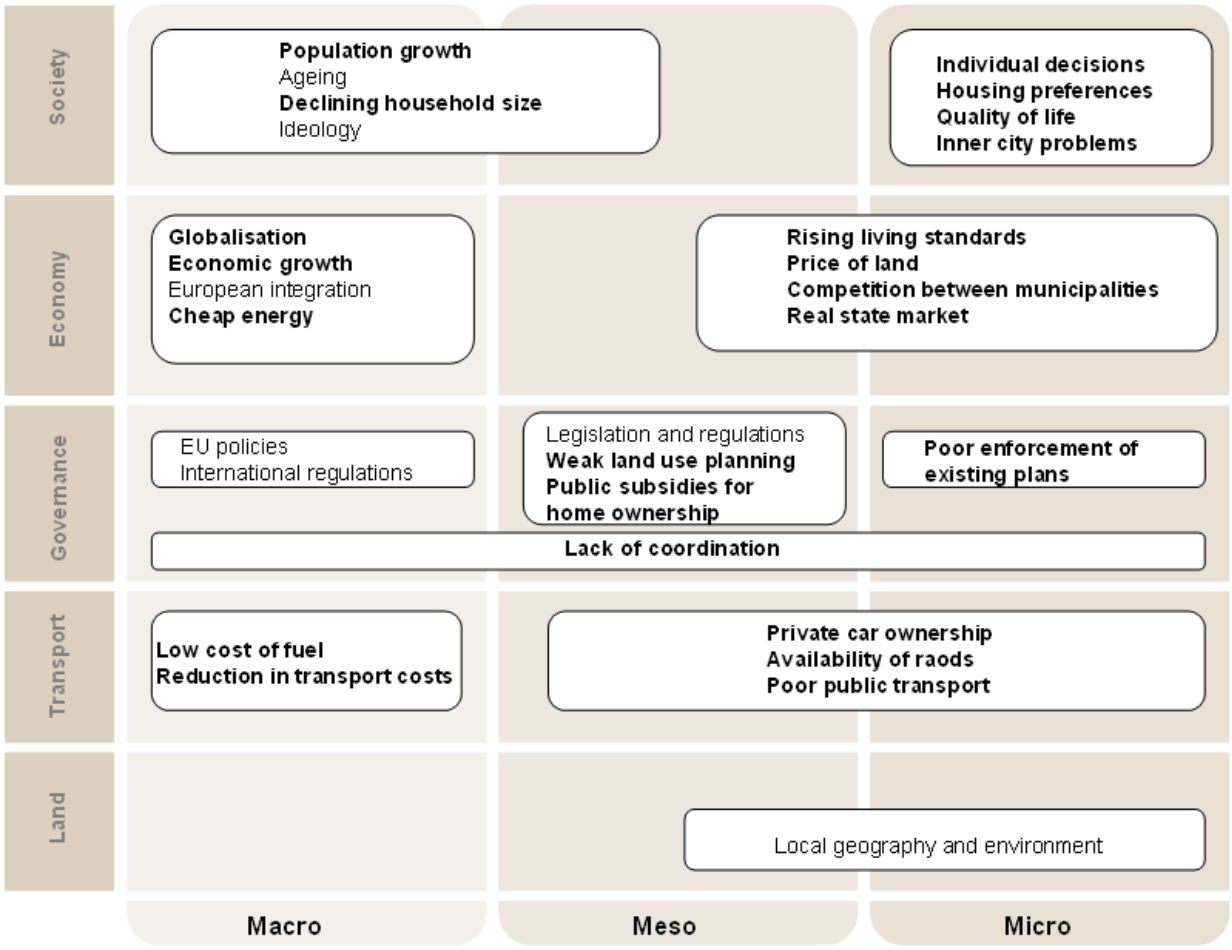


Figure 2. Main drivers of current urban sprawl in Europe. Drivers have been organised in two dimensions: domain (horizontal) and spatial scale (vertical) Demand/supply has not been differentiated.
In bold: factors that drive urban sprawl; the remaining factors may become drivers of urban sprawl under certain conditions. Adapted from EEA (2006), Couch et al. (2008) and , Urban sprawl book and PBL (2008)

As has been seen in the previous sections population growth no longer determines the outward expansion of built-up areas. There are other elements related to cultural aspects and **individual decisions** modulated by the supply side and other external conditions (price, transport, and cost).
The **feedback** between drivers and urban process can be seen in the case of population dynamics:

- Population change is an important consequence of urban conditions, especially the availability of economic opportunities (Green and Owen, 1995; Champion and Fisher, 2004; Storper and Manville, 2006). Migration is a response to differences in employment or the quality of life between places, even if the process of adjustment is inefficient. The bigger the differences, the more worthwhile it may be to move, subject to barriers such as distance, legal restrictions, housing constraints and information on the opportunities available. The propensity of

people to move is affected by their age, qualifications, financial resources and sense of attachment.

- Population change is also an important influence on urban economic conditions (Glaeser et al., 2001; Glaeser, 2005; Florida, 2004; Krugman, 2005). There is evidence that sheer population size and deep labour pools increase agglomeration economies and productivity (Rosenthal and Strange, 2004; Rice et al., 2006). Loss of population has certainly caused wider economic and environmental problems for cities (Cheshire and Hay, 1989; Begg et al., 1986). Shifts in the level of population affect local jobs through demand for consumer goods and services, housing, schools, etc. Changes in working age residents also affect the supply of skills, which may influence mobile investment decisions. The composition of the new population is bound to have an important bearing on the scale and nature of the economic impact.

Globalisation is recognised as one of the main drivers of urban sprawl interrelated with the development of information and communication technologies together with the increased accessibility to almost any place in the world (JRC). The traditional geographic range (space of influence) is overcome, and place is disconnected of economy (Castells, 2001). This has direct consequences for governance creating a conflict between local/regional policies and global market.

EU integration may have an undesired side effect through the investments on major transport infrastructures and opening the doors of sprawl to new areas. Since transport is one driver of urban sprawl special attention should be paid in these cases implementing additional policies of containment (EEA, 2006).

Real state market is an important player from the supply side. According to Bertaud land price profile follows approximately the population density profile in market economies. This promotes the urbanisation of the less dense areas within a certain time distance of the main centre.

The **differential price** between agricultural land and already urbanised land discourages the revitalisation or recycling of built space generating derelict land. It also has a strong impact in fertile flat areas where accessibility generates a conflict of uses leading to a **marginalisation** of agriculture.

One of the main failures to effectively control urban sprawl is the **lack of horizontal (space) and vertical (institutional) integration of policies** (EEA, 2006). City boundaries are becoming diffuse increasing the complexity of levels of governance (e.g. intermediate metropolitan administrations).

Nearly all environmental management is carried out at a **local level**, and measures adopted at this level influence the impacts at broader scales (Bellot et al. 2007). Municipalities have limited number of tools to influence the urban spatial structure although some typical municipal objectives have a spatial implication:

- Protecting the natural environment requires more compact cities;
- Maintaining a high ratio of public transport trip requires high densities;
- Low housing prices requires an increase in land supply at densities set by demand generating a large suburban expansion.

Fragmented decision-making. Typical situation for actor groups involved in the development of land (UBA, 2008):

- **Municipalities** maintain the hope that new inhabitants will lead to a tax surplus, when in fact studies have shown that this is only seldom the case. Therefore they generally favour the development of land. Costs are transferred as far as possible to the investor and as the municipality bears "no" costs the project is regarded as "good".
- For **landowners** a plot represents an economic asset in whose increasing value they hope to profit. Thus, owners of agricultural land which is facing development become highly active.
- For **project developers** high unit costs to connect new dwellings or commercial premises to supply networks are often more than offset by the much cheaper land

prices in peripheral areas at the edge of existing settlements. The extra transport costs are countered by other sales arguments (e.g. property prices, "living in the countryside").

- **Utility companies** have little motivation to influence the location and density of use of newly constructed or newly connected areas, as the associated costs are reimbursed by users in the form of construction subsidies or by a general rising of charges for all users.
- **Householders** seeking a new location are often ignorant of the high costs for technical infrastructures associated with low density peripheral areas. The low price of suburban land hides the rising infrastructure costs per housing unit which low settlement density causes.
- As a result fragmented decision taking supports therefore unsustainable land use developments: The single decisions are comprehensible; but whether actors ignore the high follow up cost for transport, infrastructure, loss of land, biodiversity and ecosystem services or transfer these costs to others, finally every resident.

The complex interrelations and possible **side effects** are often missed –or difficult to assess at the time of issuing the policies. For example rising prices as consequence of policy for urban concentration (Cheshire, 2006; Richardson and Bae, 2004).
In market economies **actors** play an important role. It seems that that the preferences of people are lower densities and car ownership in many parts of Europe (see France for example Richardson and Bae, 2004 pàgina 93 posar referència). It has also been reflected in the rise of second homes that has been facilitated by the supply side (construction and related economies have been one of the most successful sectors in Spain in the last 10 years).
Land use and transport are inter-dependent in complex ways as development influences mobility patterns. New suburban development without adequate public transport typically increases the demand for private car use. In contrast the construction of new light rail systems has a tendency to increase housing densities around access points (Handy, 2005). Households make choices between residential areas taking into account the price of housing and the price of commuting between the work and home. When travel costs fall below a certain threshold and income reaches a certain level the rat of sprawl quickens, and sprawl is more common in regions where incomes are high and commuting costs are low (Wu, 2006).
Past history and geographical surroundings of the cities are underlying factors that modulate the morphology and trajectories of the cities. Coastal or mountainous location creates very different development options than location on a plain or along a river (Kasanko et al. 2006).

3. Future perspectives

Cities are concentrators (population, knowledge, economy), but also of waste (Bugliarello, 2006). In order to overcome the negative aspectes there is a need for local energy generation, more efficient management of energy use and readjustment of living patterns.

- Factors that will be active in coming years and that will have a certain impact (high certainty).
    - Cities have certain **inertia** and policy takes a long time to have any significant effect in terms of change of urban patterns (Cheshire, 2006). For this reason tackling the problems at an early stage, with a progressive implementation, is to be preferred to late and aggressive action. These results challenge current assessment methods of climate change stabilization strategies and show that it is essential to take into account urban dynamics and inequalities in the design of climate policy (Gusdorf, Hallegatte, and Lahellec).

- Urban sprawl has a long term impact since it is a process almost irreversible. Hence it is very important to **consider the past legacy on planning** (e.g. costs for developing public transport system). Some extreme cases: brownfields, ghost neighborhoods
- **Implementation of stronger policies** to control urban sprawl (e.g. Germany, National Sustainability Strategy of the Federal Government, 2006) and stronger enforcement of law at mesoscale (see for example the resolution of the European Parliament on the Fact-finding mission to the regions of Andalusia, Valencia and Madrid, 21 June 2007).
- **Air quality** and **noise** levels are expected to improve given the current European policies, but also because of increasing concern on public health.
- Climate change is expected to have an impact on the environment and quality of cities in different ways:
  - Policies to reduce the vulnerability to climate change, in particular drought and other extreme events (heat waves) will improve early warning systems and better management of water resources.
  - Convenant of Mayors. Althuough it is voluntary, some 1000 cities have already joined this iniciative which involve monitoring and planning for emissions reduction. There is an uncertainty on how economic crisis will stop the involvement of more cities and the performance of the ones that have already joined it.
- **Land price** is an important driver very often not controlled by policies.

- Emerging issues that may have a potential impact (uncertain, but high potential – management at meso/micro level).
  - Management of current built-up areas, and in particular the sprawled ones, remains an area for big improvements. The focus so far has been too much in avoiding or controlling urban sprawl and large dispersed areas has been forgotten.
  - Innovative housing design (intermediate between collective and individual housing) in order to meet simultaneously the individual household aspirations and the collective density criteria (SCATTER project).
  - Location of community services, like schools, seems an important factor for people to decide where to live.
  - Green economy in the construction sector. There is a large sector of people involved in construction that has low qualification. There is a bast opportunity to improve the energy efficiency of existing buildings and to develop cheaper and more sustainable construction systems.
- High uncertainties
  - Changes in actors
    - Next to the implementation of traditional "top-down" growth control instruments, urban land use policies should employ awareness campaigns and foster capacity building for more effective inter-municipal planning cultures in regional and sub-regional scales. Furthermore, this study found (qualitative) evidence that the intensity of the political debate on urban sprawl and more sustainable forms of urban development at the federal and state level influences the consciousness of local stakeholders.
    - Actor's structure: age, economic sectors, social classes.
  - Private investments going to Eastern Europe to find new opportunities (recent trends and still to be in coming years)
  - Integration of different levels of governance.

- There is not a unique model of urban evolution given the history and geographic constrains. Consequently the objective should be to reach similar objectives (increased diversity, mixed use of spaces, improved urban environment), but not necessarily with the same means. Best practices should be promoted taking these aspects into consideration.

4. Empirical results

How are European cities growing (1990-2006)?

Structure of European cities: compacity

The understanding of the citie's structure is important for the assessment of its growth. The availabilty of space and set up of the urban area may determine to some extent the feasibility for a city to grow and to what extent. European cities have been identified as compact cities compared to the American counterpart, and this is considered a more sustainable model. However, the complexity of the spatial organisation of cities could not be translated in simple indexes that establish threshold for what is a compact city and what is a dispersed one. More than that there is a continuum where the compact cities and dispersed cities are only the extremes. Because that, very often comparisons are taken having in mind the extremes and ommitting the complexity of the full range of situations. Analysing the compacity of European cities means to apply a magnifying glass to a segment of the continuum between dispersed and compact cities

The degree of compacity of a city could be described by its density, proximity and continuity. In our case we have focussed on the population density since it is a good proxy and relatively easy to measure. The assessment of the continuity and proximity of urban areas requires a more complex spatial analysis that was out of the scope of this project.

Population density is not an unambiguous concept. In most cases population density is calculated as inhabitants/km2 and the whole land area of the city is taken as the reference point. In that case the changes in population density depend solely on the number of inhabitants and it is very sensitive to the size of the city. To overcome this problem we have approached the population density taking into account the residential land area.

Given the limitations of data resolution from CORINE Land Cover a good alternative would be the land cover data from Urban Atlas. However, at the time of performing this analysis it was not yet complete for all Urban Audit cities. As an alternative we have taken the high resolution soil sealing data (2006) which reflects the degree of imperviousness of the artificial areas.

The sealed area per inhabitant ranges from 11 to 332 m^2 per inhabitant (Figure 3), being Prague the city with the lowest index and Charleroi on the opposite side. In general, Southern cities have lower values which is in line of higher compacity of Mediterranean cities (e.g. Barcelona, Rome, Athens). However, it should be noted that the sealed area per habitant is high in the coastal cities of Portugal. Cities from UK also show, in general, a low degree of sealing. Cities that use more land per inhabitant are in Northern and Central Europe.

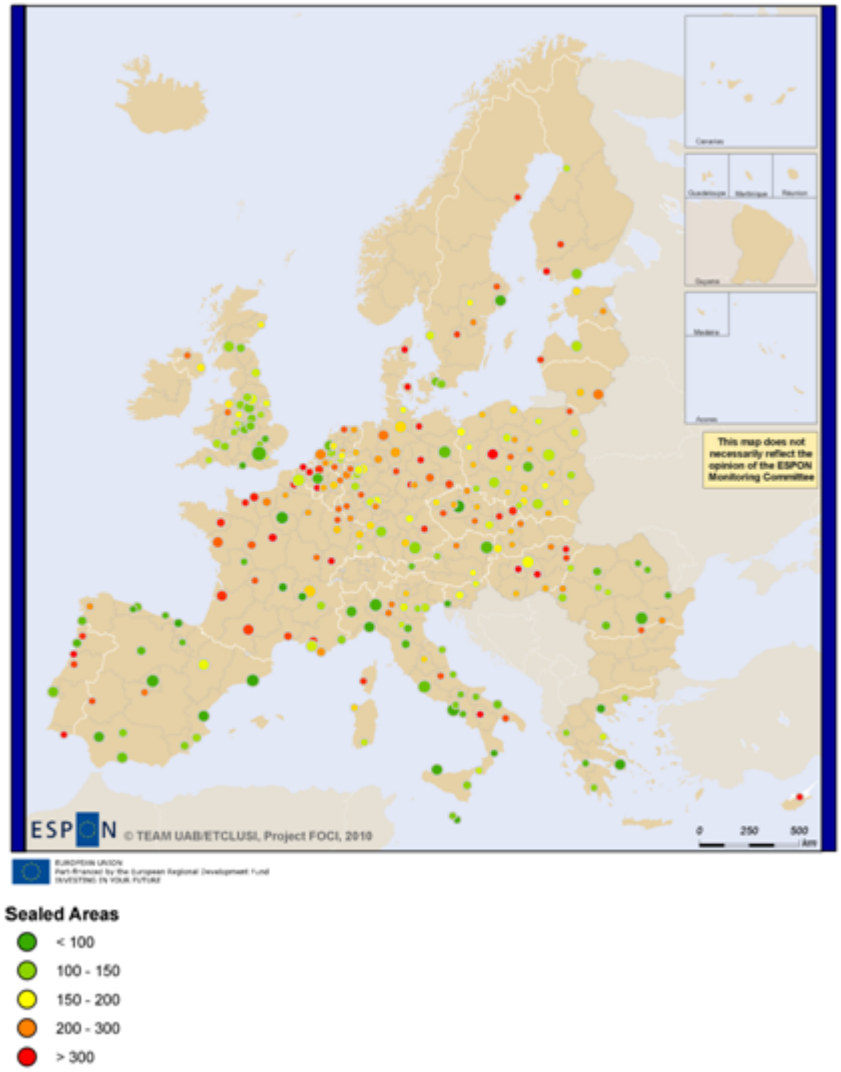


Figure 3. Sealed area per inhabitant in European cities (2006)

The figure shows the land that is sealed for residential, industrial and commercial uses (in m^2) per inhabitant. Sources: Urban Audit and Hig Resolution Soil Sealing Layer (2006)

Typologies of growth

The main question behind city growth is urban sprawl and its sustainability. In a similar manner as it has been explained in the structure of the cities, urban sprawl is part of the complex interactions and evolution of cities and there is not a single index that would enable to classify a city as sprawling or not. Once again we should consider different trajectories of cities leading to different types of growth which in the most extreme cases could be defined as sprawl.

Conceptually different type of urban developments have been considered:

- **Redevelopment**. Changing the use of existing urban land (e.g. industrial to residential). This would fit with the idea of land reuse or recycling.
- **Infilling**. Development of new areas within the dense city.
- **Expansion**. Urban development in the fringe or in less dense areas

Redevelopment and infilling can be related to compact urban development, while expansion will lead to more diffuse patterns.

In order to characterise the urban development in Europe a first set of variables were selected representing the status and changes. After removing the variables higher correlated and those that explained less variability in the factorial analysis, the following ones were selected.

Index	Description
Ratio of built-up area	Percentage of built-up area of total land area
Degree of soil sealing	Percentage of sealed area of the total land area
Increase of built-up area	Percentage of new of built-up area over total buil-up area at the beginning of the period.
Land take per capita	Increase of built-up area divided by the total population
Degree of redevelopment	Percentage of redevelopment over all new built-up areas for the period.
Destination of new urban areas	The growth rate of residential areas and industrial, commercial and transport areas. Those areas have been identifyied according to CORINE Land Cover nomenclature and methodology.

Table 3. Variables used in the definition of typologies of urban development

It should be highlighted that the information on built-up areas and related changes are derived from CORINE Land Cover. Then, there is a clear limitation on the resolution of the data both on the stock (percentage of certain type of land cover) and changes. Limitations are clear on linear features (e.g. roads and rails) and also on plots below the CLC resolution that may be relevant for urban areas. This issue is further discussed in page 34 (*What is the accuracy of CLC*?).

The existing CORINE Land Cover data allows to analyse changes for two periods: 1990-2000 and 2000-2006. However, data for United Kingdom and Greece was not yet available for the period 2000-20006 at the time of the preparation of this report. Consequently the basic analysis is for the period 1990-2000 and later on comparisons are done for the second period without UK and Greece.

Three main typologies have been identifyied which are charcterised by three group of descriptors (Table):

- Size and form. Only the extreme values of degree of soil sealing and the ratio between the city and LUZ are significantly different.
- Urban development. The differential urban development in the city and the LUZ can describe the process of expansion of the city. When the ratios of increase are similar or higher in the core city one can consider a stable situation. On the contrary, when the increase is higher in the LUZ, then there is a clear expansion of the city beyond its (administrative) boundary.
- Destination of new urban areas.

The distinctive features of each typology are summarised as follows:

- **Type 1. Slowly growing cities.**
    - **a. Slowly growing cities densifying the existing urban areas**. Cities with below 600 000 inhabitants and low degree of sealing. Very slow rate of urban growth with a high degree of redevelopment. However, the low percentage of soil sealing (also related to low percentage of built-up areas) shows the potential for these cities to grow. The new developed areas are mainly residential in the core city. Some of these cities are loosing population both in the core city and LUZ (e.g. Kaunas). Geographic extent: Mostly Eastern cities. Examples: Vilnius, Kaunas (LT); Szczecin (PL); Miskolc (HU); Bradford (UK).
    - **b. Slowly growing cities with diffuse urban development**. Those cities are also growing slowly. However, the core city shows a higher

degree of soil sealing (higher percentage of urbanised land), and has a relatively large LUZ. Consequently the rate of growth is about three times higher in the LUZ compared to the core city. The degree of redevelopment is very low both in the core city and LUZ. The risk for those cities would be to increase the pace of urban development that would lead to more sprawled system. The population is very stable or has small rates of growth.
Geographic extent: Some capital cities. UK, DE, BE. Examples: Budapest (HU); Brussels (BE), Berlin (DE), London (UK).

- **Type 2. Rapid growing cities.** This group represent almost half of the European cities. Because this variety they don't have any particularity regarding its size and form. This group is defined by an intermediate rate of growth and low level of recycling. New developments in the core city are mainly residential areas, whereas in the LUZ the new developments are for industrial and commercial activities. However, there is a small gorup of cities (**2b**) that have a relatively large LUZ. Comparatively the urban development in the LUZ is also very high. Geographic extent: There is not any specific pattern of distribution. Examples: Madrid (ES); Rome (It); Prague (CZ); Tallinn (EE).
- **Type 3. Very rapid growing cities with diffuse urban development**. This group includes the cities with the highest degree of urban development, far beyond the average of the other typologies. In terms of city structure they have the lowest degree of sealing (high availability of space) and the city is almost half of the LUZ size. It seems that the availability of space is a factor that facilitate the expansion which show similar trends in core city and LUZ. Examples: Braga (PT), Groningen (NL), Erfurt (DE); Murcia (ES)

	Size and form			Urban development				Destination of new urban areas		%
	City area (km^2)	Sealing (%)	City/LUZ	Increase of built-up area (%) City	LUZ	Land take per capita	Redevelopment (%)	City	LUZ	
1 Slowly growing										
a. compact	200	17	21	0.8	1.7	1.8	33	**Residential**>Commercial	Residential=Commercial	19
b. diffuse	250	42	10	1.0	3.1	1.7	6	Resiedential=Commercial	Residential=Commercial	13
2 Rapidly growing & diffuse										
a. City < LUZ	233	24	18	7.8	8.6	13.3	10	**Resiedential**>Commercial	Residential<**Commercial**	47
b. City << LUZ	114	27	8	11.7	20.9	9.0	11	Residential<**Commercial**	Residential<**Commercial**	9
3. Very rapid growing & diffuse										
	332	14	40	44.0	41.5	79.4	1	Residential=Commercial	Residential=Commercial	12

Table 4. Typologies of cities according to urban development (1990-2000)

Changes in urban development of European cities are synthesized in five typologies representing different pace and patterns of growth. Size and form parameters are: city area, percentage of soil sealing in the city and the ratio between city and LUZ area (in percentage). Significant differences are only observed on the extreme values of soil sealing and City/LUZ ratio. Urban development includes those parameters that explain how much the urban areas are growing: increase of built-up as percentage of existing artificial areas (if the value is higher in the LUZ it could be associated to more diffuse/sprawling processes); land take per capita is the increase of built-up divided by the population (it could be assimilated to an indicator of land consumption); redevelopment estimates the percentage of total land changes that occurs on previously developed land (this indicates the degree of land recycling) .Destination of new urban areas: two classes of new urban areas are gdifferentiated a) urban residential, and b) industrial, commercial and transport areas. Perccentage (last column) indicates the percentages o cities in Urban Audit within each typology. Sources: Urban Audit: city and LUZ delineations, area and population. CLC (1990, 2000 and 1990-2000 Changes): increase of artificial areas, redevelopment and destination of new urban areas.

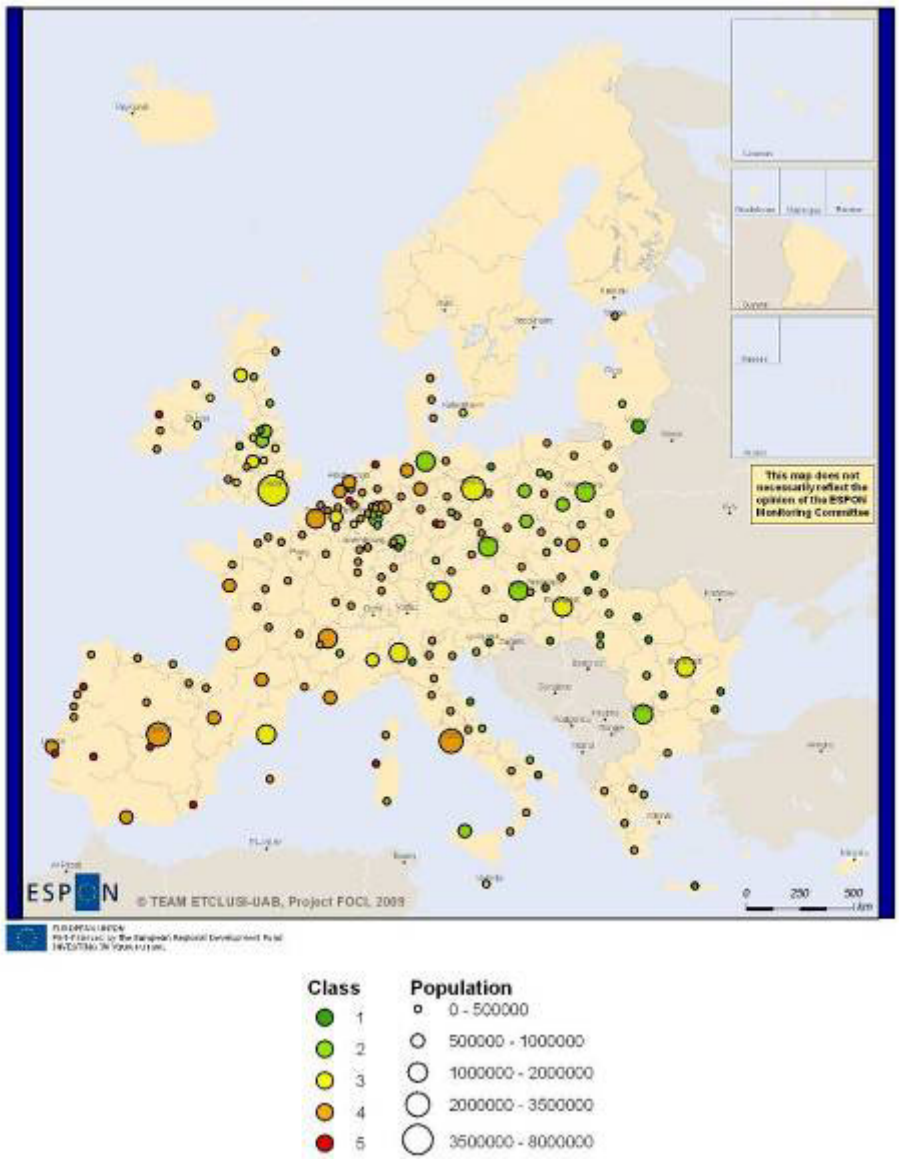


Figure 4. Typologies of urban development (1990-2000)
Sources: CORINE Land Cover 1990, 2000, 1990-2000 changes.

How cities evolved in the period 2000 – 2006?

As has been highlighted before, United Kingdom and Greece were exluded for the comparison since land cover data was not available for 2000-2006 in these countries.

A first look at the overall changes in the European cities indicates an increase in the land that has undergone some urban development (Figure 5). However, the areas under redevelopment have significantly increased in both core city and LUZ during the period 2000-2006. The development of new residential areas have been reduced, while industrial and commercial areas are still increasing and becoming the main source of urban expansion. This is a general trend observed in the last 20 years where urban sprawl is less and less associated to increase of residential areas and more to other economic developments. However, there are some exceptions like the Mediterranean coast, and specifically in Spain where second homes and speculation have been driving factors for urban sprawl still in the period 2000-2006. Many Eastern cities also show a differential trend being the development of new residential areas dominant over new industrial and commercial ones.

All in all, the densification process (redevelopment + infilling) is slightly increasing in the overall balance.

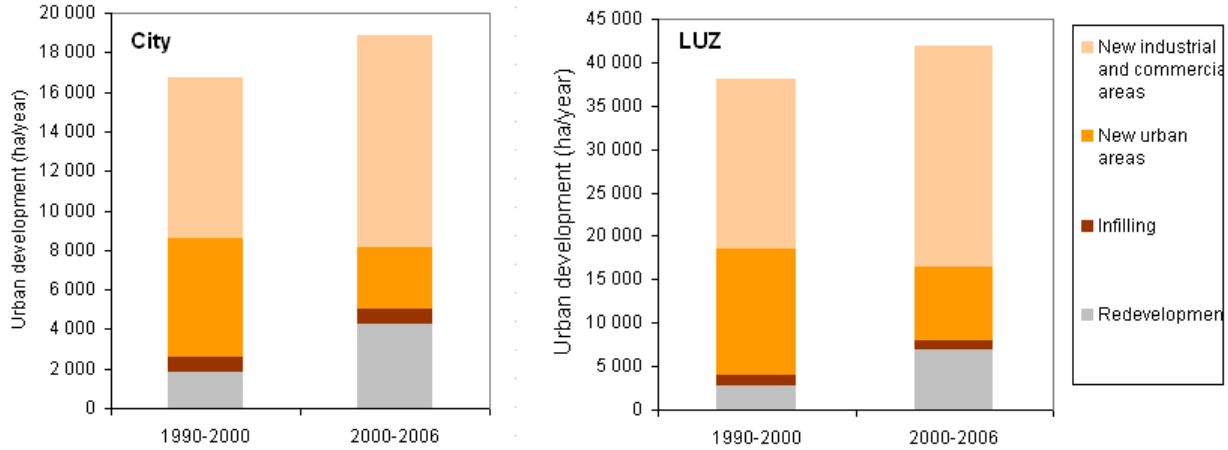


Figure 5. Urban development in cities and LUZ (1990-2000, 2000-2006)

Urban development refers to the total urban changes for the given period and aggregated for all European cities. The trends are similar in the city and the LUZ as well. The hectares per year reused or redeveloped in 2000-20006 have significantly increased compared with the previous period. Development of new residential areas have decreased while development of new industrial and commercial areas are still increasing. Infilling: Development of new areas within the denser city. Sources: CLC 1990, 2000 and 2006. UK and Greece are not included because data not available for 2006.

Moving from the overall picture to the pathways taken by the different typologies it is observed that the the **slow growing and compact** cities (type 1a) have experimented an increase of rate of development and land take (type 3). The availability of space and the low rates in the 90's may have facilitated these new developments. The new developed areas are mainly for industrial and commercial use in the bigger cities, whereas in some smaller ones residential development is still prevailing.

The **slow growing and diffuse** cities (type 1b) decreased the land take during the period except on the LUZ. Those cities had a relativelly small city compared to LUZ so it could partly explain this evolution.

The **rapid growing and diffuse** cities (type 2) includes half of the European cities. Then, their evolution fits very well with the overall picture: reduction of the land take in both cthe city and LUZ. However, the growth in the LUZ is still relatively higher than in the core city. The second group within this class (2b) has increased.

Finally, the **very rapid growing cities** in the 90's have slowed down. This process have been more marked in the core city than in the LUZ.

There is a process of convergence between the different typologies, with few exceptions (cas 2b), characterised by decreasing differences in the rate of land take, a general increase of redevelopment and an higher pace of change in the LUZ.

	Urban development				**%**
	Increase of built-up area (%) City	LUZ	Land take per capita	Redevelopment (%)	
1 Slowly growing					
a. compact	2.2	2.9	4.6	13.0	19
b. diffuse	0.6	4.4	1.2	24.0	13
2 Rapidly growing & diffuse					
a. City < LUZ	3.3	5.6	7.5	20	47
b. City << LUZ	14.1	21.7	12.1	20	9
3. Very rapid growing & diffuse					
	11.6	18.0	30.5	17	12

Table 5. Change in urban development by typologies (2000-2006)
The table shows the evolution of the typologies defined for the period 1990-2000. Red colour indicate that the indicators have changed in the direction of increasing urban development and reducing land recycling. Green colour indicates that urban development has stabilised or is decreasing.
Sources:

Brownfields
To be finalised.
Definition
Estimated situation in Europe
Costs (economic)
Some good practices

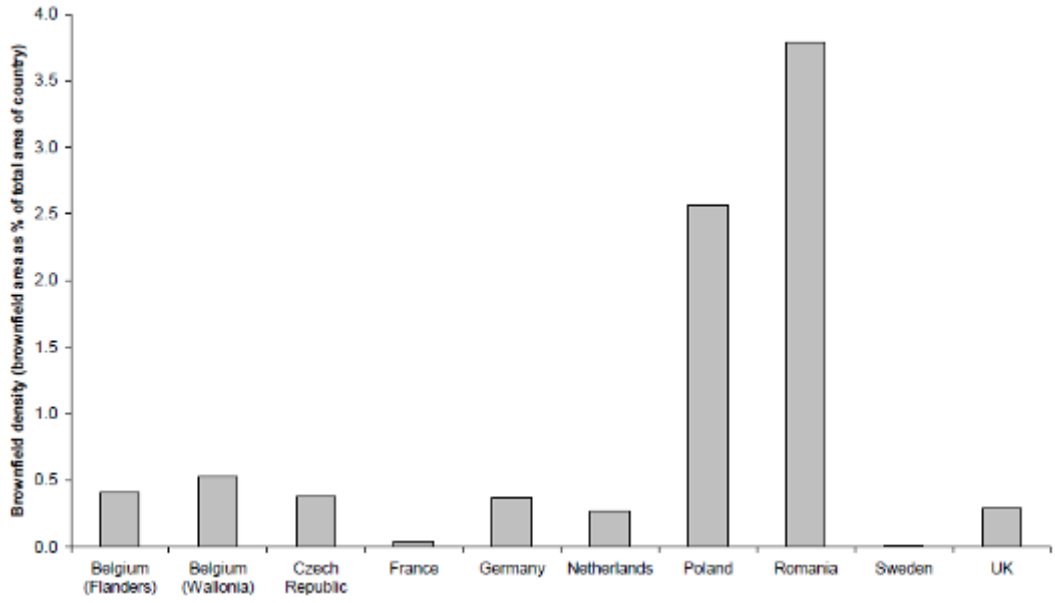


Figure 6. Estimated percentage of brownfield area as total area of country.
Source: ClariNet.

Impact on natural resources

What has been lost?

Urban growth is at expenses of other land uses. In the core cities there is a clear dominance of new building development in previous agricultural land (Figure 7). This is due to several factors. Firstly most of the available land for urban growth is agricultural. Secondly, agricultural land is in most cases technically more suitable for construction than forest areas both topographically and in economic terms. Thirdly, natural areas are often considered as valuable recreational areas and hence cities have protected them from building activities. Grouping cities by regions highlights some specificities like in Eastern countries about 30% is developed on previous forests.

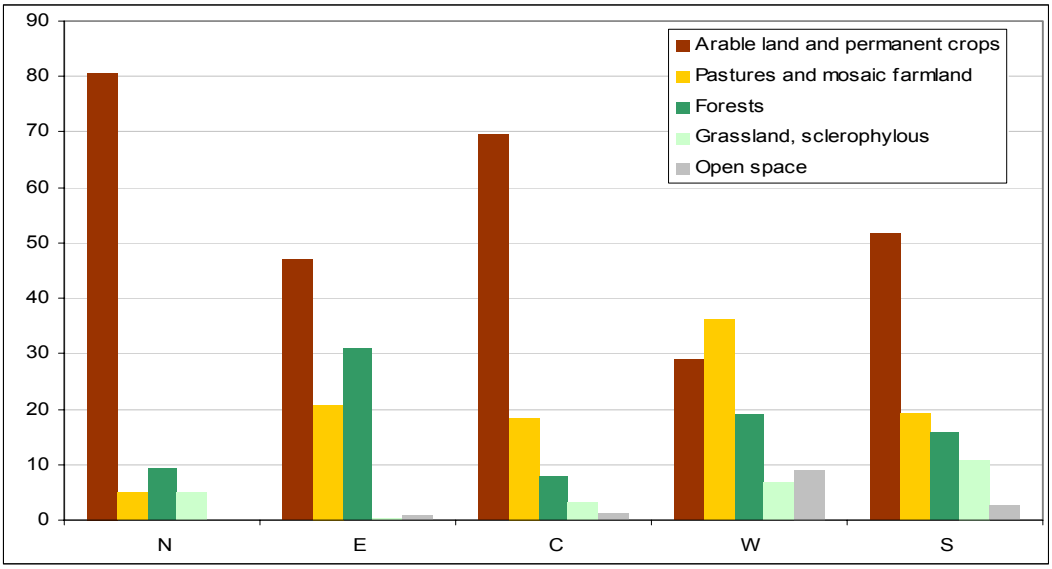


Figure 7. Natural and agricultural land lost due to urban development in the cities (1990-2000)

Percentage indicates the previous land uses in the total developed land. Cities have been grouped by countries**:** Northern, Eastern, Central, Western and Southern Europe[4]. Source: CORINE Land Cover.

In the LUZ the agricultural land is still the primary source. However, in Eastern cities most of the land is developed on forests.

[4] Northern countries: DK, FI, SE, NO. Eastern: HU, BG, CZ, EE, HR, LT, LV, PL, SK, SI, RO. Central: AT, BE, DE, LU. Western: FR, IE, NL, UK. Southern: CY, ES, GR, IT, MT, PT.

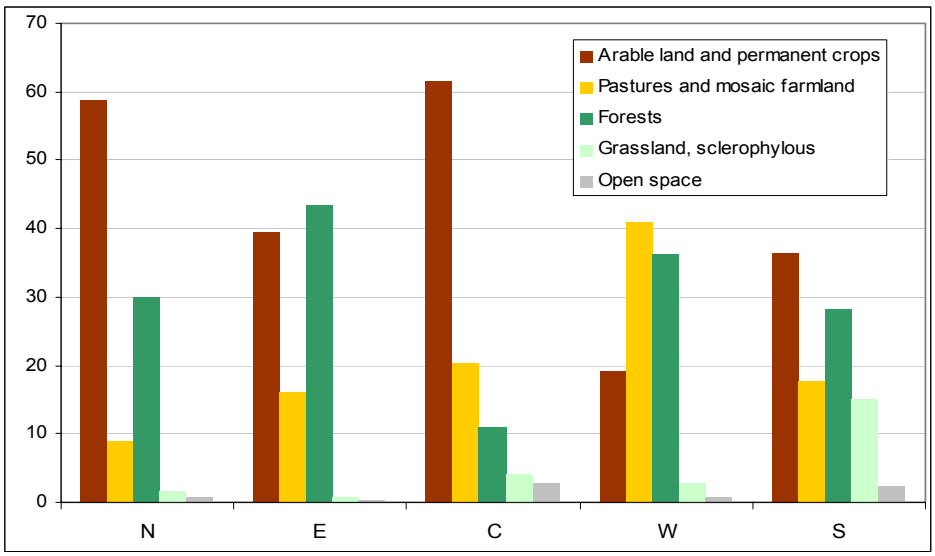


Figure 8. Natural and agricultural land lost due to urban development in LUZ (1990-2000)
Percentage indicates the previous land uses in the total developed land. Cities have been grouped by countries**:** Northern, Eastern, Central, Western and Southern Europe. Source: CORINE Land Cover.

How valuable is the agricultural soil lost?
Percentage of soils of good quality for agriculture lost in the LUZ

What is the accuracy of CLC?

All the spatial analysis developed so far is based on CORINE Land Cover. As has been explained before there are some important methodological constrains, namelly the minimum mapping unit and the minimum change detection. In addition, the methodology used for CORINE is know to underestimate linear features like roads and rails.
The development of the Urban Atlas is a great improvement in that sense, since the Urban Audit cities will be mapped at higher resolution. However, this is an ongoing project and for the moment data is only available for 2007.
The following cities have been compared since they represent different typologies or specificissues (green urban areas, compact cities, water bodies,…): Copenhagen, Barcelona, Warsow and Amsterdam.
Figures 9 and 10 provide two examples of comparison between CORINE Land Cover and Urban Atlas.
Although there is a high variability on the errors, some patterns have been identified:

- However discontinuous urban fabric, and road and rail network (always underestimated) are those with the higher discrepancies. The maximum values of discrepancies are around 30%.
- Industrial and commercial units are always underestimated.

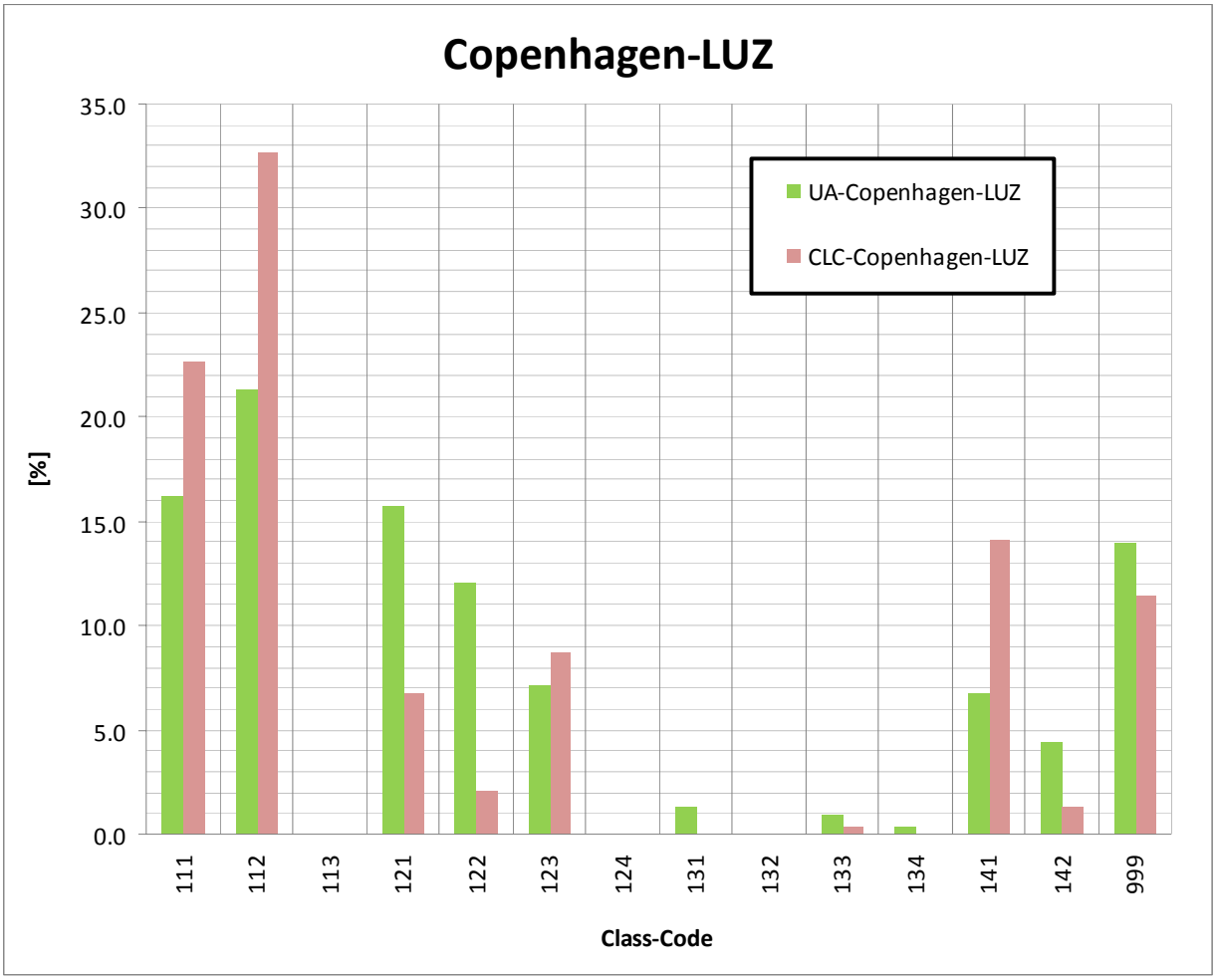
In general as more fragmented is a particular class, the error will be higher.
The implications for our assement are as follows:

- Probably the growth of industrial and commercial areas is higher than the results obtained. On the other side, probably we overestimated the growth of residential areas.
- CLC is structured in a 3 hyerarchial layers. Then, it is not relevant to compare some classes at level 3.
- There may be important errors on the stocks (percent of different land cover areas). However, in the case of compacity we have used the soil sealing layer

which is already a high resolution information.

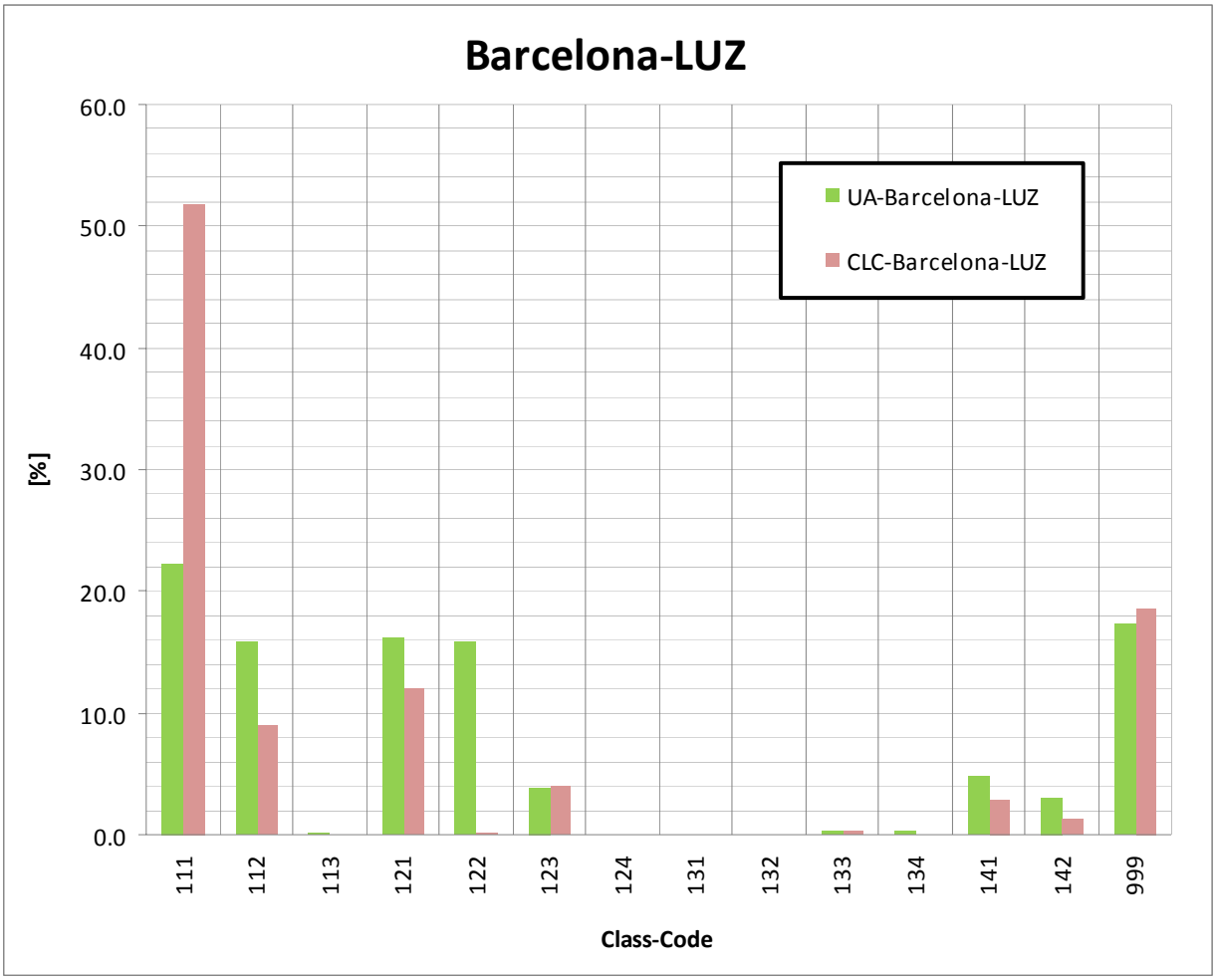
- The impliccations for changes are not known since Urban Atlas only has one time shot.

These results confirm that new approaches are needed, and currently the technologies are already there. In fact there is already a working group defining an improved methodology to provide CORINE Land Cover Like information at higer resolution for the areas were this may be relevant (e.g. urban areas).



Code	Land cover class
111	Continuous urban fabric
112	Discontinuous urban fabric
121	Industrial or commercial units
122	Road and rail networks and associated land
123	Port areas
124	Airports
131	Mineral extraction sites
132	Dump sites
133	Construction sites
141	Green urban areas
142	Sport and leisure facilities

Figure 9. Comparison of land cover classes in Copenhagen (LUZ) derived from CORINE Land Cover (red) and Urban Atlas (green)
The numbers of class-code represent different land cover classes described at the bottom of the figure. It could be observed that classes 111 and 112 (continuous and discuntinuous urban fabric) have been overestimated in CLC. Class 141 (green urban areas) is also overestimated. On the other side, class 122 (road and rail) is underestimated by CLC.



Code	Land cover class
111	Continuous urban fabric
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123	Port areas
124	Airports
131	Mineral extraction sites
132	Dump sites
133	Construction sites
141	Green urban areas
142	Sport and leisure facilities

Figure 10. Comparison of land cover classes in Barcelona (LUZ) derived from CORINE Land Cover (red) and Urban Atlas (green)
The numbers of class-code represent different land cover classes described at the bottom of the figure. It could be observed that class 111 (continuous urban fabric) has been largely overestimated in CLC. On the other side, Class 121 (diffuse urban fabric) is underestimated by CLC.

Transport

It is considered that low densities result in greater traffic demands. This means, development of transport infrastructure does not only trigger urban sprawl; the relationship is reciprocal causing a "loop of positive feedback" between urbanisation and transport systems (ESPON 2004). Low density urban development - urban sprawl - demands more transport, in particular by road; although, a large number of socio-economic factors influence travel patterns as well. It is also assumed that above certain thresholds of city density or certain density of habitants in certain cluster the public transport is not efficient.
We explore if there is any relationship between the parameters and the typologies developed before with tww indicators available in Urban Audit.

Share of public transport
According to what have been explained one would expect some relationship between public transport and compacity, density or densifying process.
There is a strong regional component since the Eastern countries have a higher share of journeys by public transport to work. This may be explained by the concurrence of several factors: the evolution of different economic systems in the past which in turn left more dense cities in the Eastern countries, economic difficulties to access to private car,…
When the geographic divide is ommitted, one can observe that the cities that were very rapidly growing have significantly less percentage of journeys to work.

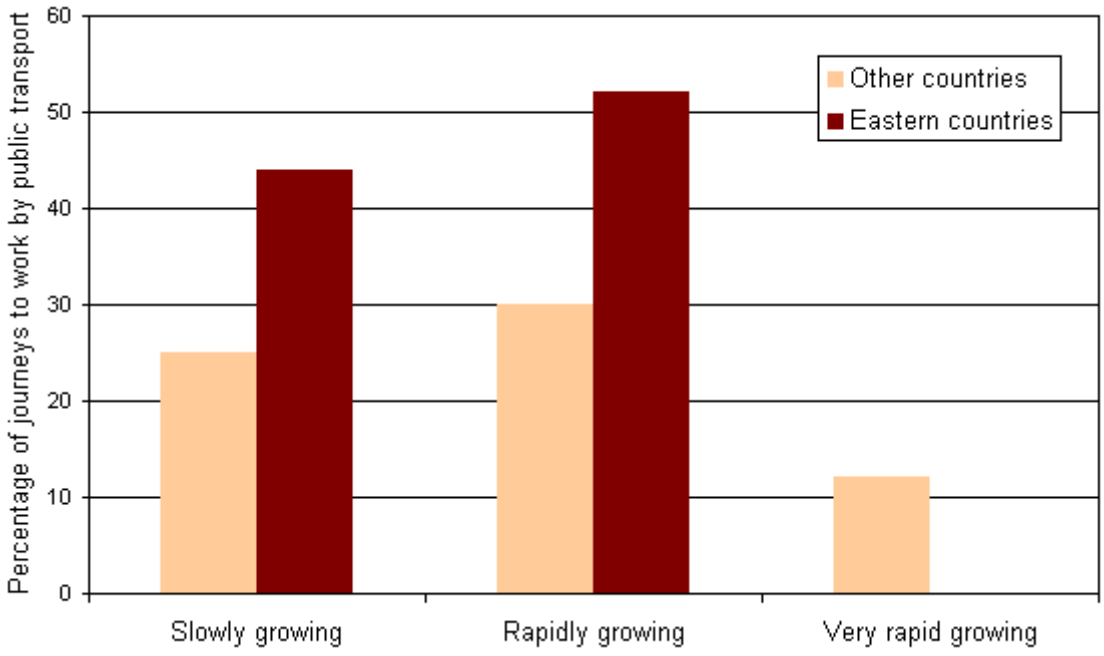

Figure 11. Percentage of journeys to work by public transport (rail, metro, bus, tram)

Average time of journey to work

Emissions

From the metabolism perspective, emissions are part of the output of the urban system. Consequently emissions could be used in the global balance to evaluate its performance and efficiency. Moreover, CO_2 emissions are also relevant in the context of climate change. The political focuss is also moving more and more to the lower level of governance to combat climate change and reduce CHC emissions (see for example the Conveyor of Majors initiative).

The current situation on data availability at city level is still scarce, but several programmes have already started to define common methodologies and standards (e.g. Global Greenhouse Gas Standard for cities recently lunched by UNEP, UN-HABITAT, and the World Bank).

At present data reported to the Convention on Long-range Transboundary Air Pollution by Member States provides location of sources and associated annual emissions for almost 90% of total industrial emissions in Europe. This information only provides a fragmented picture of the total emissions, but it is the only existing data at this level of resolution and geographic coverage.

The pattern of total emissions is more related to the distribution and size of industries. There is not any clear regional pattern, although most of the Italian cities have lower emissions.

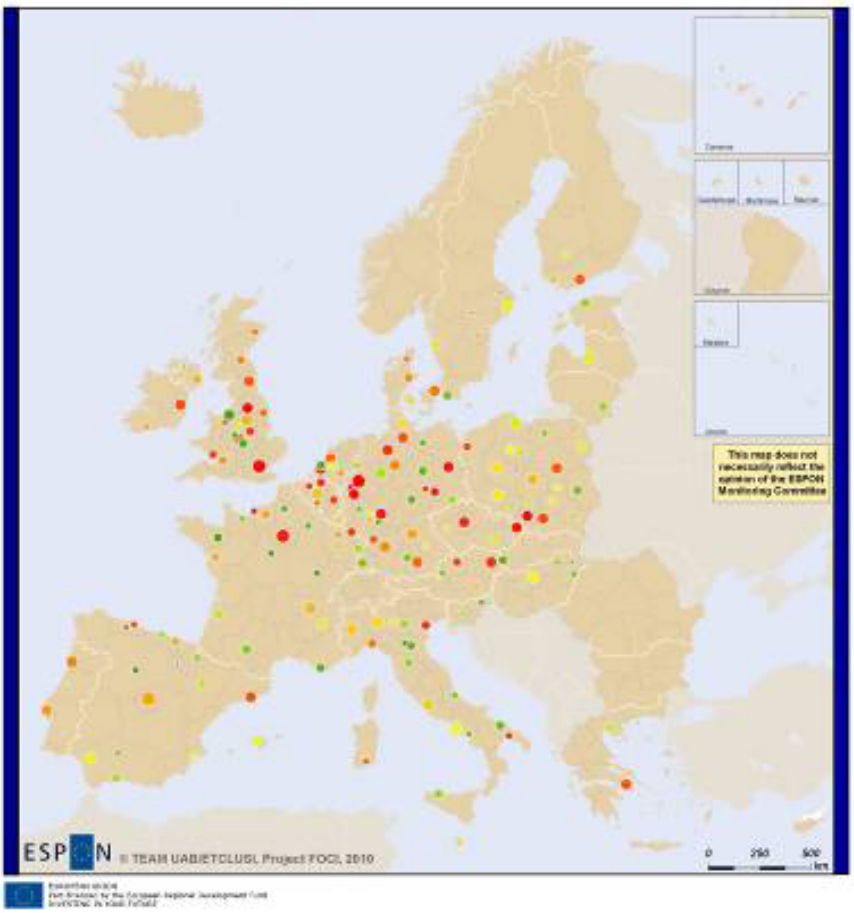

Figure 12. CO_2 emissions from industries in LUZ

Air quality

Air quality is the final result of the process taken in the urban area, or in other words its metabolism. However, many other factors are relevant in the final result of the measured air quality like the local geographic factors that determine specific weather conditions. In addition, air quality in a particular point may be the result of long distance travel of contaminants.

Fine particulate matter PM_{10} is one of the contaminants with a higer impact on health and it is strongly linked to anthropogenic activities, in particular to road traffic.
There seems to be a strong geographic component on the distribution of PM_{10}.

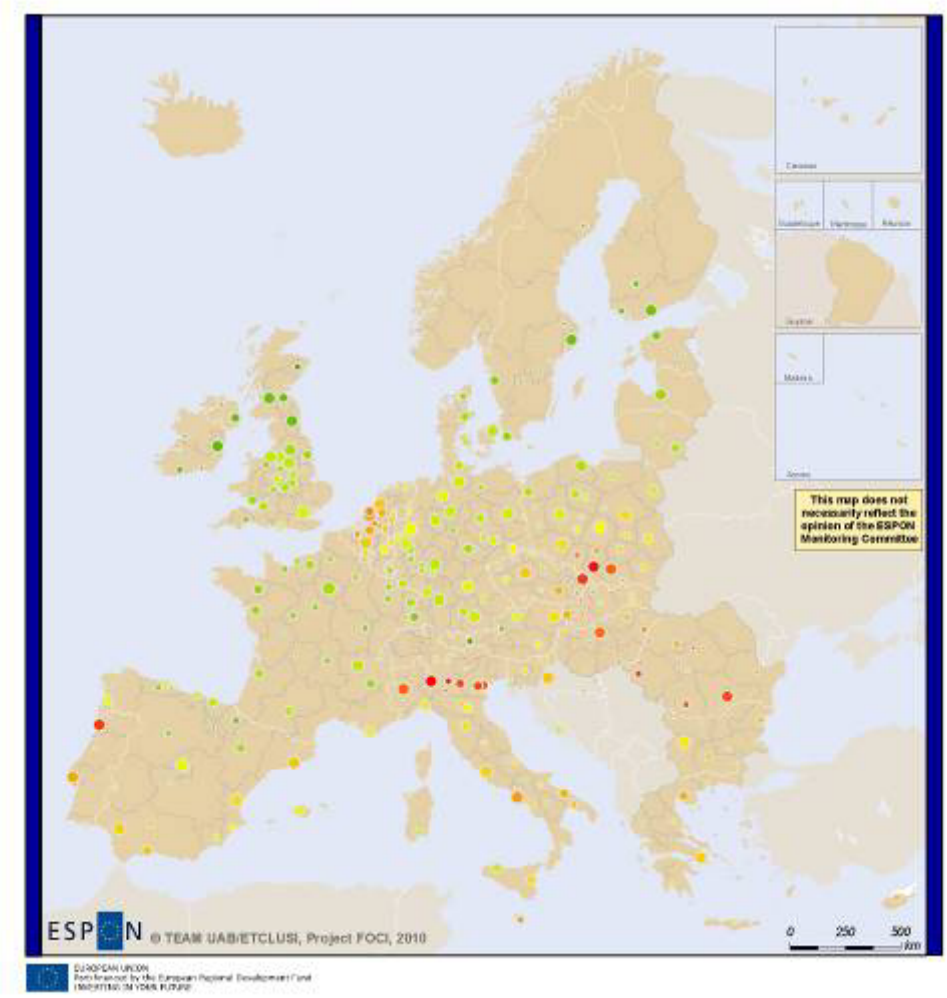

Figure 13. Average concentration of fine particulate matter (PM_{10}) in cities

5. Conclusion

References

Ambiente Italia, 2003. European Common Indicators Towards a Local Sustainability Profile. Ambiente Italia, Milano.

Antrop, M., 2004. Landscape change and urbanization process in Europe. Landscape and urban planning 67(1-4):9-26.

Antrop, Marc. 2004. Landscape change and the urbanization process in Europe. *Landscape and Urban Planning* 67, no. 1-4 (March 15): 9-26. doi:10.1016/S0169-2046(03)00026-4.

Babisch, W., 2006. Transportation noise and cardiovascular risk, Review and synthesis of epidemiological studies, Dose-effect curve and risk estimation. Dessau, Umweltbundesamt, WaBoLu-Hefte 01/06

Baross, P. 2007. Urban Sprawl in Eastern Europe, the Budapest example. In *Urban Sprawl in Europe*. Brussels. http://www.rics.org/Newsroom/Keyissues/Urban/urban_sprawl_seminar_31Aug07.html.

Barredo, J.I., Kasanko, M., McCormick, N., and Lavalle, C., 2003. Modelling dynamic spatial processes: simulation of urban future scenarios through cellular automata. Landscape and Urban Planning, 64(3):145-160.

Barredo, J.I., Lavalle, C., Demicheli, L., Kasanko, M. and McCormick, N., 2003. Sustainable urban and regional planning. The MOLAND activities on urban scenario modelling and forecast. Joint Research Centre of the European Commission 2004 EUR 206 200 73 EN.

Barredo, J.I., Lavalle, C., Kasanko, M., Sagris, V., Brezger, A.S. and McCormick, N., 2004. Climate change impacts on floods in Europe.Towards a set of risk indicators for adaptation. Joint Research Centre of the European Commission 2004 EUR 21472 EN.

Barredo, J.I., Petrov, L., Sagris, V., Lavalle, C. and Genovese, E., 2005. Towards an integrated scenario approach for spatial planning and natural hazards mitigation. Joint Research Centre of the European Commission EUR 21900 EN.

Bellot, Bonet, Peña, and Sánchez. 2007. Human Impacts on Land Cover and Water Balances in a Coastal Mediterranean County. *Environmental Management* 39, no. 3 (March 17): 412-422. doi:10.1007/s00267-005-0317-9.

Bertaud, A. 2004. The Spatial Structures of Central and Eastern European cities: more European than socialist? In *International symposium on post-communist cities the Russian and East European Center (REEC) "Winds of Societal Change: Remaking Post-communist Cities"*, 21.

Blue Plan, 2005. A Sustainable Future for the Mediterranean. The Blue Plan's Environment & Development Outlook. Edited by Guillaume Benoit & Aline Comeau. Earthscan, London. 450 p.

Bond, T.C., Wehner, B., Plewka, A., Wiedensohler, A., Heintzenberg J., Charlson R., (2006). Climate-relevant properties of primary particulate emissions from oil and natural gas. Atmospheric Environment. 40 (19), 3574-3587

Borrego, C., Martins, H., Tchepel, O., Salmim, L., Monteiro, A. and Miranda, A.I., 2006. How urban structure can affect city sustainability from an air quality perspective. Environmental Modelling & Software, 21(4):461-467.

Brueckner, J.K., (2000). Urban sprawl: diagnosis and remedies. International Regional Science Review, 23 (2), 160-171

Bulkeley, H., Betsill M., (2005). Cities and Climate Change: Urban Sustainability and Global Environmental Governance. London and New York: Routledge.

Burton, E. 2000. The Compact city: Just of just compact? A preliminary analysis. Urban Studies 37(11): 1969-2001.

Camagni, R., Gibelli, M.C., and Rigamonti, P., 2002. Urban mobility and urban form: the social and environmental costs of different patterns of urban expansion. Ecological economies, 40(2): 199-216.

Cameron, I., Lyons T.J. and Kenworthy, J.R., 2004. Trends in vehicle kilometers of travel in world cities, 1960-1990: underlying drivers and policy responses. Transport Policy, 11(3):287-298.

Couch, C. and Karecha, J., 2006. Controlling urban sprawl: Some experiences from Liverpool. Cities 23(5):242-363.

Couch, C. Karecha, J. Nuissl, H. Rink, D., 2005. Decline and Sprawl: An evolving type of urban development – observered in Liverpool and Leipzig. European Planning Studies (13)1:117-136.

Couch, C., G. Petschel-Held, and L. Leontidou. 2007. *Urban Sprawl in Europe - Book Information*. http://www.blackwellpublishing.com/book.asp?ref=9781405139175&site=1#about.

Couch, C., Petschel-Held , G. and Leontidou, L., 2008 Urban Sprawl in Europe. Landscape, Land-Use Change & Policy. Blackwell Publishing, RICS.

Couch, Chris, Jay Karecha, Henning Nuissl, and Dieter Rink. 2005. Decline and sprawl: an evolving type of urban development – observed in Liverpool and Leipzig. *European Planning Studies* 13, no. 1: 117. doi:10.1080/0965431042000312433.

De Roo, G., Miller, D., (2000). Compact Cities and Sustainable Urban Development: A Critical assessment of Policies and Plans from an International Perspective. Ashgate, Hampshire, England.

Dieleman, F.,Wegener,M., (2004). Compact city and urban sprawl. Built Environ, 30 (4), 308-323

Dosch, F. 2008. Driving forces of land consumption in Germany. http://www.bbr.bund.de/cln_005/nn_62854/EN/ResearchProgrammes/GeneralDepartmentalResearch/SpatialPlaning/LandConsumption/01__Start.html

Dosch, F., 2001. Land consumption and soil sealing in Germany - monitoring, measures, indicators. Technical Workshop on Indicators for Soil Sealing. Copenhagen, 26 - 27 March, 2001.

EEA & JRC, 2002. Towards an Urban Atlas. Assessment of spatial data on 25 European cities and Urban areas. European Environment Centre and Joint Research Centre of the European Commission. Environmental Issue Report No. 30. Luxembourg, Office for Official Publications of the European Communities.

EEA and JRC, 2006. Urban sprawl in Europe. The ignored challenge. EEA Report 10/2006. Office for Official ublications of the European Communities, Luxembourg.

EEA European Environment Agency, 2007. http://ims.eionet.eu.int, EEA CSI 004

EEA, 2009. Ensuring Quality of Life in European Cites and Towns. In press.

European Commission, 2007. EU Research on Environment and Health - Results from projects funded by the Fifth Framework Report, Luxembourg: Office for Official Publications of the European Communities.

European Commossion, 1990. Green Paper on the urban environment. Communication from the Commission to the Council and the European Parliament. COM(1990) 218 FINAL.

Ewing, R., Pendall, R., Chen, D., (2002). Measuring Sprawl and its Impact. Smart Growth America, Washington, DC.

Fisher, J.B., Kelly, M., Romm, J., (2006). Scales of environmental justice. Combining GIS and spatial analysis for air toxics in California. Health & Place 12 (4), 701-714

Frank, N., S White, Z.-R. Peng, K. Harris, and W. Sanders. 2000. Exploring Sprawl: Findings of a Comprehensive Review of the Literature Related to "Sprawl" or What Do We Really Know? Department of Urban Planning, University of Wisconsin-Milwaukee.

Gillham, O., Maclean, A., (2001). The Limitless City. Island Press, Washington, DC.

Gjestland, T; 2007. The socio-economic impact of noise: A method for assessing noise annoyance. Noise Health, 9:42-4

Gusdorf, François, Stéphane Hallegatte, and Alain Lahellec. Time and space matter: How urban transitions create inequality. *Global Environmental Change* In Press, Corrected Proof. doi:10.1016/j.gloenvcha.2008.06.005. http://www.sciencedirect.com/science/article/B6VFV-4T9TC2J-1/2/eb3974b73eb4f0e1b75a7792d393347a.

Haase, D., Nuissl, H., (2007). Does urban sprawl drive changes in the water balance and policy? The case of Leipzig (Germany) 1870-2003. Landscape and Urban Planning, 80 (1-2), 1-13

Handy, S., 2005. Smart growth and the transportation-lad use connection: What does the research tell us? International Regional Science Review 28(2):146-167.

Hasse, J., Lathrop, R., (2003). Land resource impact indicators of urban sprawl. Applied Geography, 23 (2-3) 159-173

Highwood E.J., Kinnersley R.P., (2006). When smoke gets in our eyes The multiple impacts of atmospheric black carbon on climate, air quality and health. Environment International 32 (4), 560-566

Hitzenberger, R., Tohno, S., (2000). Comparison of black carbon (BC) aerosols in two urban areas - concentrations and size distributions. Atmospheric Environment, 35 (12), 2153-2167

Hoek, G.et al, 2002. Association between mortality and indicators of traffic-related air pollution in the Netherlands: a cohort study, The Lancet 360 (2002) 9341-47

Holden, E. and Norland, I., 2005. Three challenges for the compact city as a sustainable urban form: Household consumption of energy and transport in eight residential areas in the greater Oslo Region. Urban Cities, 42 (12):2145-2166.

Holmes, N.S., Morawska, L.,(2006). A review of dispersion modelling and its application to the dispersion of particles. An overview of different dispersion models available. Atmospheric Environment, 40 (30), 5902-5928

Jarup L., et.al., 2008. Hypertension and exposure to noise near airports: the HYENA study. Environmental Health Perspectives Volume 116, Number 3, March 2008:329-333

Jenks, M., Burgess, R., (2000). Compact Cities: Sustainable Urban Forms for Developing Countries. Spon Press, London.

Johnson, M.P., (2001). Environmental impacts of urban sprawl: a survey of the literature and proposed research agenda. Environonmental Plannning A, 33, 717-735

Kalnay, E., Cai, M., (2003). Impact of urbanization and land-use change on climate. Nature, 423, 528-531

Kasanko, Marjo, Jose I. Barredo, Carlo Lavalle, Niall McCormick, Luca Demicheli, Valentina Sagris, and Arne Brezger. 2006. Are European cities becoming dispersed?: A comparative analysis of 15 European urban areas. *Landscape and Urban Planning* 77, no. 1-2 (June 15): 111-130.

Kasanko, Marjo, Jose I. Barredo, Carlo Lavalle. 2006. Are European cities becoming dispersed?: A comparative analysis of 15 European urban areas. Landscape and Urban Planning 77, no. 1-2 (June 15): 111-130.

Keilman, N., 2003. Biodiversity: The threat of small households. Nature, 421 (6922):489-490.

Koelmans, A.A., Jonker, M., Cornelissen, G., Bucheli, T., Van Noort P., Gustafsson O., (2006). Black carbon. The reverse of its dark side. Chemosphere. 63 (3), 365-377

Kousky, C., Schneider S.H., (2003). Global climate policy. Will cities lead the way. Climate policy. 3 (4), 359-372

Longley, P.A., Mesev. V.,(2000). On the measurement and generalization of urban form. Environonmental Planning A, 32, 473-488

Marshall, J.D., McKone, T.E., Deakin, E., Nazaroff, W.W.,(2005). Inhalation of motor vehicle emissions: effects of urban population and land area. Atmospheric Environment. 39 (2), 283-295

Mattew K., (2006). Green Cities.Urban Growth and the Environment. Brookings Institution.

Mitchell, C.J.A., 2004. Making sense of counterurbanization. Journal of Rural Studies, 20:15-34.

Muñoz, F., 2003. Lock-living: urban sprawl in Mediterranean cities. Cities 20(6): 381-385.

Naess, P., and O. Jensen. 2004. Urban structure matters, even in a small town. Journal of Environmental Planning and Management 47, no. 1: 35-57.

Nuissl, H. and Rink, D., 2005. The 'production' of urban sprawl in eastern Germany as a phenomenon of post-socialist transformation. Cities, 22(2):123 – 134.

Ode, Å. and Fry, G., 2006. A model for quantifying and predicting urban pressure on woodland. Landscape and Urban Planning, 77(1-2):17-27.

Ott, T., 2001. From concentration to deconcentration – migration patterns in the post-socialist city. Cities, 18(6):403 – 412.

Owen, S.M., MacKenzie, A.S., Bunce R.G.H., Stewart H.E., Donovan, R.G., Stark, G., Hewitt C.N., (2006). Urban land classification and its uncertainties using principal component and cluster analyses. A case study for the UK West Midlands. Landscape and Urban Planning, 78, 311-321

PBL, 2008. Urbanisation dynamics and Quality of Place in Europe, EURBANIS report 1. Planbureau voor de Leefomgeving (NEAA), Bilthoven, the Netherlands.

Per Ronald van Kempen, Marcel Vermeulen, Ad Baan, European Institute for Comparative Urban Research, 2006. Urban Issues And Urban Policies In The New EU Countries. Ashgate Publishing, Ltd.

Pijanowski, Bryan C., Daniel G. Brown, Bradley A. Shellito, and Gaurav A. Manik. 2002. Using neural networks and GIS to forecast land use changes: a Land Transformation Model. Computers, Environment and Urban Systems 26(6): 553-575.

Scipioni, Antonio, Anna Mazzi, Marco Mason, and Alessandro Manzardo. 2008. The Dashboard of Sustainability to measure the local urban sustainable development: The case study of Padua Municipality. Ecological Indicators In Press, Corrected Proof.

Stansfeld et al., 2005. Aircraft and road traffic noise and children's cognition and health: a cross-national study. The Lancet, Volume 365, Issue 9475, Pages 1942

Sutton, P.C., (2006). A scale-adjusted measure of Urban sprawl using night-time satellite imagery. Remote Sensing of Environment. 86 (3), 353 - 369

Svensson, M.K. and Eliasson, I., 2003. Diurnal air temperatures in built-up areas in relation to urban planning. Landscape and Urban Planning, 61:37-54.

Tapioa, P., Banisterb, D., Luukkanena, J., Vehmasa, J., Willamo R., (2007). Energy and transport in comparison: Immaterialisation, dematerialisation and decarbonisation in the EU15 between 1970 and 2000. Energy Policy, 35 (1), 4333-451

Thunis, P., Rouil L., Cuvelier, C., Stern R., Kerschbaumer, A., Bessagnet, B., Schaap, M., Builtjes, P. Tarrason, L., Douros, J., Moussiopoulos, N., Pirovano, G., Bedogni, M., (2006). Analysis of model responses to emission-reduction scenarios within the citydelta project. Atmospheric Environment, 41 (1), 2007, 208-220

Torrens, P.M., Marina, A., (2000). Measuring Sprawl. Centre for Advanced Spatial, London.

Tsai, Y., (2005). Quantifying Urban Form. Compactness versus 'Sprawl'. Urban Studies, 42 (1) 141-161

Turok, Ivan, and Vlad Mykhnenko. 2007. The trajectories of European cities, 1960-2005. *Cities* 24, no. 3 (June): 165-182.

van Kempen, R, Vermeulen, M. Baan, A. 2005. Urban Issues And Urban Policies In The New EU Countries. Ashgate Publishing.

Voogt J.A., Oke T.R., (2003).Thermal remote sensing of urban climates. Remote Sensing of Environment. 86 (3), 370-384

York, R., (2007). Demographic trends and energy consumption in European Union Nations 1960 - 2000. Social Science Research. 36 (3), 855-872

Zellner, Moira L., Thomas L. Theis, Arunprakash T. Karunanithi, Ahjond S. Garmestani, and Heriberto Cabezas. 2008. A new framework for urban sustainability assessments: Linking complexity, information and policy. Computers, Environment and Urban Systems In Press. Corrected Proof.

Chapter 2 – Major past trends and probable future demographic trends

Gilles Van Hamme

Demographic trends in the European cities are in accordance with the general trends at European level and at the national and regional level in which they are embedded. This is why we will first describe the demographic trends at the European level (section 1) before we get into the national and regional specificities of these trends (section 2). Demographic specificities of the cities will be tackled in the third section, including the intra-urban demographic differentiation.

1. Major trends at the European level

Past trends

At the most general level, demographic trends of the whole Europe are of course affecting the cities. Demographic trends are well documented in the institutional literature: the state of the cities and cohesion reports give a relatively clear idea of demographic trends in the European cities and regions. In this literature, the accent is put on global trends affecting nearly all European cities: the ageing process, immigration processes, evolutions of the household compositions and declining fertility are the most common themes. These trends are the result of long term structural trends on which policies seem to have little impact:
- the decline of fertility rate is related to social and cultural evolutions such as the increasing women's activity rate. In recent years, fertility rates have stabilized at a relatively low level in nearly all European countries, with some countries showing a slight increase (Sweden, France) ;
- the increase of life expectancy;
- the ageing process as a long term consequence of these two first processes;
- the household's decomposition with the growing share of single-adult household is also to be understood in this structural evolutions of the society (woman's work, individualism…);
- immigration. From the nineties on, Europe became an immigration continent, which was not the case before (Vandermotten et al., 2004). The trends in immigration are much more subject to short and medium term evolutions and immigration is often seen as the possible adjustment variable in demography and economy. However, migratory policies have a moderate impact on migratory flows which concentrate in the major cities.

Future evolutions

Because of the inertia of the age structure, demographic trends are reasonably well predictable. First, it seems that in the last years, fertility rate has reached a bottom level and does not change much. Second, life expectancy continues to increase regularly in Europe. By applying these trends on the age structure, there is little doubt that Europe as a whole and all parts of Europe will have to face a population decrease, an ageing process and a growing dependency ratio.

Immigration seems to be the only process which could soften this ageing process. However, the economic crisis will probably affect immigration policies. Past experience in the seventies in North-western countries suggest that the crisis and closing borders finally reduce the immigration process and change its nature (from working immigration

to familiar one). How much the new crisis will affect immigration in a more open, unequal and globalized world is of course subject to uncertainty?

2. Geographical differences in these major trends

Past trends

At the second level, the European trends have diversified pattern at regional level and cities themselves have similar evolutions than the regional and national environment in which they are embedded (State of the European cities, 2007). These national and regional demographic patterns are well known and also, to a certain extent, well predictable because of the inertia of the age structures (Espon 1.1.4, 2004; Shrinking regions, 2008; Fourth report on social and economic cohesion, 2007). The most unpredictable evolution concerns of course migratory flows, especially those coming from outside Europe.

The major geographical cleavage is between Eastern and Western Europe (Map 1). The most dramatic demographic evolutions have been observed in central and Eastern European countries. First, it is due to the huge fall of fertility in the 90's. Second, in the same time, life expectancy is lower and has stagnated in some countries in the nineties. Finally, central and Eastern Europe has not been attractive for immigration: on the contrary, migratory balances have been negative for nearly all regions between 1995 and 2005 except Czech and Hungarian regions as well as some capital cities. However, because of originally younger population in the eighties, the population is not older in the NMS than it is in Western Europe but the ageing process is much faster because of these trends.

In Western Europe, the fall of fertility has been more regular and never reaches the level observed in some parts of Eastern Europe, except in some parts of Germany, Northern Italy and Northern Spain. One of the main long term evolutions inside Western Europe is that we do not anymore observe difference between peripheral Western Europe (Mediterranean and Ireland) and the north-western countries. In the sixties, natural growth was higher in the peripheral Europe and migratory flows were from peripheral to central areas at both European and national scales (Vandermotten et al., 2004).

Nowadays, the geographical pattern of demographic trends inside Western Europe has become much more complex (map 1):

- the difference in fertility rate has disappeared and some southern parts of Europe have the lowest rates of all Europe (Northern Spain for example);
- life expectancy is often higher in some Mediterranean regions (Greece for example). Once reached a certain level of GDP per capita, the economic wealth has a marginal impact on life expectancy which depend much more on social and cultural features, such as the quality of the food or the health system (OECD, Social indicators, 2006);
- Mediterranean countries and Ireland have become massive immigration countries at least from the end of the nineties.

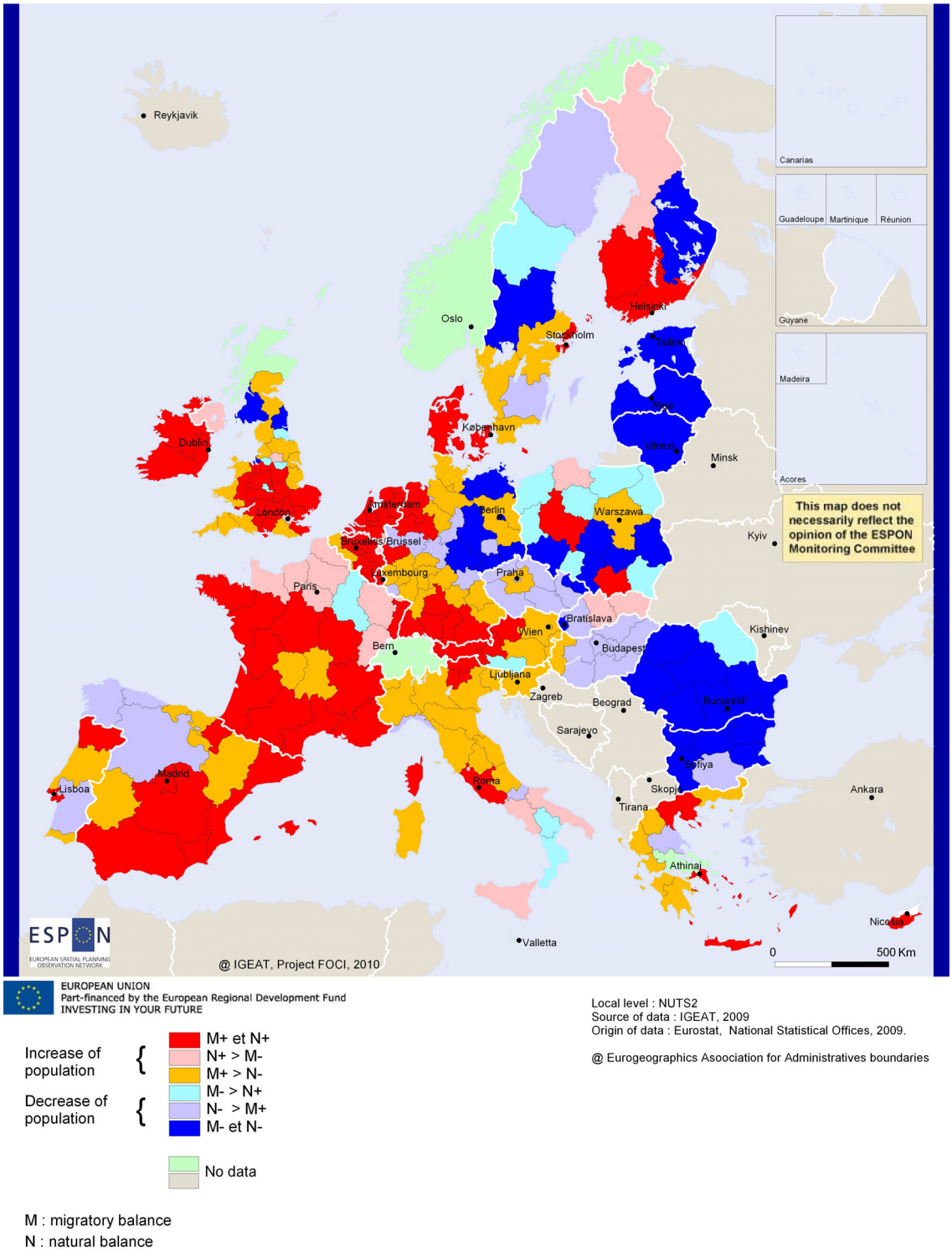

Figure 1. Components of population increase at NUTS2 level, 1995-2004
Note: Each region has been classified according to the main component (natural or migratory) of its demographic increase or decrease. For example N+ > M- (pink) means a region with population increase because of natural growth and despite negative migratory balance.

Future evolutions

Most of the shrinking regions for the next 25 years are indeed located in central and Eastern Europe, including Eastern Germany (see map 2) (Shrinking regions; ESPON 1.1.4). However, the capacity of Western European regions to maintain their population is in most of the regions, except France and Ireland, related to the capacity to attract new migrants. And as already discussed in section 1, for economic and political reasons, there is no certainty about that.

However, because of the inertia of age structure and lower life expectancy, dependency ratio of the older population on the active age population will still be lower in the NMS than it will be in Western Europe in 2030 (Map 3). Major cities are also characterized by lower dependency on the old population but the main reason here is their capacity to attract young active population.

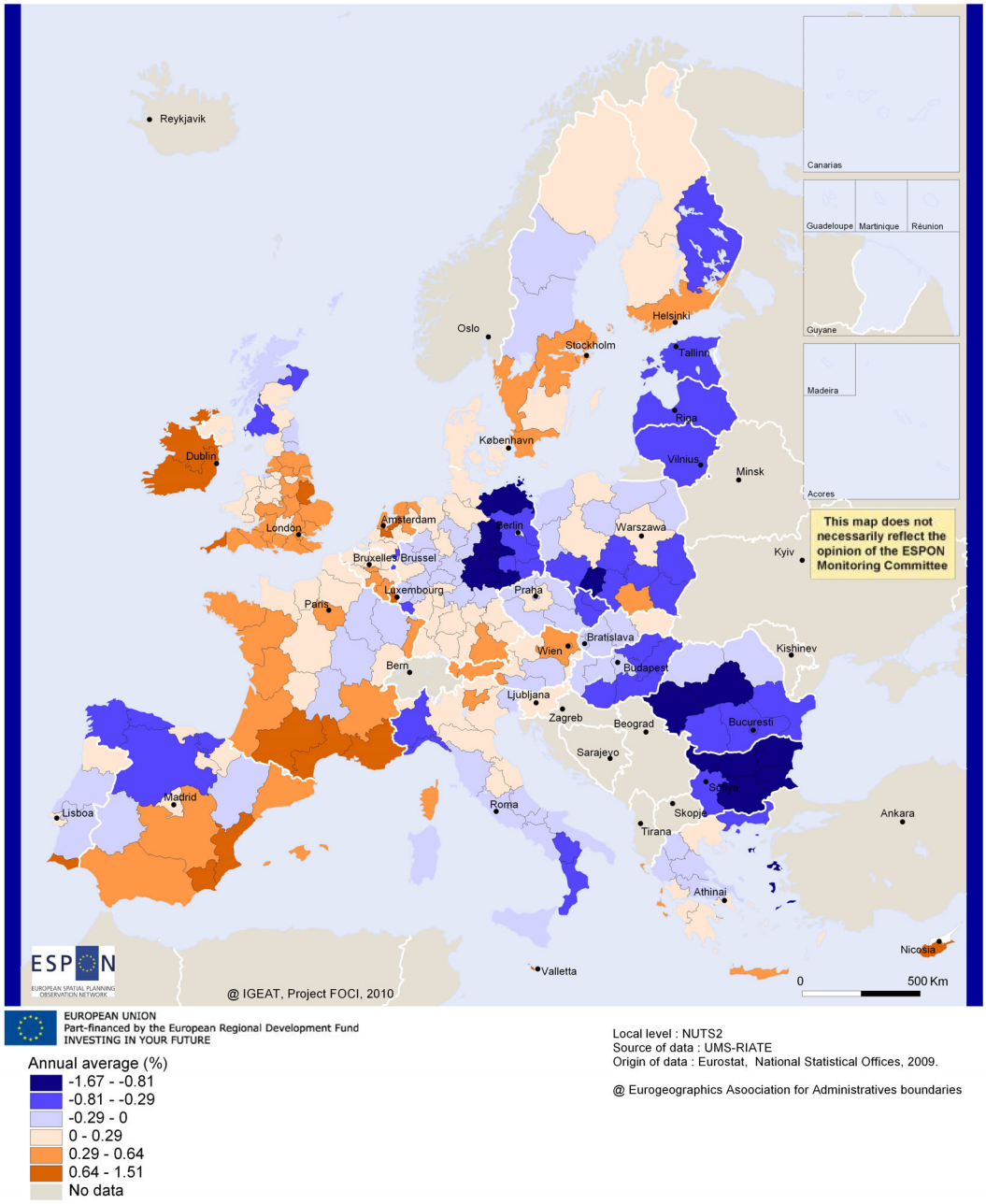

Figure 2. Population increase 2005-2030. NUTS2.
Source: Eurostat, National Statistical institute for France and UK, UMS-RIATE for calculations*.
*Data have been gathered in a project financed by the European parliament

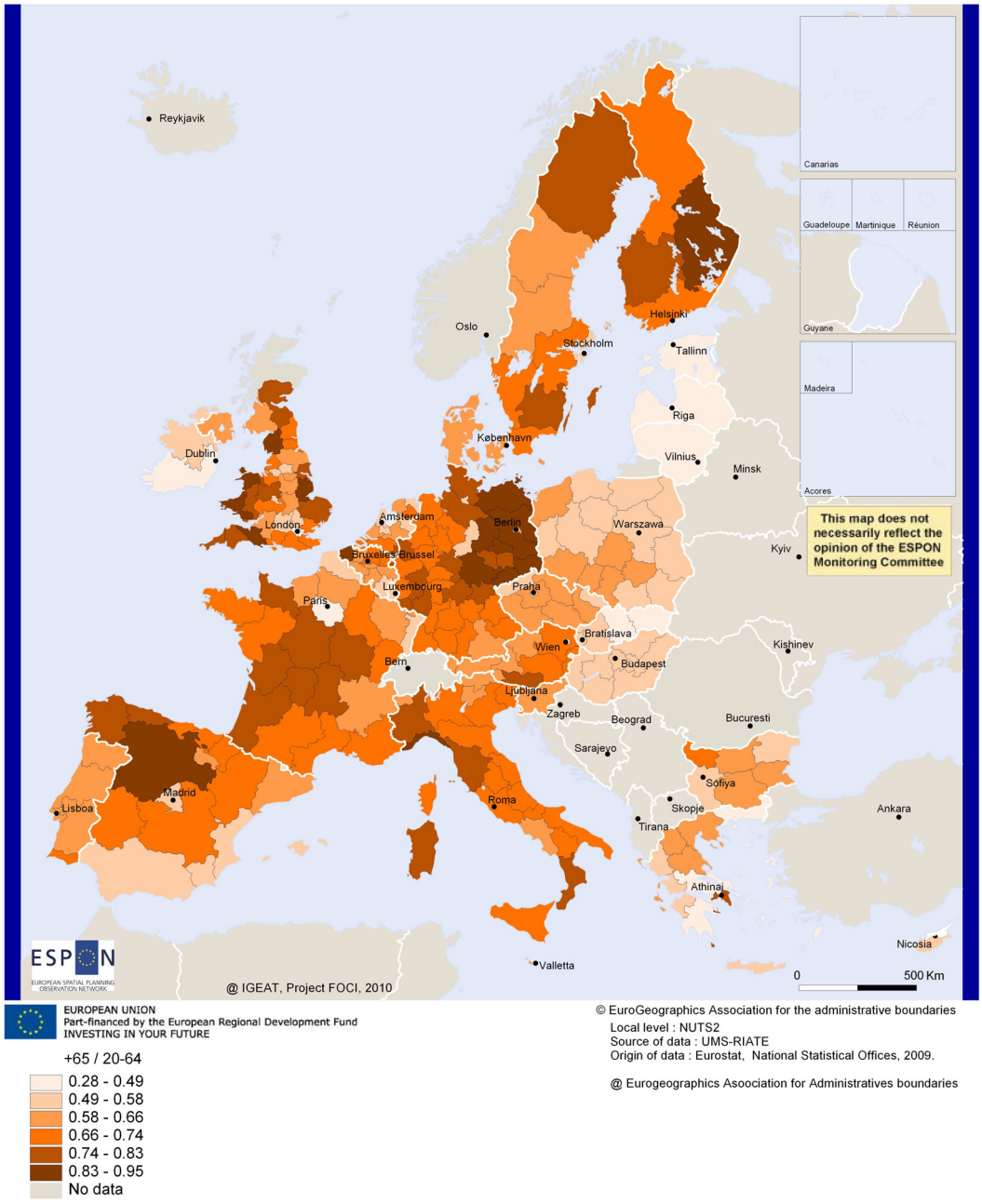

Figure 3. Dependency of old versus active age population in 2030. NUTS2
Source: Eurostat, National Statistical institute for France and UK, UMS-RIATE for calculations*.
*Data have been gathered in a project financed by the European parliament

3. Specificities of the cities

As already stated, The demography of the cities – especially when not considering the biggest ones – are very much in accordance with the regional and national trends in which they are embedded. This is illustrated by maps 4 and 5, which illustrate the growth pattern of European cities on two different periods, according also to two different sources. Map 4 gives annual population growth on the base of NUTS3 proxy of LUZ, because data are more complete than urban audit in the 90's. Map 5 gives the evolution of population between the two last periods of urban audit, that is for most regions between 2001 and 2004. When compared to the data of NUTS3 proxy for the same period, correlations are 0.7 which is rather weak for two different measures of the same indicator. It may be explained by the difference of period and delimitations in the sources.

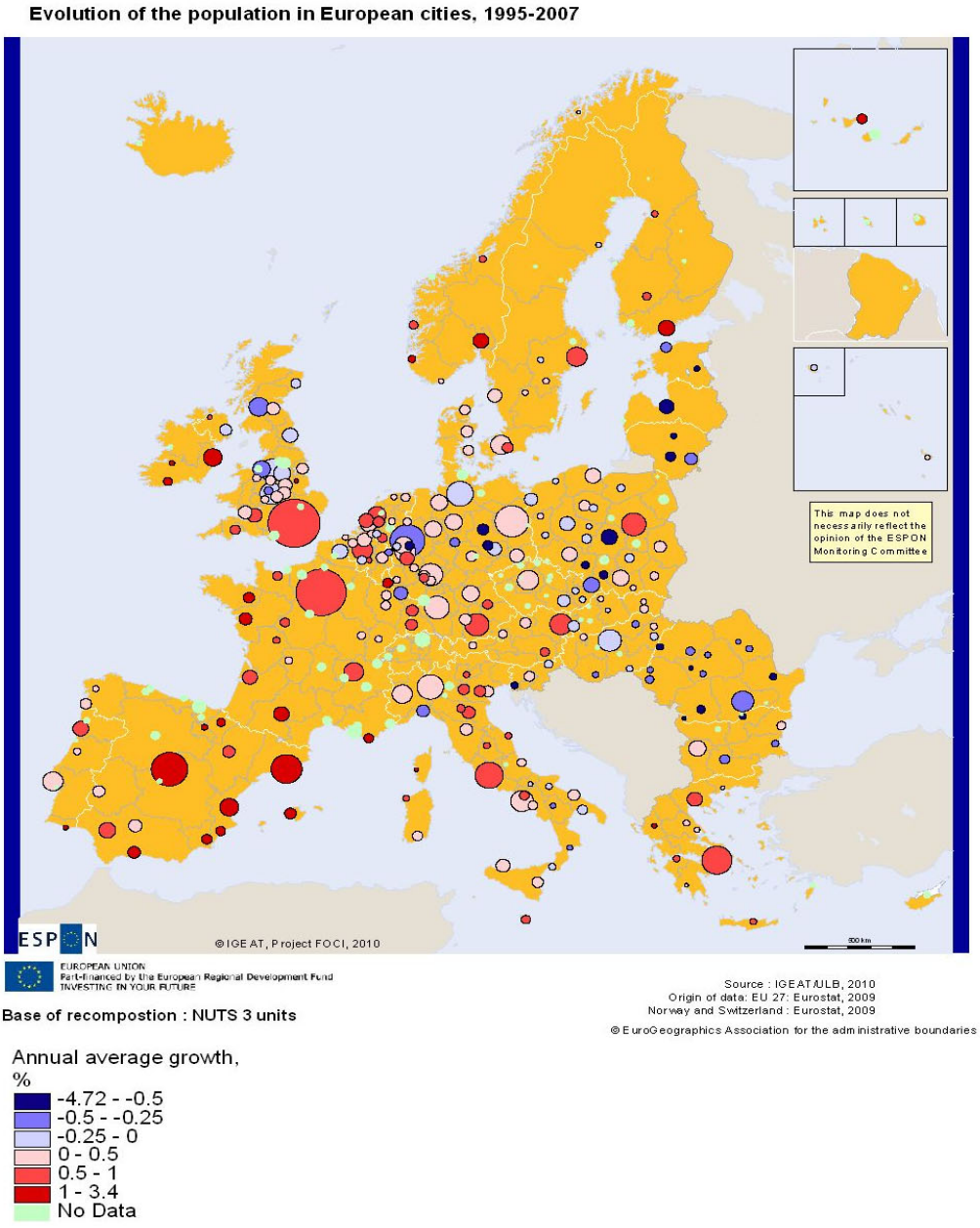

Figure 4. Population growth in the LUZ, 1995-2007
Source: Eurostat, and personal calculations

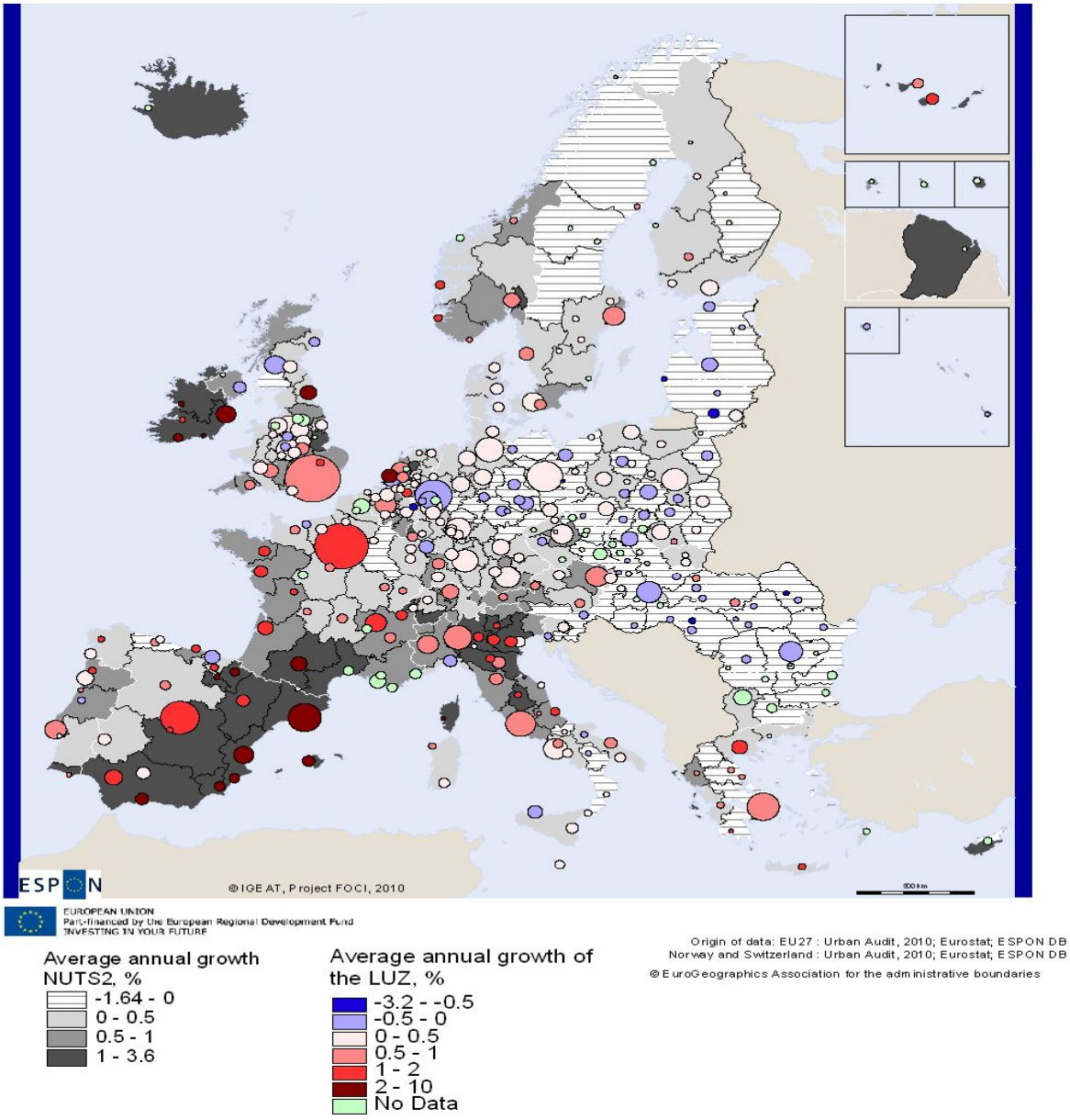

Figure 5. Population growth in the LUZ and in the NUTS2 regions, first half of the years 2000*

* the period is not strictly the same for all cities because the reference year of the data are different for each city. For most cities, the period is 2001 to 2004.
Source: Urban audit, Eurostat and personal calculations

However, cities in general – at least beyond a certain level of the urban hierarchy – have a specific position in the migratory process. They attract young populations (students, young active and foreigner immigrants) and expulse older active (active adult's households with children, old active people, and young pensioners).

According to the position of the cities in the urban hierarchy, this process occurs at the different scales: major cities such as London or Paris and many other capital cities play this role at the national and growingly at the international level (migration of wealthy pensioners to coastal Spain for example); at a lower hierarchical level, cities may play this role at the regional level; for the small cities, this process could be reduced to the suburbanization process which is of course also taking place in the bigger cities.

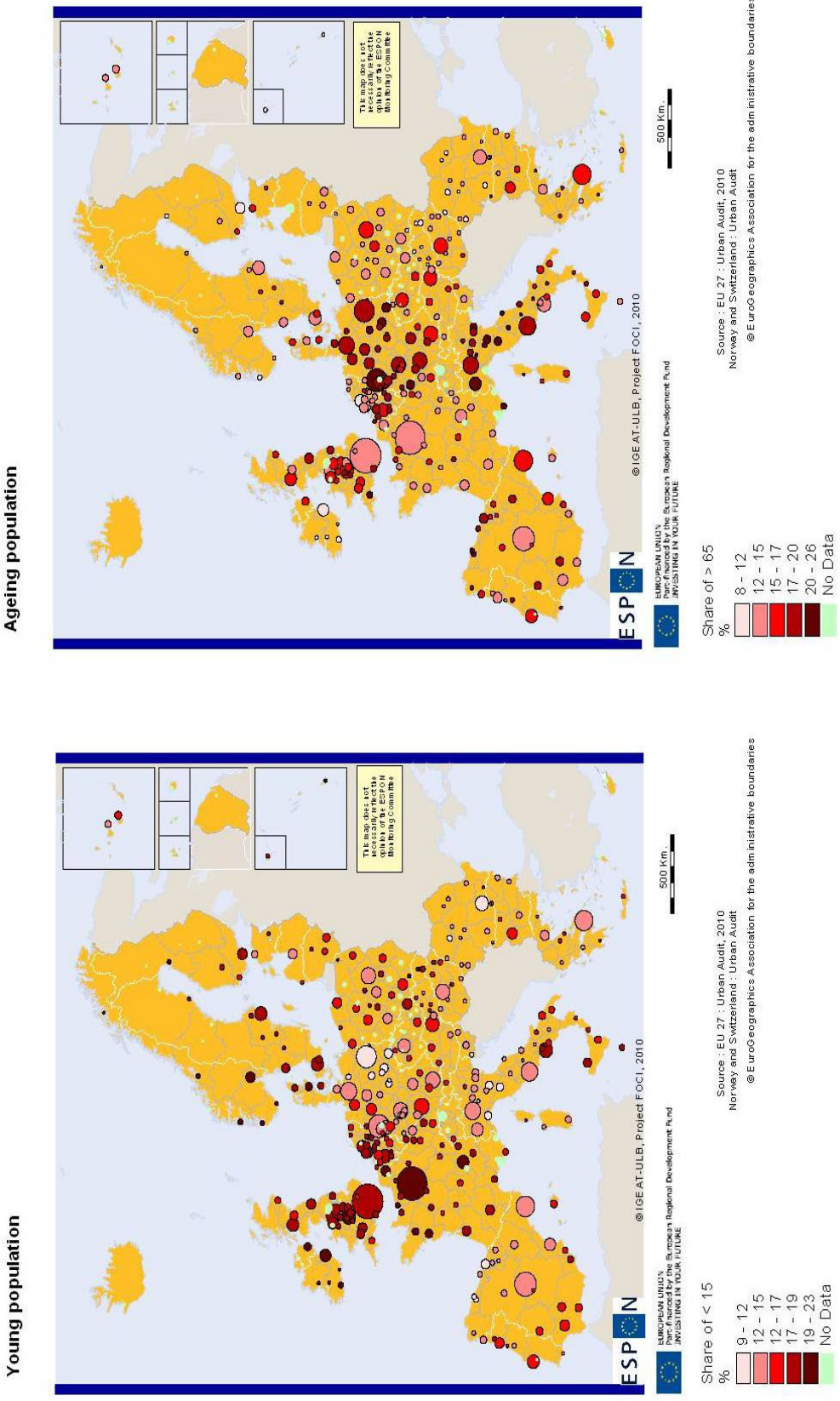

Figure 6. Young and old people in European LUZ, around 2005
Source: Urban audit, and personal calculations

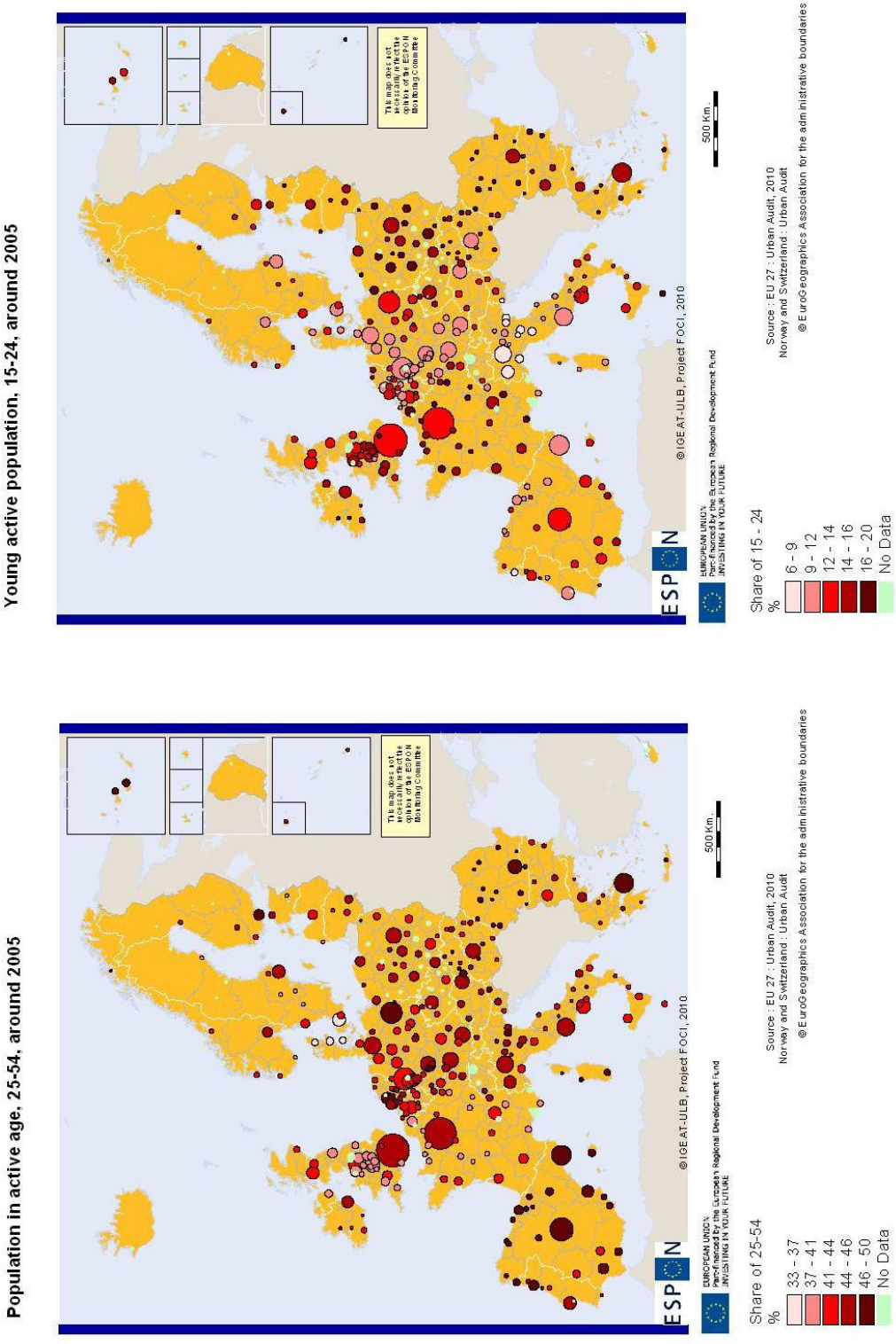

Figure 7. Active ages in European LUZ, around 2005
Source: Urban audit, and personal calculations

The official literature treats in a more marginal way major trends of the internal evolutions of the cities. Concerning this aspect of intra-urban dynamics, the huge scientific literature is structured around two major paradigms, strongly related to the social and territorial cohesion: suburbanisation (Harvey, 1990; Donzelot, 2004) and gentrification (e.g. Smith, 2000; Lees et al., 2007; Van Criekingen, 2008). The demographic results of the intra-urban migratory movements can be synthesized as follows:

- A younger population in the city centres, especially in the most central areas where a gentrification process has taken place;
- A higher share of active households with children in the suburban areas. These middle class populations are the most concerned by the urban sprawl process through suburbanization;
- Poor immigrants – new comers as well as the second or third generation of ancient immigration – are concentrated in some specific areas of the cities. Two types of geographical structures can be observed regarding the location of immigrant in the cities: concentrations near to the centres (case in Belgium, Germany, UK…) or in specific parts of the suburbs (France, Mediterranean countries).

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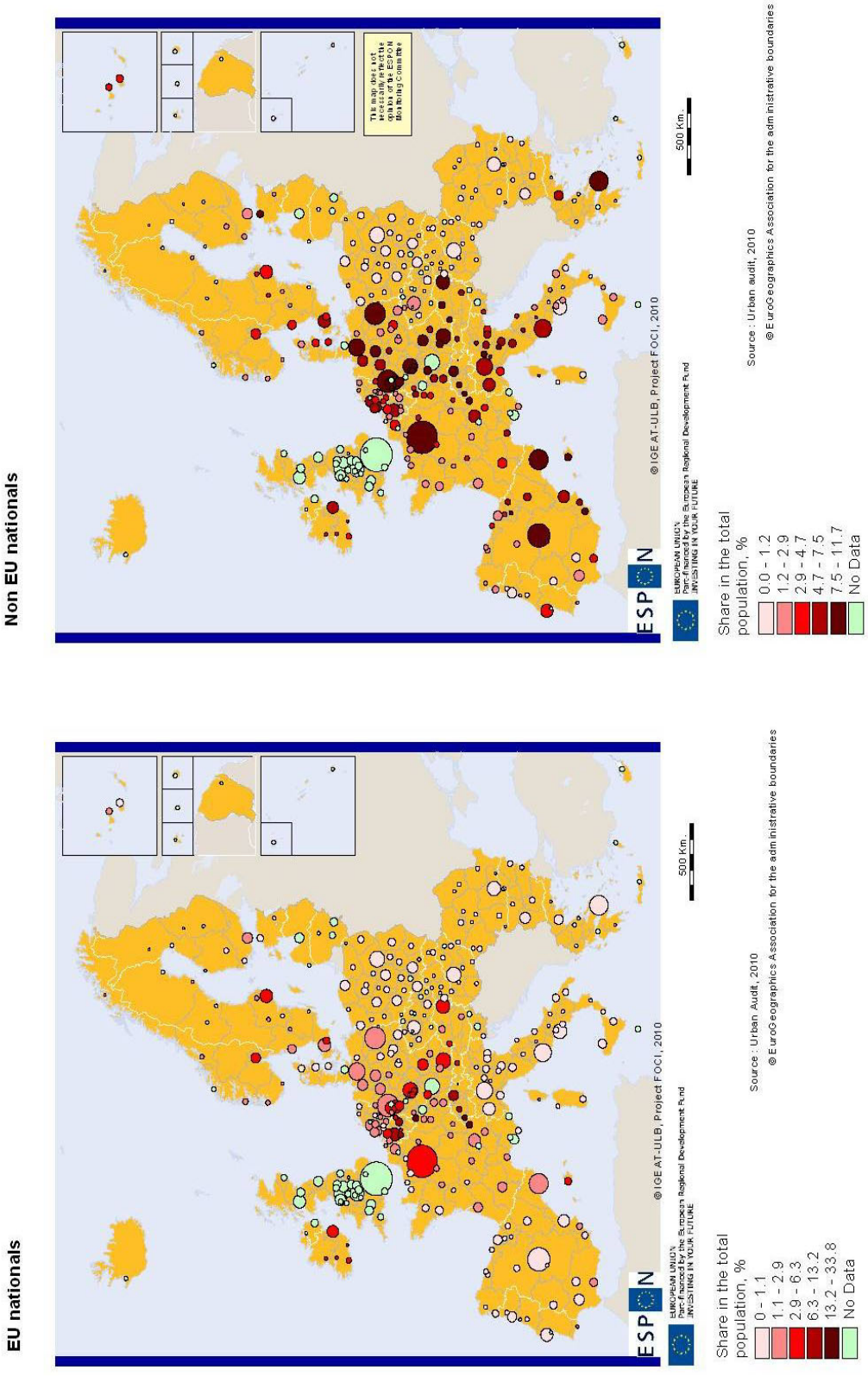


Figure 8. Share of foreigner population in European cities, around 2005

According to these trends, Map 9 is showing spectacular results. Cities in blue on the map have gone through higher population growth in the core cities than in the suburban areas. Of course, most of the cities are in red, which means the suburbanization process is the dominant process. This is especially true in most of Mediterranean, Ireland and Central and Eastern cities, where suburbanization has developed much later than in most north-western European cities (after 1990 in ex-communist countries). But for many cities, especially in the most dense and urbanized parts of Europe – the blue banana between Northern England and Northern Italy – the reverse is true, that is core cities have gone through higher population growth than their suburbs. This is particularly true in Great Britain but also in some big German cities, in Vienna and in the two biggest North Italian cities (Milano and Torino). Ain exceptions are to be found in Amsterdam and Den Haag, that is in a country where suburbanization has traditionally been limited by very strict land planning. This is a rather new situation which can be explained by several factors:

- a gentrification process, that is a renewal of the core cities dynamics due to processes of urban renovation, new cultural features and the growing flexibilization of young active population (Vancriekingen, 2009; Bromley et al., 2007);
- a concomitant slowing down of suburbanization process, notably because this process occurs at higher ages;
- intense foreigner immigration towards city centres, where new foreigner population is often confined in specific deprived and not yet gentrified neighbourhoods (see map 11).

However, because this intra-urban dynamics may hide very different demographic evolutions, we propose a typology of European LUZ according to their intra-urban dynamics: we distinguish first between growing and declining LUZ, and then we take into account the dynamics in the core and in the peripheral areas of the LUZ. On this map, we can distinguish several major types of evolution:

- in the dense urban and central parts of Europe, many cities are characterized by their population growth in both core and peripheries, with often higher growth rates in the core cities;
- in Eastern Europe, most of the cities are characterized by the decline of their population with an intense process of suburbanization, except mainly Warsaw and Praha;
- in Mediterranean LUZ, we observe population growth with an intense process of suburbanization.

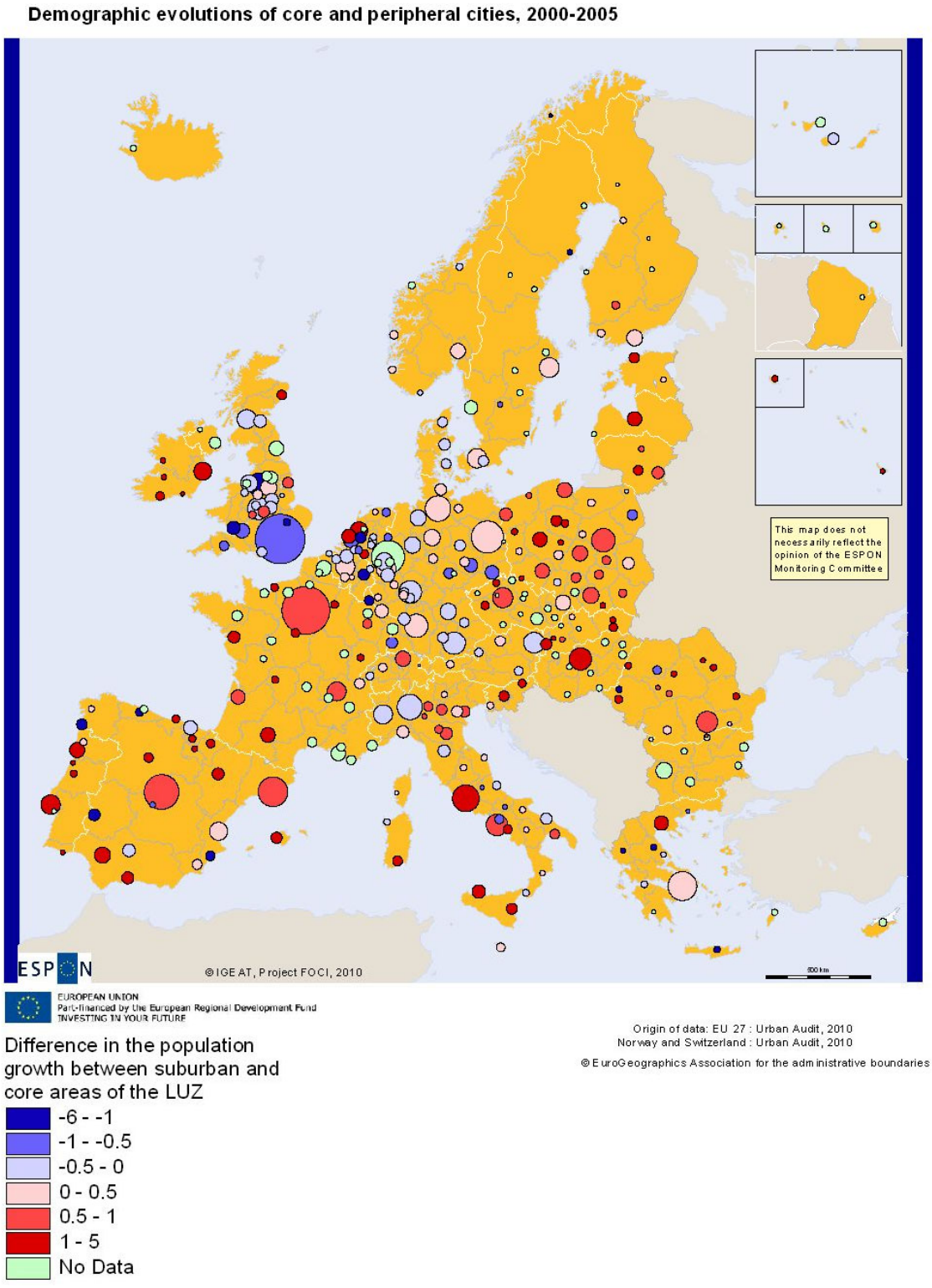


Figure 9. Population dynamics in core and peripheral European cities, first half of the years 2000

* the period is not strictly the same for all cities because the reference year of the data are different for each city. For most cities, the period is 2001 to 2004.

Source: Urban audit, and personal calculations

Indicator: For each LUZ, the difference between the average growth of the periphery and the average annual growth of the core cities is calculated. The more blue, the higher the difference in favour of the core city

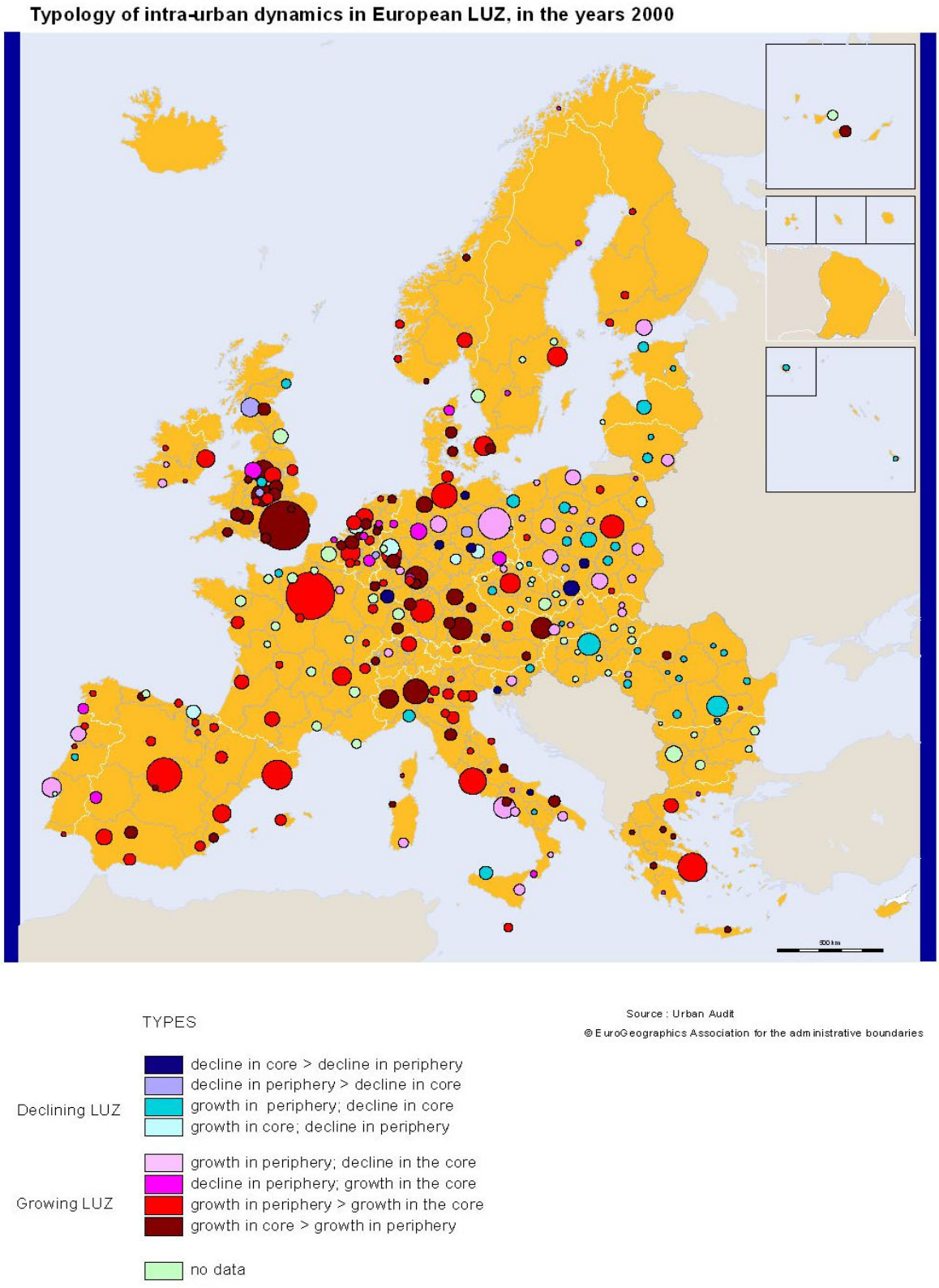


Figure 10. Typology of cities according to the population dynamics in core and peripheries, first half of the years 2000

* the period is not strictly the same for all cities because the reference year of the data are different for each city. For most cities, the period is 2001 to 2004.

Source: Urban audit, and personal calculations

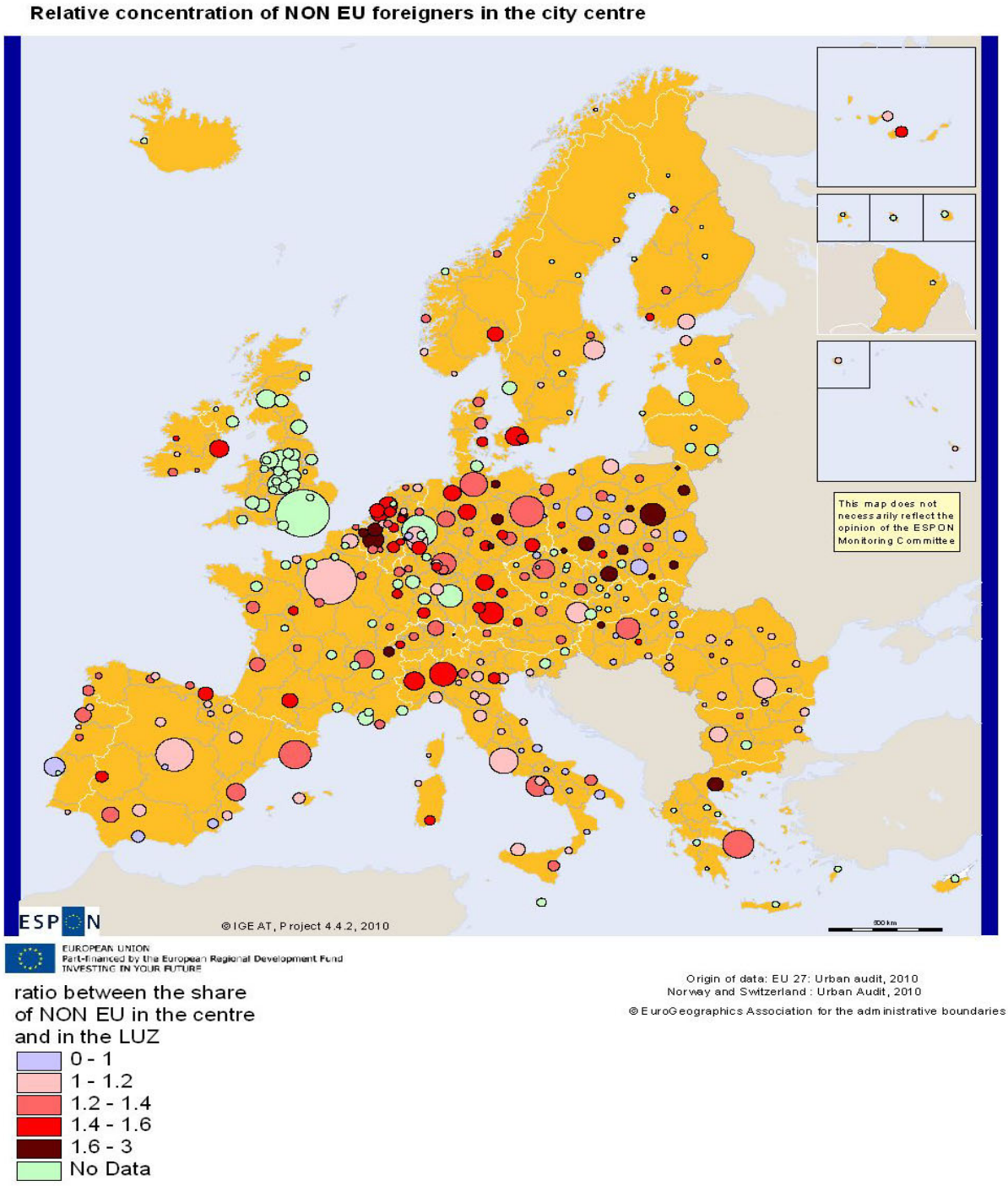


Figure 11. Relative concentration of the NON-EU foreigners in the city centre, around 2005

4. Main expected trends

At European level, as already stated, we should not expect major evolutions in the structural trends in terms of the evolution of fertility rates and life expectancy. Hence, given the current age structure, demographic evolutions are well predictable at the European, national and regional level (map 2).

However, migratory trends are much more unpredictable.
For Western Europe as a whole, the question is whether, in the context of the crisis, the extra-European immigration will continue in the next years. Two scenarios are possible. First, because of push factors, immigration remains at high level despite the political will to control it. Second, because job opportunities are declining, immigration slows down and is limited to family reunification, which has been the evolution observed during the seventies crisis in north-west European countries. However, in both scenarios, we may also suppose that the most attractive countries for immigration, except for family reunification, will not be the same because most of these countries have been more severely hit by the crisis. This is the case for Spain, Greece, Ireland and, to a lesser extent, United Kingdom.
At the intra-urban scale, the question is whether the recent dynamics of core cities observed in the denser and urbanized parts of Europe will spread to Mediterranean and Eastern cities. In the latter, suburbanization has been a very late process, mostly post 1990, which means that we may expect it will continue for some years.

Chapter 3 – Social cohesion in European cities

Gilles Van Hamme, IGEAT

Introduction

In general, European studies are using a static and normative view of social cohesion through several simple indicators (see for example « State of European Cities »; Reports on social and territorial cohesion). Also, it seems to confuse two very different aspects in the way to assess the social cohesion inside the European space: social cohesion to sustain competitiveness; social cohesion as alternative non economic evaluations of well-being (Buck, 2005).

In this project, we intend to clearly separate these two main aspects and only focus on the second one in this chapter, the first being integrated in the chapter on competitiveness. This approach is also the one adopted by OECD in its report on social indicators (Society at a Glance: OECD Social Indicators - 2006 Edition, page 16): "Promoting social cohesion is a central goal for social policy in many OECD countries. However, because of the lack of a commonly-accepted definition of the term, identifying suitable indicators is especially difficult. The approach taken in this volume is to assess social cohesion through indicators that describe both the extent to which citizens participate in societal life and derive satisfaction from their daily activities; and those informing about various pathologies and conditions that put affected individuals at risk of exclusion from mainstream society, or that reveal the extent of social strife in a country."

OECD provides then a more operational conception of social cohesion related to 4 major objectives of social policy:
"A) Enhancing ***self-sufficiency***
B) improving ***Equity***
C) improving the ***health status*** of populations
D) Improving the ***Social cohesion*** which is often identified as an over-arching objective of the social policies of countries. While little agreement exists on what precisely it means, a range of pathologies are informative about *lack* of social cohesion. This is true, for example of crime, imprisonment, suicides, industrial strife, and family instability. Falling under this heading are also measures of the extent to which individuals' participate in the community where they live." (Society at a Glance: OECD Social Indicators - 2006 Edition, page 11)"

The literature provides some evidence of general trends about the evolution of social inequalities, social-spatial inequalities and social exclusion in the cities.

First, it seems clear that in the last decades, social polarization has increased in nearly all rich countries, including the new member states of EU after the collapse of communism. However, the intensity and the timing of this trend are very different from one country to another. For example, while it has mainly occurred in the eighties in the UK, it has begun only from the nineties in the Nordic countries. Also, the final point is very different from one country to another (Croissance et inégalités : Distribution des revenus et pauvreté dans les pays de l'OCDE, OCDE, 2008). However, we also find some evidences, at least for the European countries, that – mainly for the recent years – the inequalities have increased more at the top of the income distribution than at the bottom (Smeeding, 2002).

There is no systematic empirical testing trying to assess these trends at the city level in Europe. However, many authors argue that this trend has been particularly dramatic in the global cities, whatever the driving forces behind this process (Sassen, 1990; Hamnett, 1996). To put it very simply, the level of social polarization of a city seems to

depend first of the national context and second to its level of insertion in the global economy and the new forms of economic growth related to the knowledge-based economy.

Second, social-spatial polarization in the cities seems also to have increased in the last decades with growing gaps in well-being between the districts of the cities. This can be explained by global economic changes and cut backs on welfare (Badcock, 1997). However, it is clear that the spatial configuration of this process is very different according to the socio-residential heritages of the cities (Musterd & Murie, 1996). This socio-spatial configuration is not unimportant since some authors argue that the place of residence has an impact on the social exclusion processes (Musterd & Kesteloot, 2003).

Third, there is less evidence of a general increase of social exclusion since it might take very different forms and be measured through very different indicators: employment; incomes; social life…. In the city, major evolutions could have contradictory impacts on social exclusion: on the one hand, the specificities of the cities labour market reinforce social polarization and, on the other hand, informal networks inside the cities might soften such exclusion process.

Given the lack of empirical evidences on these different aspects at the city level, our project needs to produce more systematic empirical evidences on these past trends in Europe with some basic indicators concerning social polarization at the whole city level, socio-spatial polarization, social exclusion processes.

From the scientific literature, we identify several major driving forces on the social polarization in the city: **the economic evolutions, especially regarding the evolution of the job offers in terms of qualification** (Sassen ; Hamnett; Wilson; numerous monographic studies); the **socio-demographic evolutions** which have huge impacts on social exclusion (composition of the household for example); **the evolution of real estate market** which is strongly related to the previous factor through the gentrification processes (Madanipour et al., 1998; Mingione, 1999); **public policies** at the state and at the city-level (Esping-Anderson, 1990; Harvey, 1989; Musterd & Ostendorf, 2004).

We will examine these driving forces in more detail in section 1. In section 2, we will propose a methodology to assess the position of European cities according to social cohesion, which will be applied in section 3. The last section (section 4) focuses on the empirical analysis of the complex relationship between social cohesion and economic growth in European cities.

1. Past evolutions and main driving forces behind the process of social polarization in cities

1.1. Economic and labour market driving forces of social polarization in the city

The basic question is about the relationships between the economic evolutions – the "new forms of growth" – on the one hand, and the evolution of social polarization, on the other hand.

Interpretative frameworks have long remained dominated by considerations of the social and socio-spatial consequences of the decline of the fordist / industrial model. The decline of industrial manufacturing industry has been observed in all developed countries. Already during the fordist period, we observed a decline of industrial manufacturing activity in the city: the shortage of workforce during the golden sixties (full-employment

period) for "taylorized production" and the growing space demand of new industrial architecture are the major causes of this divorce between the manufacture and the city in the sixties. The seventies crisis has accelerated the deindustrialization process of the cities leading to a social crisis. However, to a certain extent, deindustrialization is not the major process of social polarization in the last years because most of the manufacturing industry has already gone in most of the cities. In many European cities, even industrial suburbs are nowadays poorly industrialized. This is however less true for some German cities for example (see Working Paper on competitiveness). Also, it clearly appears that central and eastern capitals have been able to attract both medium-high level services and manufacturing industries at the same time.

In the last decades, the literature has emphasized more on the major restructuring of economic process occuring in many cities through the concept of metropolitanization. There is a large body of works in economic geography or spatial economy tackling with issues of economic growth of metropolitan areas in the contemporary post-industrial – or post-fordist – period (e.g. Fujita et al. 1999; Veltz, 1996; Storper, 1997; Taylor, 1998). These works notably highlight the new emphasis put on short-term profitability in knowledge-based sectors and the growing competition between firms for new, innovative products or services in advanced capitalist economies. These characteristics strongly emphasize high-skilled segments within the production process (such as R&D, marketing, consultancy, financial analysis, etc.), while low-skilled routine functions are subjected to a wide range of cost-minimisation strategies. This **professionalization process** in a more intensively **knowledge-based economy** is also to be understood in the **globalization process**. The literature emphasizes the growing importance of interconnections between cities especially in the most advanced services. In this perspecive the interconnectivity of the cities (space of flows) is supposed to become more important than the connection in the local environment with the Hinterland (Taylor, 1998). In this context, we observe the emergence of a very mobile world elite with very high salaries, strongly disconnected from their local (temporary) environment (Castells, 1996). Locations in large metropolitan environments are clearly favoured under such new conditions of economic production, notably given the possibility for firms to tap into a vast reservoir of highly-skilled professionals or specialist sub-contractors (e.g. Sassen, 1998) and the interconnectivity of these cities (Knox & Taylor, 1995).

However, the processes that lead to a social polarization of the labour market in the cities are still a matter of debate. Parallel to the growing demand for highly skilled labour, some authors also highlight that there is also a growing demand for low qualified personal services in low unionized, female, precarious and partial jobs (Sassen, 1998). Others authors insist more on a general professionalization with lower and insufficient demand of low qualified labour (Hamnett, 1998), with the emergence of a spatially concentrated urban underclass (Wilson, 1987).

In the Marxian and regulation literature, the focus is on the new forms of regulation of the so-called flexible capitalism in regard to the fordist regime (Husson, 2008; Levy & Duménil, 2001). As compared to the analysis described above, the focus is less on the technological evolutions related to the knowledge-based economy or informational technologies, but more on the reorganization of the work after the blockages faced by the fordist economy (Harvey, 2006). Labour force shortage, high salaries and the high level of organization of the workforce explain at least for a part the decline of the profit rates at the end of the fordist period and the necessity to restore them through new forms of (de)regulation. Flexible capitalism is often considered as this new form of (de)regulation: it notably supposes a more flexible reorganization of the work (outsourcing process at different scales) and a growing competition between workers in a more globally integrated economy. In consequence, social polarization has been accelerated rather than initiated by technical innovations. In this perspective, the social polarization is not the result of new offer/demand equilibrium for qualified and unqualified workforce but a new political form of economic regulation to restore the profit

rate which has been possible because of new power relations between capital and work in a period of structural unemployment. The fragmentation and segmentation of the production process has weakened (and made more flexible) the workers and produced worst situations for large segments of them than in the previous period.

From the literature, we can argue that the new forms of economic growth lead to growing social polarization through different mechanisms. From this literature, we can argue *that the more global and the more engaged in the knowledge-based economy a city, the more socially polarized it will be* – all other things being equal –.

1.2. Socio-demographic driving forces and real estate

In the process of social exclusion and social polarization, household composition plays a major role (OECD, 2008; State of European cities, 2008). It means that within stable economic and labour market conditions, social polarization and poverty increases only because of some socio-demographic trends, which are particularly marked in the cities. First, there is a general tendency of household size to reduce and the share of single-adults household to increase. This is due to long term social, economic and cultural trends in the European societies. Second, the risk of poverty is much higher for this type of household, especially mother-single household, even when they are working. Moreover, this process of household decomposition is particularly advanced in urban areas, where the share of single mother is much higher than average.

A second important process is the international immigration. Very roughly, we can distinguish two types of international immigration: from rich countries and from poor countries. The first one is globally balanced in the European countries, even if cities are particularly attractive for qualified workforce (ESPON 1.1.4; OECD, 2002). Immigration from poor countries had complex evolutions since the golden sixties (Van Hamme *et al*., 2004). From the nineties on (and not before), Europe became an immigration continent. The intensity and the geography of this international immigration completely changed from the traditional patterns of European migrations. Outmigration countries of Mediterranean Europe (Greece, Portugal, Spain, and Italy) and Ireland became massive immigration country during this period. In all countries, immigration concentrates in the cities and particularly the biggest ones (ESPON 1.1.4; see also working paper on demography). There are several reasons for this, notably the networks of the migrants and the economic demand in personal service sectors, for example related to the population ageing. Related to this new economic demand, it is interesting noting that female immigration for work has an increasing share of the total international immigration (OECD, 2007).

As a consequence, big cities concentrate immigrants from low and high-level of qualification reinforcing the social polarization process. At the same time, the poor immigrants concentrate in certain specific areas of the big cities reinforcing the pattern of socio-spatial polarization. However, to a certain extent, this concentration helps making work the solidarity networks inside some communities. It might also reinforce the emergence of specific economic activities sometimes called ethnic entrepreneurship (Musterd & Ostendorf, 1998).

Whether these processes very visible for the big cities are also true for middle or smaller cities is rarely tackled in the literature. Will the economic crisis reduce the immigration flows is another interesting question? The previous major crisis in the seventies did not stop immediately immigration flows towards Europe; this mainly happened during the eighties. Of course, we already see some countries – where the economic growth also relied on a cheap and massive import of workforce – changing their policies when economic conditions are getting worse. However, due to new conditions of mobility and

strong push factors from poor countries, it is not sure whether European countries will be able to really limit the immigration flows even if they intend to.

A third important process is intra-urban migrations. These movements play a major role in the socio-spatial polarization process and its geographical shaping. Suburbanization and gentrification are the major paradigms to describe these intra-urban migratory patterns. *Suburbanization* dates back to the fordist period, when the space consumption was one of the major aspects to sustain the consumption as a whole (Harvey, 1989): the suburbanization process does not only sustain the construction activity but also many other forms of consumption, especially the car industry. This process has certainly not lessened in the postfordist period: middle class households with children continue to leave core cities to acquire unifamiliar house in the suburbs (see also the Working paper on demography). As a consequence, core cities often concentrate both social extremes, while in different neighbourhood: the poorest, including old and new immigrants, and the richest segment of the urban population. The intensity of the suburban process has been much related to financial conditions – interest rates in particular – but showed no tendency to slow down on medium term perspective. It means that the financial crisis could reduce this process to some extent but economic, social and cultural factors which favoured this process need strong political involvement to be reversed.
Gentrification paradigm describes the social and demographic transformations in the core cities – notably the historical centre – through renovation processes. It is often not contradictory to the suburbanization process because young middle classes without children are the most concerned, rather than older households with children. One of the consequences is the growing concentration of the most fragile populations in the most deprived and not (yet) gentrified neighbourhoods (Smith, 2002; Lees and al., 2007).

These evolutions cannot be understood without taking into account housing market prices. First, the rise of the housing market prices has a clear impact on the living standards and the level of poverty of the households, especially the most deprived. Second, suburbanization is constrained by the high prices of the ground for middle classes which are willing to become owner of their homes. Third, renovation process – often initiated by public powers – makes housing prices grow and lead locally to the "natural" expulsion of the most fragile populations. Finally, housing market explains the reproduction of the spatial configurations of the social inequalities in the cities (Marcuse & Van Kempen, 2000).

1.3. Political driving forces

One of the major determinants of social inequalities and social exclusion in the cities is related to public policies at two different scales: the state and the city levels.

The state level is the main scale through which welfare state functions operate. The type and the level of welfare state are central to explain the intensity of social redistribution within a society and, as a consequence, the level of social inequalities and social exclusion. While in many countries welfare state functions have been cut off and reoriented from the eighties on, we still observe major differences from one country to another (OECD, 2008). Esping-Andersen defines three different types of welfare state in the rich countries: the liberal, the social-democrat and the corporatist. The first is minimal and based on individual responsibility while the second is built on a Universalist and egalitarian conception of social protection. Corporatist regimes concern continental Europe (Belgium, Germany, Netherland…) and are characterized by the importance of intermediate institutions between the states and the individuals in the redistributive system. It seems obvious that social and even socio-spatial polarization within cities is lower in the social-democrat than in the liberal welfare states (Musterd & Kesteloot, 2003). However, in all these systems, the ideology of individual responsibility has developed and justifies welfare cuts off which have favoured increased social inequalities. This is also described as the shift from welfare to (more Anglo-Saxon) workfare regime.

The public policies at the city level are decisive on three different perspectives in the social inequalities trends and its spatial shaping.
First, urban municipalities are a part of the welfare state notably through the social housing system. Property regulations and the level of social housing play a major role in the socio-spatial polarization of the city: while Scandinavian or Dutch cities are less spatially polarized because of their high level of social housing, it is not the case for Belgian or French cities, where housing market is nearly entirely privatized (Badcock, 1997).
Second, cities played a growing role in accompanying the economic development. Some works have particularly emphasised the changing attitudes of urban governments vis-à-vis the regulation of economic growth, in particular the shift shift from a 'managerial / redistributive' framework to an 'entrepreneurial / neo-liberal' heavily focused on city-marketing strategies and large-scale flagship projects (Harvey, 1989; Van Criekingen & Decroly, 1998; Moelaert *et al*., 2003; OECD, "Competitive cities", 2007). In this perspective, entrepreneurial policies ruled by the cities reinforce "natural tendencies" of the labour market notably by focusing on the attraction of advanced services or major events.
Third, and in accordance with the new entrepreneurial cities, the last decades have seen the development of social policies oriented toward place-based policies rather than houselholds- and individuals-oriented policies: urban renovation in the deprived neighboorhoods; social mix policies; attraction of prived investments through tax exemptions; flagship projects located in the deprived districts… However, some authors are very skeptical about the ability of these policies to solve social problems, that is to really have an impact on the most disadvantaged of the deprived neighborhoods which are targeted (Murie & Musterd, 2004). Several reasons may explain the inefficiency of intra-urban place-based policies regarding their social cohesion objectives: the weakness of neighbourhood effects in European cities does not always justify such policies because of lower level of spatial segregation than in US cities; the fact that these policies often fail to benefit to the most disadvantaged of the deprived neighbourhoods; in consequence, some authors also point to the fact that neighbourhood characteristics seem to be less important where welfare state is still highly developed (Murie & Musterd, 2004). This means that social policies focusing on individuals strongly limit the impact of the neighbourhood environment on individuals. Moreover, social mix policies often associated with place-based policies seem also to have pernicious effect when they focus on urban renovation and housing policies aimed at attracting more wealthy households. In these cases such policies may induce gentrification and exclusion of the more fragile households because of growing housing prices, in contradiction with the official goal of improving their situation through neighbourhood effect (Musterd & Ostendorf, 2004).

1.4 A synthesis of the main determinants of social exclusion in the city

Inspired by the Esping-Andersen model based on the three pillars of social protection (the market, the reciprocity notably through the family and the redistributive functions of public bodies), Musterd and Kesteloot (2003) proposed to analyze the trends and the specific role of the pillars inside urban areas. From this analysis, they conclude that:
1°) labour market trends seem to have favoured social exclusion in the cities through professionalization (Hamnett thesis) rather than polarization (Sassen thesis) in most of the European cities;
2°) Welfare state of course softens social exclusion through redistributive policies. However, local bodies have increasingly become growth sustaining bodies rather than social ones. They focus more and more on the will to adapt local conditions to global economic demand;
3°) household structure and social networks play a major role in the concrete process of social exclusion. Some evolutions have contradictory results in political terms. For example, the concentration of immigrants – sometimes also on an ethnic basis – might at

the same time favour social networks and soften exclusion process from both labour markets and welfare state redistributive policies and worsens the situation by the concentration of social problems and cultural specificities in some parts of the city.

2. Indicators, data and methodology

In line with the OECD approach, we could define 4 types of indicators related to the major dimensions of social cohesion: self-sufficiency, equity, health, participation to social life and social pathologies.

We will select indicators related to these specific dimensions of social cohesion. These indicators will be compared at the LUZ level, because cities have very different types of internal spatial structure. In social terms, it has huge consequences when comparing social cohesion between cities. While in some cities, the most deprived districts are located in the peripheral parts of the city, in other cities, poor districts are located near the centre. As a result, the LUZ allows a more homogeneous comparison between cities than figures based on core areas.

Inside the LUZ area, social cohesion can be tackled through different forms of aggregation of the data: average of the social indicators for the whole LUZ (average infant mortality, unemployment…); districts inequalities (level of the social indicators in the different districts of the cities); social inequalities at the individual (or household) level (income inequalities, inequalities in the access to the services…). The first types of indicators give an average quality of social life in the cities, the second gives an idea of how much social difficulties are concentrated in different areas while the third allows assessing inequalities at the individual level.

As much as possible, the data will be gathered through the *Urban Audit.* However, given the insufficiencies of data from the *Urban Audit*, we also developed alternative strategies in order to answer the main questions we are asking about social cohesion in the city. The idea is to make proxy of the LUZ from NUTS3 and/or NUTS2 classifications in order to use the more complete set of regional data that Eurostat provides at regional level. Of course, especially for the NUTS2 proxy of LUZ, it limits considerably the number of cities we can take into account in the analysis. But this number is however sufficient to assess some aspects of social cohesion in the city as well as the relationship between economic welfare and social cohesion.

2.1 Social cohesion in the European cities:

2.1.1. Self-sufficiency, health and social exclusion

Self sufficiency indicators

Most of the available self sufficiency indicators are related to the labour market. We will not consider labour market participation indicators. Indeed, these indicators are to a certain extent the result of social compromise. For example, should we consider that low labour force participation of old active in France and Belgium raise social cohesion problems? Certainly not, they are the result of social and political choices which might affect competitiveness but not social cohesion in itself.

We will thus focus on unemployment rates as the main indicators of self sufficiency. Of course, it is far from being the best possible indicator. One of the problems is related to international comparisons since labour markets very much depend on national regulations. In more flexible labour markets – such as United Kingdom – low unemployment rates may hide the problems of working poor. In other countries, low unemployment is the consequence of low female labour participation, for example in

Portugal. So, we will also show this indicator in comparison to national average. This indicator is available through the *Urban audit* but we can provide a more complete picture from 1999 to 2007 by using NUTS3 proxies of LUZ.

The geography of unemployment is showing a complex pattern (Figure 1). First, it is the result of national differences: low unemployment of the UK and Netherland are to be opposed with much higher rates in Spain or Poland. Second, the map reflects strong regional differences which can also be observed at the city level: typically, east/west difference in Germany, North/south in Spain, Belgium or Italy is highly perceptible in the maps. Third, these maps raise the question of the difference between cities and the rest of the country as well as between major cities and the rest of the country. From the maps, we see no clear evidence that cities have higher or lower rates than average. Calculations confirm that, according to their countries, cities are facing very different level of unemployment rates (Table 1). In most of the cases, cities – and mainly big cities – show lower unemployment rates than average but by far it is not the case for all countries, for example Belgium or Austria. This is particularly the case in most of peripheral countries of Southern, Northern and Eastern Europe. Especially in the Central and Eastern Europe, we can see that the biggest cities are facing less unemployment than the rest of the country: the development gap between the central metropolitan region and the rest of the country appears here clearly in the labour market, also because a still huge part of the unemployed are coming from the rapidly declining agriculture. In the countries of north-western Europe however, we don't observe this gap: this result is interesting because it shows that in some of the richest European cities like London, Wien, Brussels, Paris, Amsterdam, unemployment rates are often higher than national average. It means that for these countries at least there is a decoupling between economic welfare and social cohesion in terms of labour market integration. It could be related to the presence of high masses of unqualified people, notably immigrants.

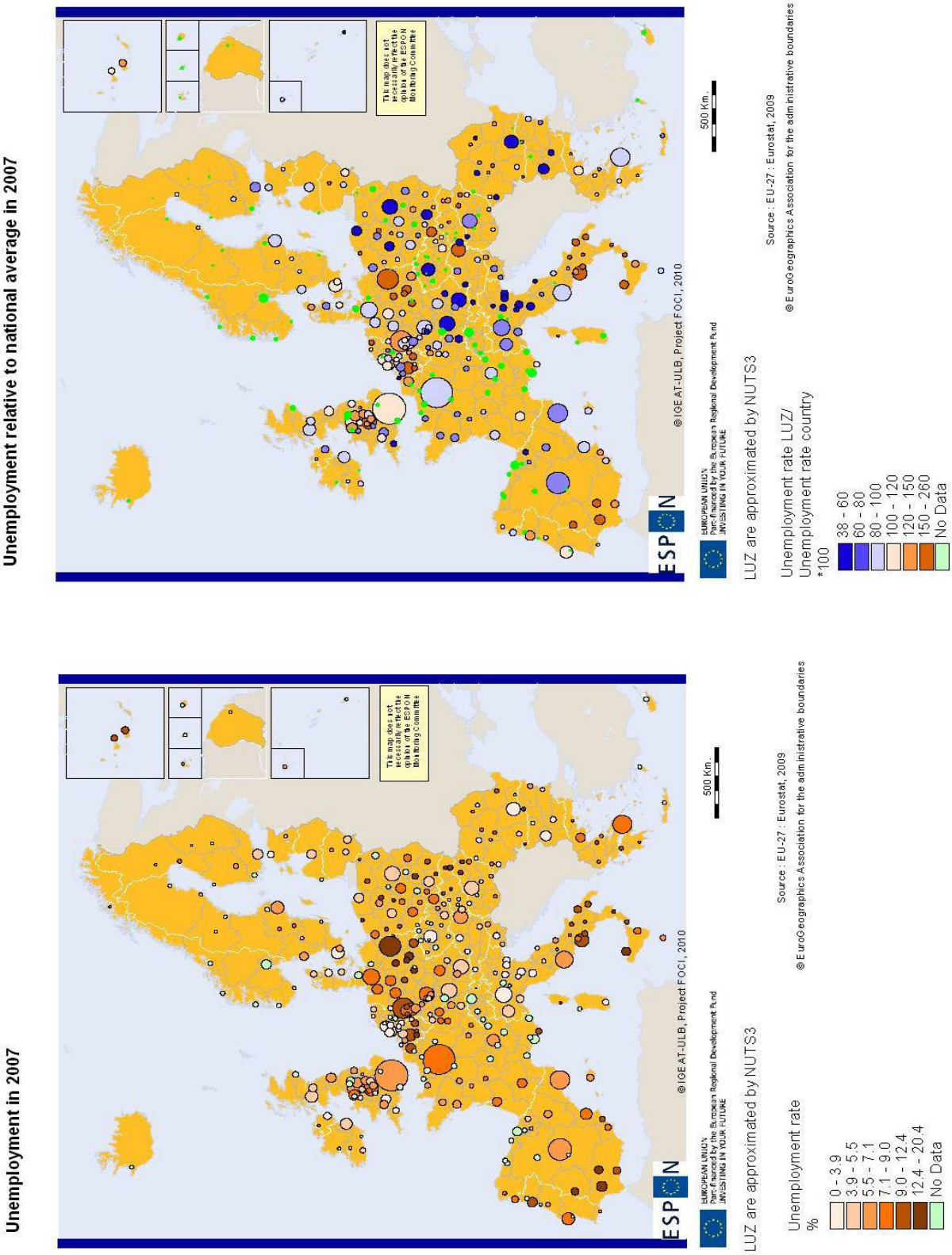


Figure 1. Unemployment rate by LUZ in 2007.

	LUZ	Main cities	National mean	Gap between the LUZ with national mean	Gap between the main cities and national mean
AT	5,12	6,54	4,40	0,71	2,13
BE	8,61	10,61	7,46	1,15	3,15
BG	4,71	3,72	6,88	-2,17	-3,16
CY	3,74	3,70	3,91	-0,17	-0,21
CZ	4,85	2,81	5,32	-0,47	-2,51
DE	8,39	9,10	8,61	-0,23	0,48
DK	3,69	3,69	3,79	-0,10	-0,10
EE	3,88	3,66	4,66	-0,78	-0,99
ES	7,44	6,30	8,26	-0,82	-1,96
FI	5,52	4,92	6,85	-1,33	-1,93
FR	8,01	8,30	8,34	-0,33	-0,03
GR	7,31	7,03	8,28	-0,97	-1,25
HU	6,52	4,52	7,36	-0,84	-2,84
IE	4,11	4,13	4,57	-0,46	-0,44
IT	5,88	5,75	6,09	-0,21	-0,34
LT	4,47	4,30	4,30	0,17	-0,01
LU	4,75	4,75	4,07	0,68	0,68
LV	5,18	5,18	6,00	-0,81	-0,81
MT	6,05	5,95	6,44	-0,39	-0,48
NL	3,34	3,80	3,18	0,16	0,62
PL	7,51	6,14	9,60	-2,10	-3,46
PT	7,94	7,89	7,98	-0,05	-0,09
RO	4,71	3,38	6,41	-1,70	-3,04
SE	5,80	5,30	6,16	-0,36	-0,86
SI	4,00	2,82	4,82	-0,82	-2,00
SK	11,47	4,13	11,14	0,32	-7,02
UK	5,51	5,65	5,25	0,26	0,40

Table 1. Unemployment rates in the LUZ, in the main cities* and in the country, in 2007.

* This includes all LUZ with more than 2 millions inhabitants and/or the main national city

2.1.2. Health indicators

Urban audit provides some health indicators but often incomplete and irrelevant. The best available indicator is infant mortality rate. This is a very good synthetic indicator of health. *Urban Audit* provides a very complete picture for this indicator.

The main gap is between Central/Eastern Europe and Western Europe, at the notable exception of the Czech Republic which shows low infant mortality rates. On the other side, it is also interesting to notice the rather high level observed in most of the UK cities. As for unemployment, we observe strong national effect. Regional effects are also perceptible in some cases for example between Northern and Southern Italy. In Eastern Europe, the capital city shows significant lower infant mortality rates, illustrating the development gap with the rest of the country.

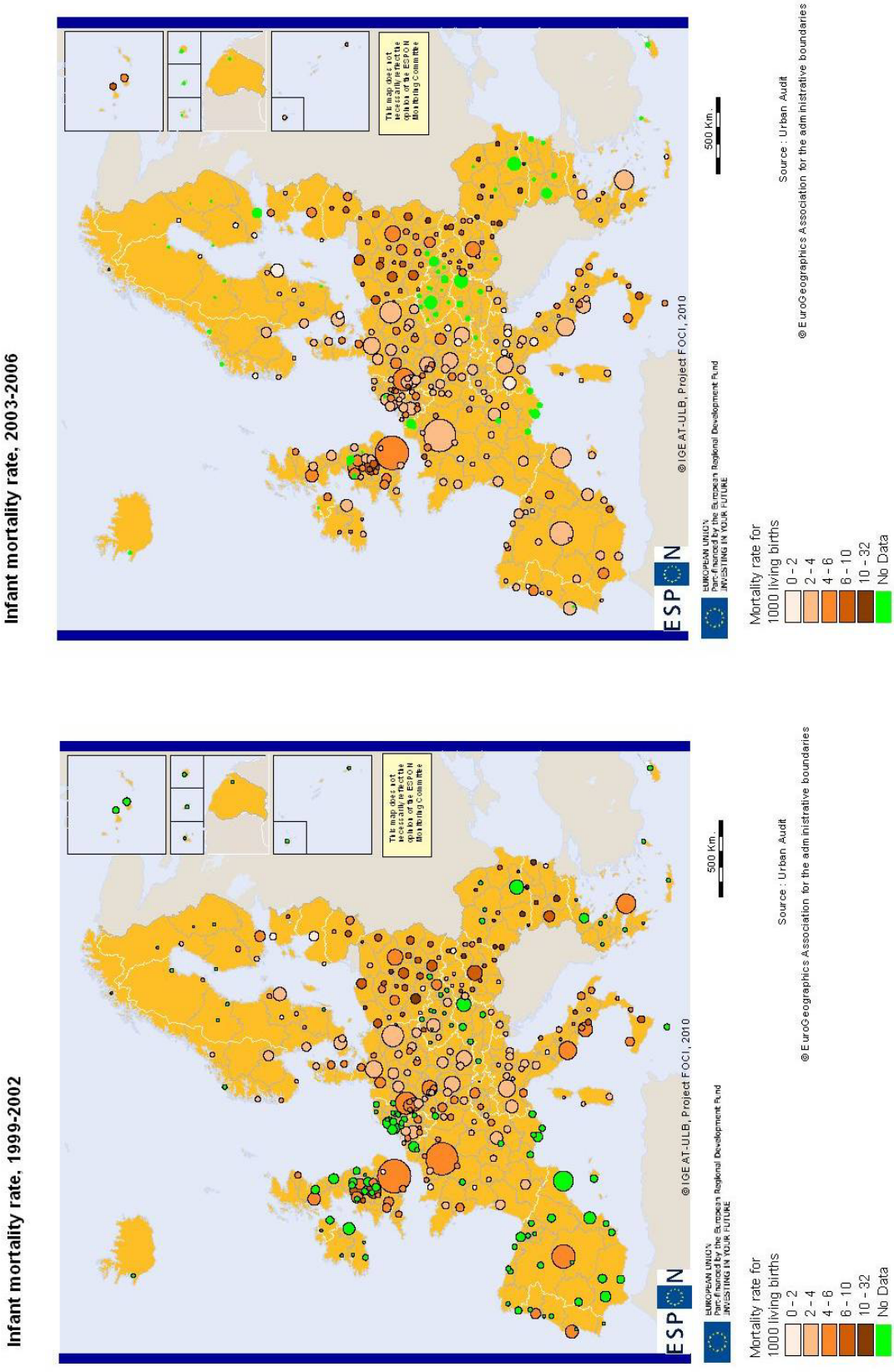


Figure 2. Infant mortality rate by LUZ in 2007.
Remark: 1999-2002 data for Belgium have been corrected on the base of 2004-2006 data.

2.1.3. Participation to social life and social pathologies

Social pathologies are interesting indicators of extreme forms of social exclusion, which might for example result in violence. However, indicators are very incomplete on this theme. From our point of view, the best indicator is the rate of murder and violent deaths because it is less subject than other indicators to statistical bias due to the type of repression apparatus (and the statistical apparatus related to it).
Maps are showing huge geographical disparities among European cities according to two types of violent deaths: homicides and suicides (Figure 3). The main geographical determinant is still the national environment even if some regional effects are also observed. As far as homicides are concerned, the main geographical cleavage is between Eastern and Western Europe, the former which in some cases are 100 times higher than in some Western cities. By far, the Baltic countries have the worst indicators (not shown on the maps because the LUZ cannot be approximated by NUTS2 with a 50% of the population criterion). Concerning suicides, the geographical pattern is more complex even if, in average, Eastern countries have higher suicide rates.

Is there a big city effect for these indicators? Table 3 allows providing a first rough answer to this question. Considering only cities for which a NUTS2 approximation is possible, and countries which have more than one NUTS2, it appears that a big city effect can be observed in terms of social pathologies. While for homicides, big cities have in nearly all countries higher rates than the country, the contrary can be observed for suicide rates. This clearly indicates that cities have specificities in terms of social pathologies. But this city effect is still relatively low in comparison with the strong national differences that can be observed for those indicators.

Country	ratio between big cities homicide rate and national average	ratio between big cities suicide rate and national average
AT	1,27	0,94
BE	1,18	0,91
BG	1,13	0,69
CH	1,22	1,17
CZ	1,21	0,98
DE	1,08	0,99
ES	1,01	0,81
FR	0,73	0,51
GR	1,07	0,84
HU	0,99	0,86
IT	0,71	0,74
NL	1,23	1,15
NO	1,37	0,96
PL	1,30	0,97
PT	1,23	0,93
RO	0,62	0,44
SE	1,17	0,96
SK	1,39	0,99
UK	0,74	0,85

Table 2. Big cities'specificities in homicide and suicide rates according to national average, around 2002 (3-years average)

The cities included are those which allow a satisfactory approximation by NUTS2 (see figure 3)

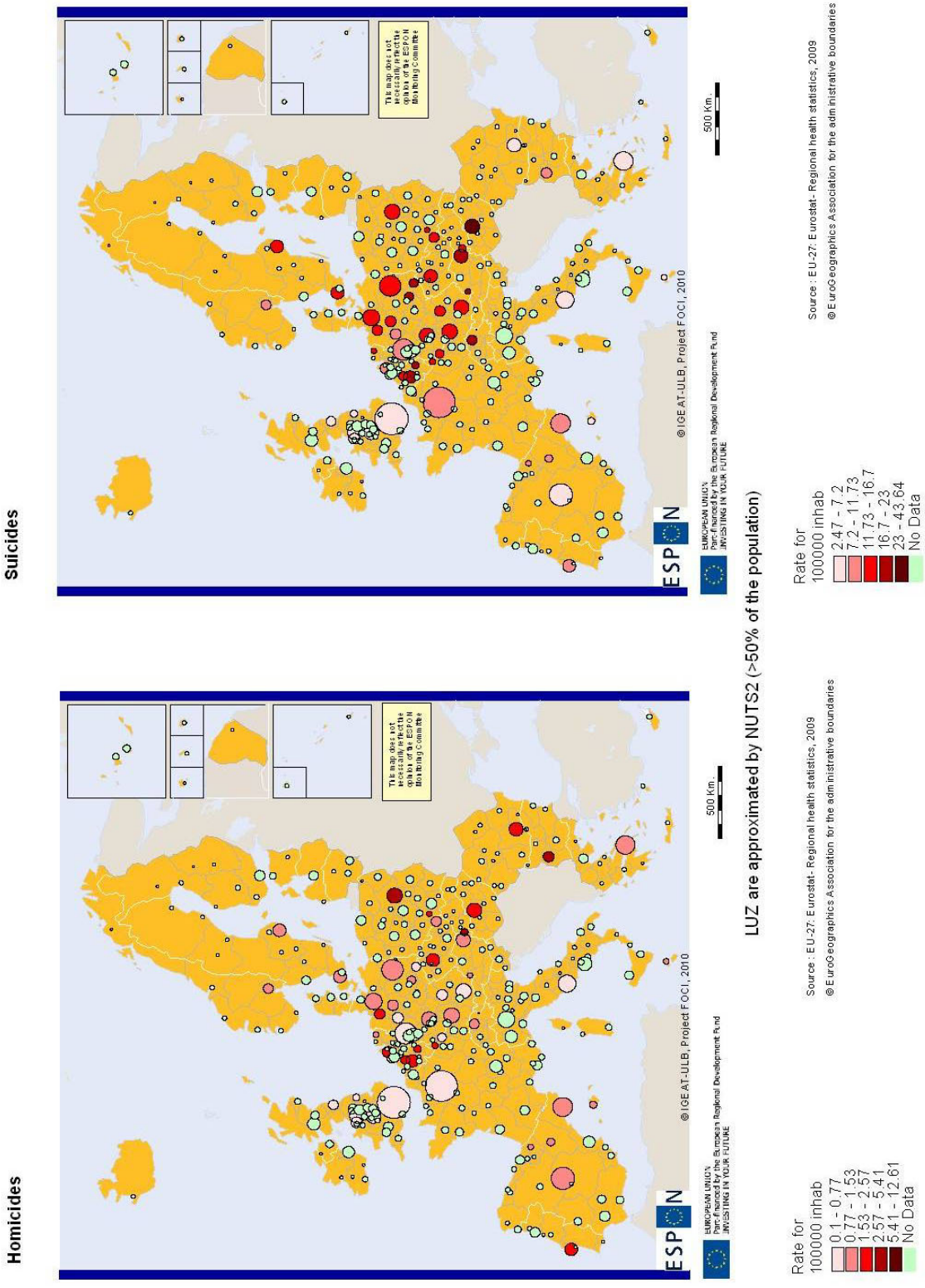


Figure 3. Violent deaths in major European cities around 2002 (3-years average).

- **Social exclusion, inequalities and equity indicators**

This dimension is the most relevant when it comes to analyse social cohesion in the city. Indeed, while cities – and moreover the biggest cities – have generally higher incomes and economic welfare than the rest of the country, it is worth examining whether this average economic welfare of the cities produces or not more social inequalities and specific processes of social exclusion. The literature provides evidences for this but it is of course necessary to test this hypothesis in a systematic way inside the ESPON space.

We select different indicators to test the hypothesis of a city's specificity in terms of social inequalities and social exclusion. Our general hypothesis is that given the dualistic structure of main cities labour markets, we could expect inequalities and social exclusion to be higher (Hamnett, 1996; Sassen, 2001).

- *Unemployment rates according to the diploma*

Unemployment rates by diploma give a similar geographical picture than the unemployment rates. This is why we will use here the gap between the unemployment of low qualified person (up to lower secondary school) and the expected unemployment rates given the average[5].

While we have observed see no general evidence of higher unemployment rate in the cities, the literature tells us that the gap between low and highly qualified could be higher in the big cities because of the specificities of the labour market, which require more and more qualified jobs. The Labour Force Survey is the only source to test this and it allows only working with big cities for which a NUTS2 proxy is reliable.

In nearly all European cities, unemployment rates are higher for the low qualified. However, the gap between low qualified and the rest has a strong geographical pattern: while it is very high in most of Eastern and German cities, it shows very little differences in Southern Europe where low qualified persons often have similar unemployment rates than average. Whether big cities have a specific behaviour is of course the main question raised here. The map we provide does not allow answering this question because of the strong contextual national effects. Indeed, low difference between the low and highly qualified can be interpreted in different ways often depending of the national market regulations and specific national behaviour in the labour market participation. For example, we can imagine that the difference observed in Mediterranean countries is the result of low participation in the labour market of the low qualified especially the aged woman, which is indeed the case. On the other hand, the low difference can also mean that the low qualified are force to find a job - even of very bad quality – because of strong incentives to do so. Here, a low difference neither means better labour market conditions for the low qualified. A comparison with national average is the only way to provide a first rough answer to our question of the cities' specificities according in terms of low qualified labour market participation. Our calculations do not confirm our basic hypothesis: on the contrary in many cities, including the biggest ones, the relative unemployment rates of the low qualified is lower than national average. This is also true for big world cities like London, Paris, Amsterdam, Frankfurt or Milan. Of course, major exceptions are also to be found especially the two biggest Spanish cities and some big eastern cities. These results suggest that in relative terms at least, low qualified seem to benefit from more job opportunities in the big cities than in the rest of the country. This first rough answer needs of course to be confirmed, notably with more detailed case studies. Also, it tells us nothing about the forms of labour market participation of the low

[5] Through a regression analysis between low diploma unemployment rates and average unemployment rates, we evaluate the residuals of the low diploma unemployment rates. This indicator is very correlated with the simple ratio between unemployment rate of low and higher diploma, but is more robust because it does not depend upon the average unemployment rate.

qualified in the cities. This question will be further explored by income inequalities data as well as with the analysis of the relationship between social and economic indicator (section 3).

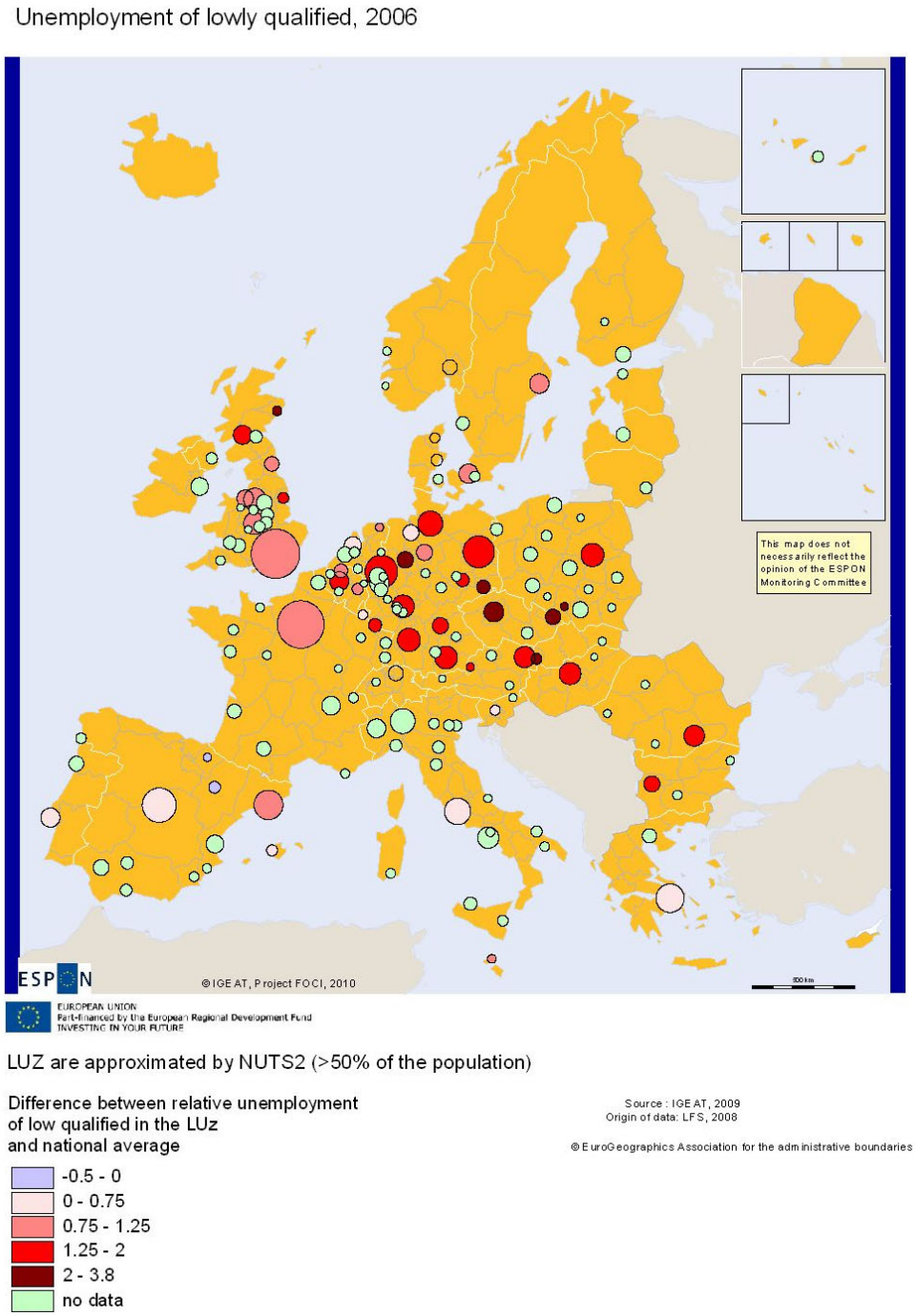


Figure 4. Relative low diploma unemployment rates according to the national average, in 2006

Note on the indicator: the indicator shows the unemployment rate of low qualified as compared to average unemployment rates in the LUZ. This rate is then compared with the same rate at the national level. It means: the higher the indicator, the higher the difficulty of low qualified to find a job as compared to rest of the country.

Incomes inequalities

Data in the urban audit cover a few countries only with some unreliable statistics such as the level of poverty in Copenhagen (72% of households receiving less than half of median income). Alternative calculation might only be produced by using enquiries such as SILC which allow a proxy of inequalities at NUTS2 level. But, this type of assessment is far beyond the possibilities of this project.

- **Socio-spatial inequalities**

One of the aspects of social cohesion in the city is related to the gaps between neighbourhoods. Whether these inequalities provoke more social difficulties in general is subject to scientific debate (Murie & Musterd, 2004). However, we raise the hypothesis that the concentration of social difficulties in some specific areas of the cities may indeed reinforce the social problems of the resident population. This is why it seems necessary to assess socio-spatial inequalities in the cities. However, it is important to insist on the fact that low neighbourhood inequalities do not mean necessarily a better social cohesion. The spatial configurations of the social problems are only one aspect of the social cohesion issue.

Urban audit provides statistics at the sub-city level. But this is an immense task and data are still quite incomplete. Because of these limitations, we have to remain very careful in the interpretation of the data. First, districts data are only available for the core city. This is a problem in terms of comparison given the fact that socio-spatial structure of the cities are very different from one city to another: in some cities, poor neighbourhoods are concentrated in the core city while in other they are located in the suburbs. Second, only few indicators are available for a sufficient number of cities. Third, despite the successful efforts to limit these differences, the size of districts is still unequal from one city to another and this might affect the measure of socio-spatial inequalities.

The availability of data obliges us to focus on unemployment rate to measure district inequalities. The figure 6 shows the weighted variance of unemployment rates by district. It shows huge differences in the socio-spatial inequalities in the cities: the highest levels are reached in UK, France, Belgium and some cities of southern Europe while we find low levels in most of Eastern countries (except Poland), in Nordic countries, in Western germany and Northern Italy. Low socio-spatial inequalities in Eastern cities are the result of real estate mechanisms and are still to a certain extent an inheritage of the communist period. In other parts of Europe, this low level can be explained by the high share of social housing (Nordic countries), as opposed to countries like Belgium where most of the housing is private with a great freedom of land use.

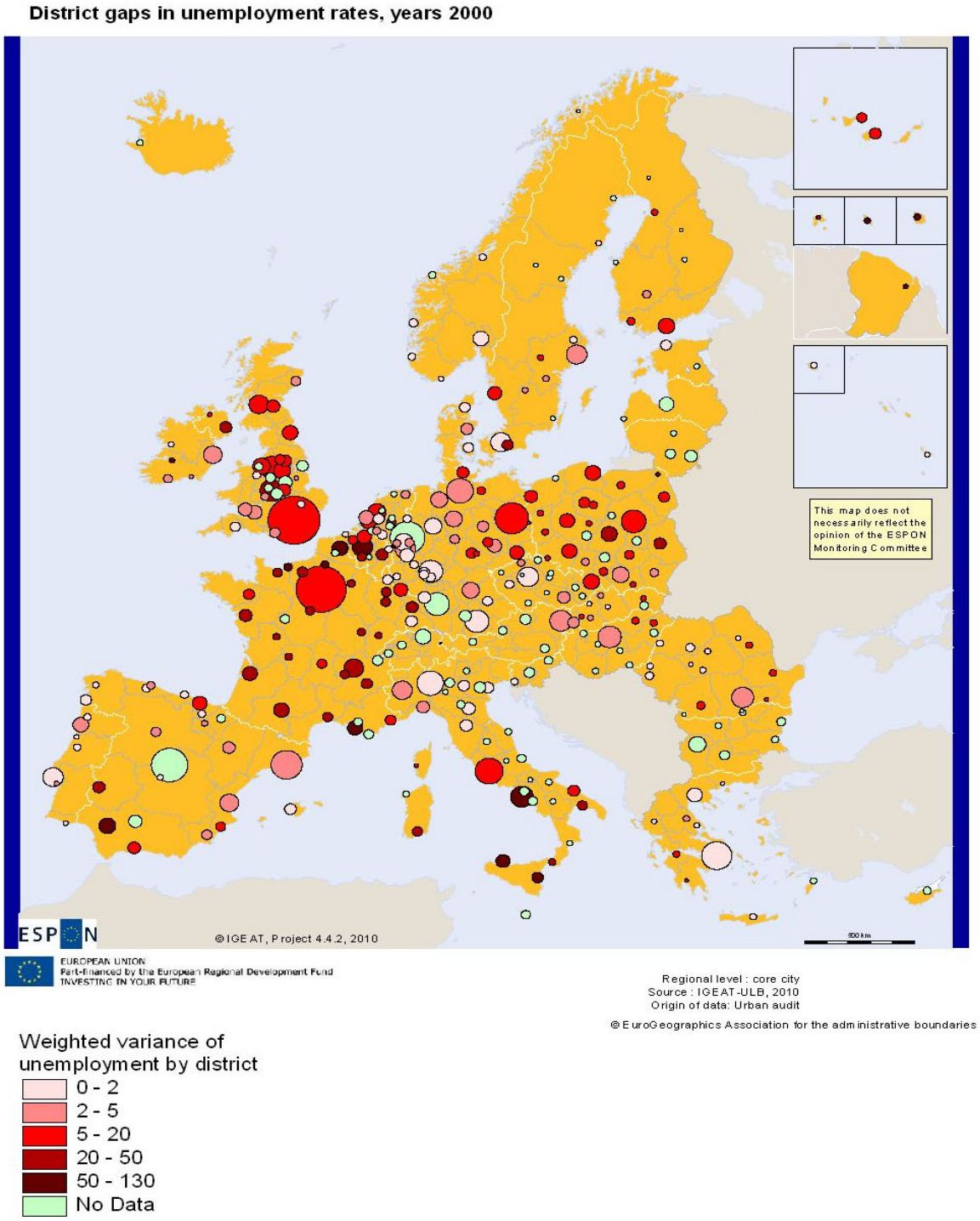


Figure 6. District inequalities in European cities

Note: For each city, unemployment rates of each district have been compared to the average. These differences are weighted by the total active population and summoned. As a result, it gives a synthetic index of the intensity of the differences between districts in the core city.

2.2 Perception indicators

The perception survey gives for 69 large European cities average indicators of satisfaction for different themes: public services, environment, economic aspects…

For each theme, the data provide a synthetic indicator of satisfaction. Through a Principal component analysis, it is possible to provide a synthetic indicator of general satisfaction, but it is still necessary to provide information on main themes separately because these different themes do not necessarily provide a homogeneous picture: for example, the quality of public services is not perceived the same way according to the different aspects (transportation, hospitals, schools…). As a conclusion, it seems reasonable first to provide a general index of satisfaction (the score on the first component) and then to provide information on the main themes separately.

The figure 5 gives the score of each city on our general satisfaction index. Macro-regional oppositions clearly appear from the map, with Eastern and to a lesser extent Southern cities having lower satisfaction level than northern and north-western cities. This is interesting because it appears that the index of general satisfaction is relatively well correlated with GDP/head. However, inside the different macro-regions this correlation does not exist anymore. It means that to a certain extent the difference of satisfaction between cities in the 3 macro-regions of Europe is related with strong economic differences but inside these groups, where economic differences are less important, other factors seem to explain the general level of satisfaction. When controlled by the GDP/head to explain difference in satisfaction across the cities, the size of the cities seems to play a negative role on the satisfaction level. To better understand the picture observed, more sophisticated analysis should be necessary but data do not really allow such analysis.

The following maps give the picture for several dimensions of satisfaction, showing different geographical patterns according to the different aspects of daily life in the cities (Figure 6). Indeed, while the general index of satisfaction is to a certain extent related to the wealth level, some very important aspects – including financial ones – are showing very different picture: for example, housing problems are very important in Paris, London but also, for different reasons, in cities like Stockholm and Helsinki; while being the richest city in Europe, London has also very high share of persons with difficulties to pay the bills at the end of the month…

These remarks demonstrate the interest of crossing perception index with some objective measures of related aspects (Figure 7). Of course, there is often no single indicator related to the objective reality associated to the perception indicators. However, we show here some examples to illustrate the complexity of the perception indicators: while the perception of the access to jobs seem significantly correlated to unemployment rates the access to housing is not correlated to average prices; in the same way, the difficulty to pay the bills is not significantly correlated to the average production per inhabitant.

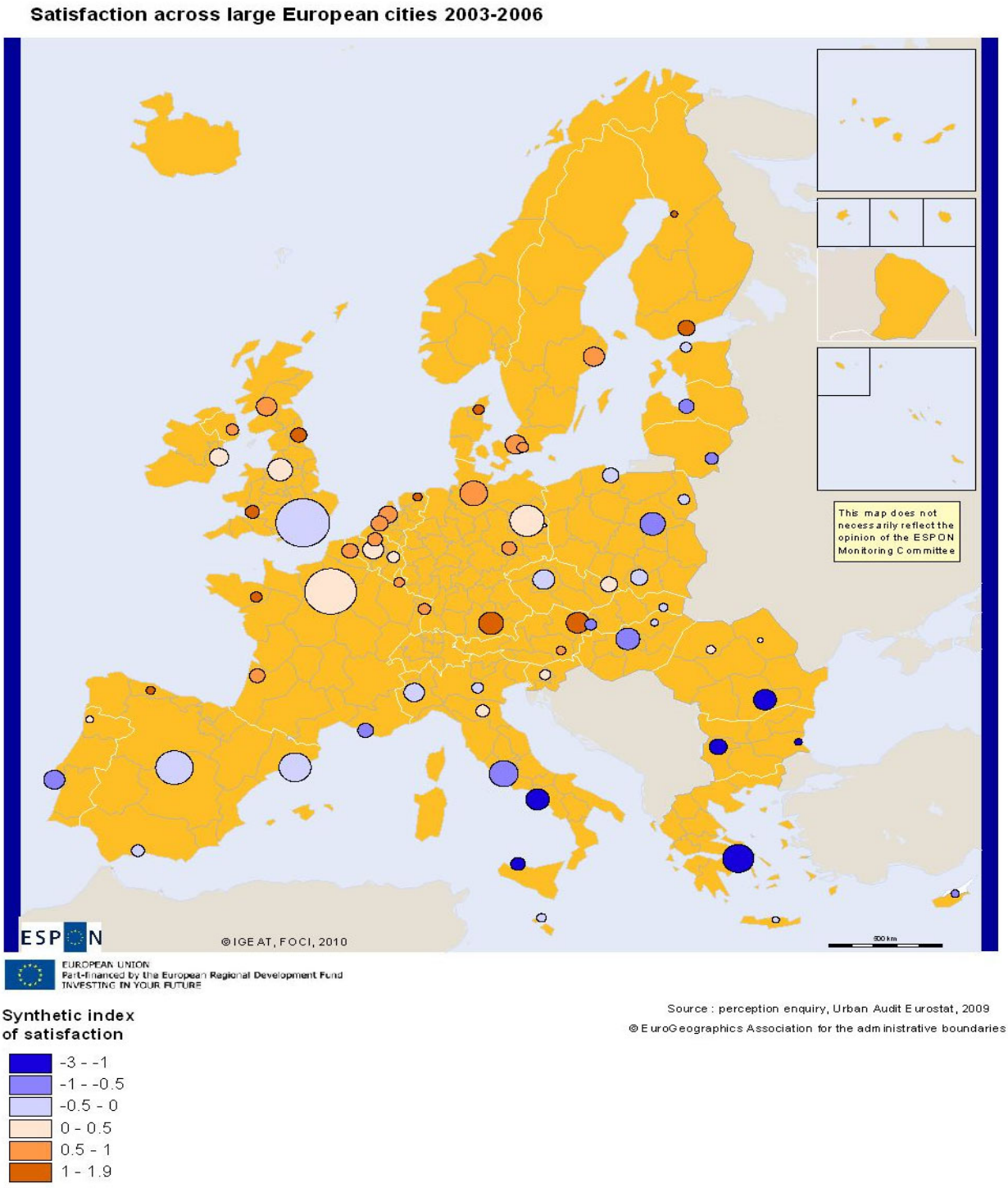
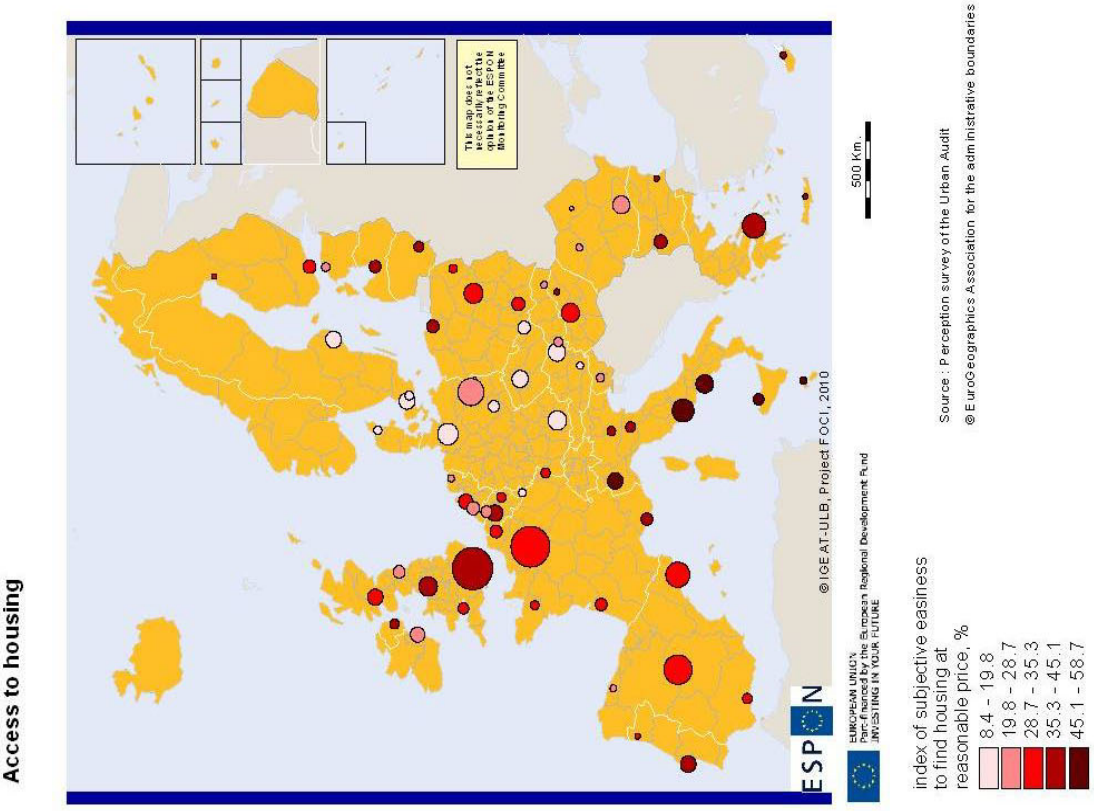
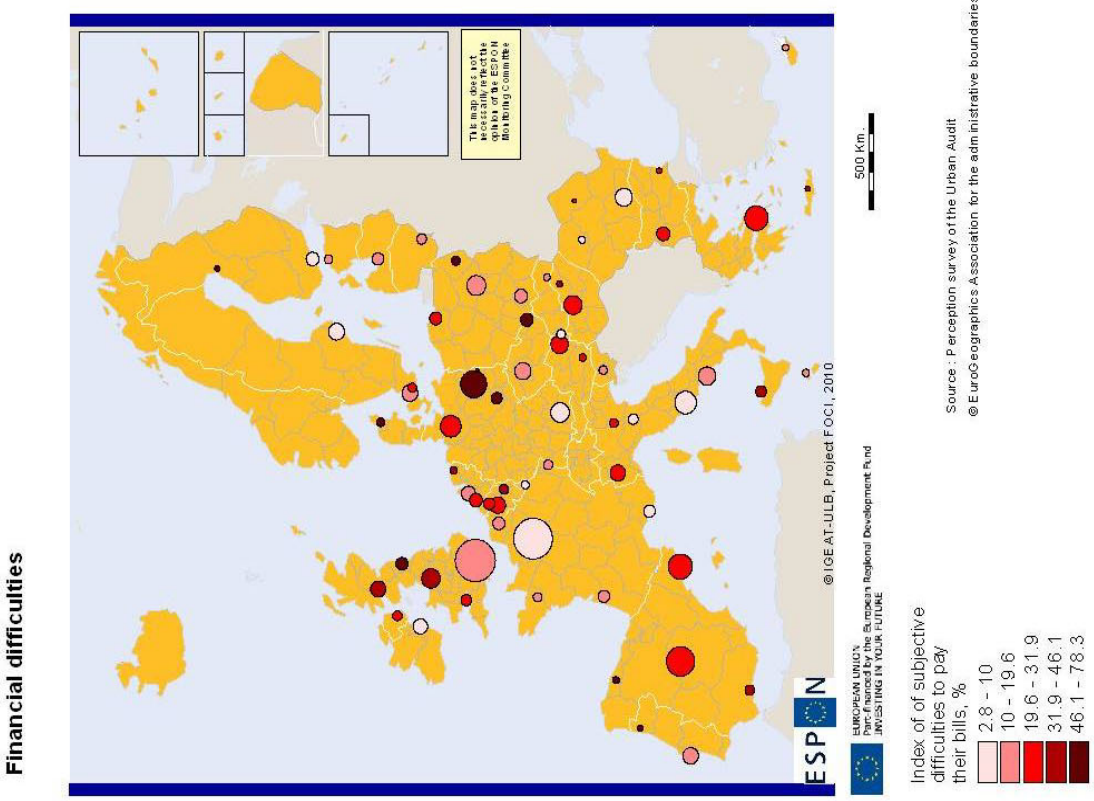


Figure 5. Average satisfaction across European cities, 2006
Source: Perception survey, Eurostat
Note on the indicator: Perception survey provides satisfaction level for different aspects. A Principal component analysis allows providing a synthetic index of satisfaction, which is mapped here.


Access to housing
This map does not necessarily reflect the opinion of the ESPON Monitoring Committee
500 Km
ESPON
©IGEAT-ULB, Project FOCI, 2010
EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE
index of subjective easiness to find housing at reasonable price, %
8.4 - 19.8
19.8 - 28.7
28.7 - 35.3
35.3 - 45.1
45.1 - 58.7
Source : Perception survey of the Urban Audit
©EuroGeographics Association for the administrative boundaries


Financial difficulties
This map does not necessarily reflect the opinion of the ESPON Monitoring Committee
500 Km
ESPON
©IGEAT-ULB, Project FOCI, 2010
EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE
Index of subjective difficulties to pay their bills, %
2.8 - 10
10 - 19.6
19.6 - 31.9
31.9 - 46.1
46.1 - 78.3
Source : Perception survey of the Urban Audit
©EuroGeographics Association for the administrative boundaries

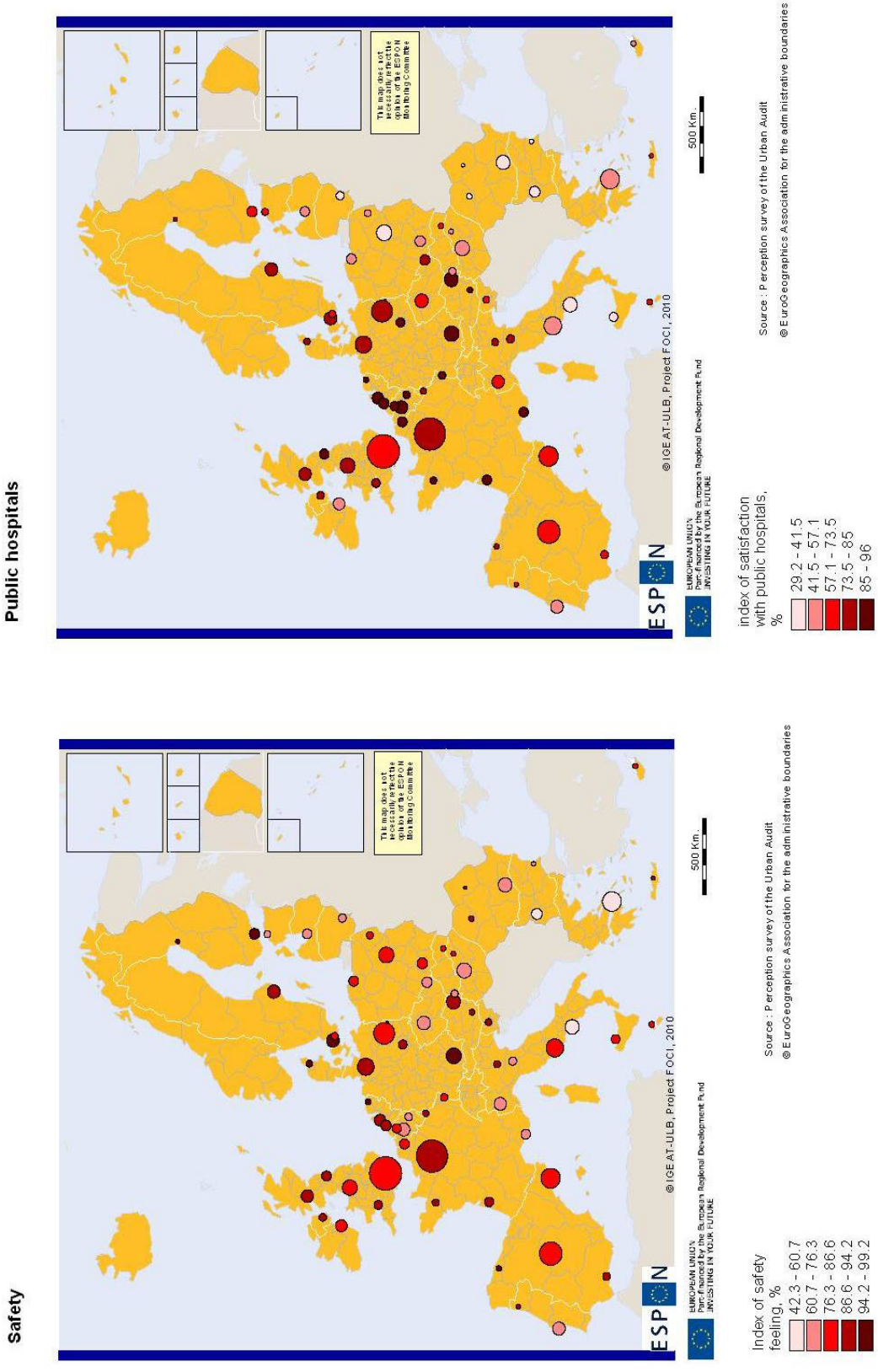


Figure 6. Satisfaction according to different aspects of daily life in large European cities

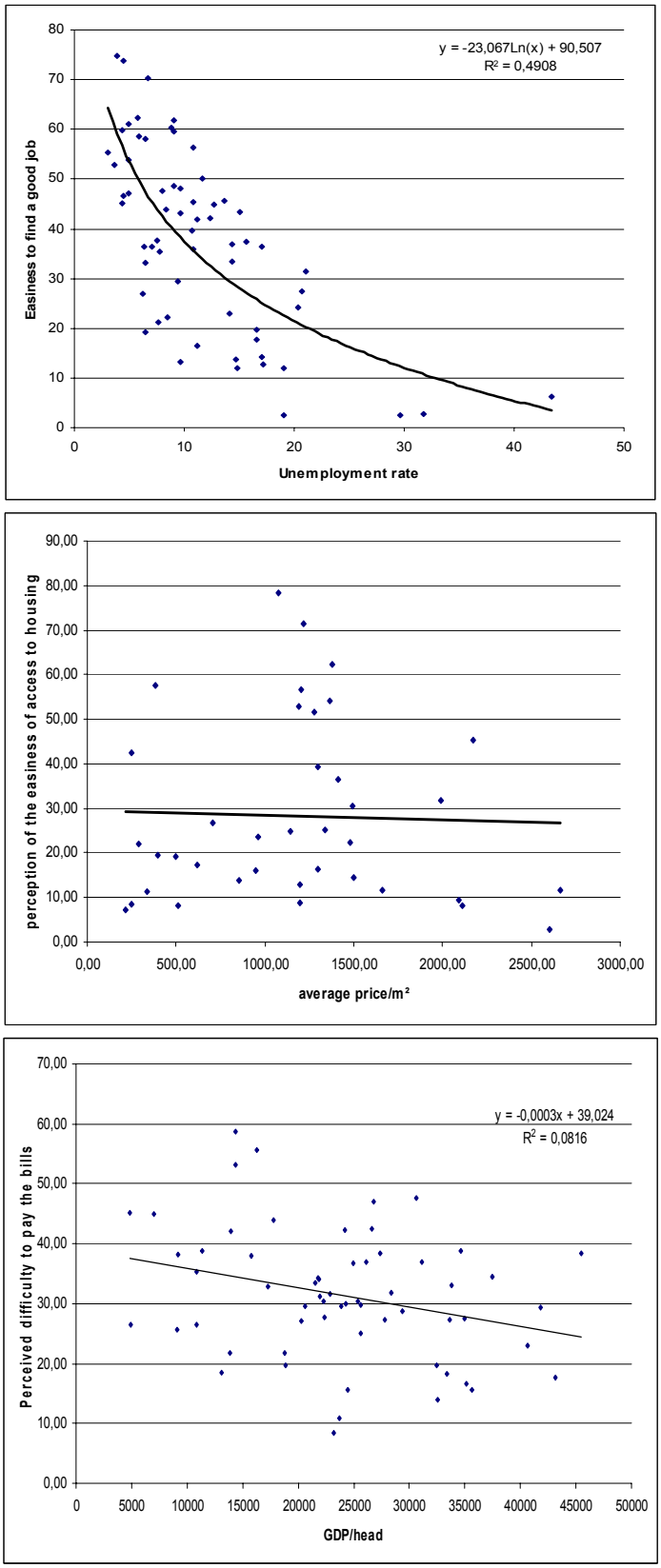


Figure 7. Comparison of satisfaction index in different fields with related objective measure: Easiness to find a job and unemployment rate; easiness to find housing and average price/m²; difficulty to pay the bills and GDP/head.

Important remark: these graphs should be interpreted with care since they do not always strictly refer to the same territory: perception survey concerns core cities while some indicators are only available at the LUZ level (GDP/head).

3. Economy and social cohesion in the city

After this descriptive approach of social cohesion in European cities, we will now analyse more in depth the relationship between economic wealth and social cohesion. It means that we will test the hypothesis that within new forms of growth in the globalized and knowledge-based economy, social cohesion is more and more decoupled from economic performances. However our data do not allow testing this hypothesis in dynamic terms, except for unemployment rate, and we will only provide elements of response in static terms. Still, this provides a unique assessment of this question for most of European cities.

3.1. Indicators and methodology

Economic wealth will mainly be measured through the most classical indicator, that is GDP/head in PPS. These data are nearly complete from 1995 to 2006 and enables us to measure an evolution (see the working papers on benchmarking of competitiveness).

Because of the availability of the data, we will focus on the following indicators of social cohesion:

- unemployment rates (according to European and national average) which is also the only indicator which allows to have a dynamic view;
- "development indicator", mainly infant mortality rate;

Statistical analyses do not pretend to be explanatory and will only show whether or not social indicators are correlated with economic wealth (GDP/head). Because the social indicators cover different range of cities, statistical tests will be ran for different list of cities.

3.2. Economic wealth and unemployment

According to table 3, there is a significant but low correlation between GDP/head and unemployment rate in the years 2000. It means that to a certain extent there could be a relationship between the economic development and the unemployment for European LUZ: the higher the GDP/head, the lower the unemployment rate. Results are very similar when Eastern and Western Europe are divided, which means that these correlations are not related to the East/West gap inside Europe.

However, we could expect a stronger relationship in dynamic terms, especially because in there are strong evidences that, in a given territory, economic growth allows reducing unemployment rates. However, this is not the case. Several explanations can be proposed:

- unemployment rates are much related to the national context in which the city is embedded, notably because of the type of labour market regulations. From this, we could expect higher correlation when they are calculated according to national average. But figures change little when calculated according to national average. It means that this explanation is not the main one;
- unemployment rate is not only related to economic wealth but also to socio-demographic structures. For example, all things being equal the evolution of the age structure has an impact on the dynamics of unemployment rates. Moreover, the participation in the labour market differs significantly from one country to another or one city to another, for example concerning women;
- our main hypothesis is however that economic wealth is partly decoupled from labour market participation, mainly because the new forms of economic growth are more and more intensive in knowledge, and could be more and more excluding for the low qualified population. The presence of low qualified population, notably immigrants, might therefore have a negative impact on unemployment.

It is not possible here to test these hypothesises because they would require many more data than available. However, we can still insist on the low relationship between economic wealth and unemployment across European cities, especially in dynamic terms. This result is important by itself because it tells that economic growth differential between cities does not explain differential in the evolution of unemployment rate. Even, when analyses are made according to national average, the correlation is nearly significant.

	LUZ > 250000 inhab.[a]	LUZ > 1000000 inhab.[b]
GDP/head and unemployment in 2006	-0.471**	-.447(**)
GDP/head and unemployment according to national average in 2006	-0.510**	-.567(**)
Evolution of GDP/head and unemployment between 2001 and 2006	-0.096	-0.129
Evolution of GDP/head and unemployment according to national average between 2001 and 2006	-0.210**	-0.162

Table 3. Correlation (R Pearson) between economic wealth and unemployment rates, in the years 2000, in static and dynamic terms
** Significant at 0.01
Remark: a: the analysis has been made on 244 cities of more than 250000 inhab. allowing a NUTS3 proxy of the LUZ; b: the analysis has been made on 80 cities of more than 1000000 inhab. allowing a NUTS3 proxy of the LUZ.

3.3. Economic wealth and infant mortality rate

We could suppose that economic wealth is much better correlated with social indicators usually described as "development indicator" in the international literature: it concerns health indicator, education indicators or quality of the equipments (internet facilities…).

The very important indicator of infant mortality rate is correlated with GDP/head but not at the intensity we might expect. On the other hand, other social "development" indicators are not correlated with GDP/head: hospital, practising physicians, and students leaving scholarship without diploma… According to the source, the share of higher degree diploma is lowly or not correlated with GDP/head across European cities.

If we focus on infant mortality rate, we find a correlation lower than expected. It could be easily explained by the fact that beyond a certain level of GDP/head, social or health indicators are not anymore related to national incomes. Since Europe as a whole is one of the most developed areas in the world, difference in GDP/head is not or badly correlated with health indicators inside this area. Indeed, when Eastern countries are excluded, the correlation is not at all significant with any of our social indicators. It means that the correlation between GDP/head and infant mortality rate is only due to the gap between Eastern and Western Europe in both GDP/head and infant mortality rate. This is very important: apart from the gap of development between Eastern and Western Europe, the economic wealth is not correlated with basic social indicators such as education or health.

This result has political consequences since it means that at the level of development reached in the EU (at least the EU-15) social cohesion cannot be achieved through economic development strictly defined (that is economic growth) but relates to other factors, notably through the quality of public services.

	NUTS2 proxy	N	all available Urban audit cities	N	Urban audit cities excluding New Member States cities	N
Infant mortality rate	-,494(**)	45	-,426(**)	139	-0,041	97
Number of hospital beds/inhab	-	-	-0,045	121	-0,033	79
Number of practising physicians/inhab.	-	-	0,197	54	0,006	19
Share of higher diploma	0,279	45	,399(**)	102	-0,012	68
Share of students leaving without diploma	-	-	-0,017	84	0,114	70

Table 4. Correlation (R Pearson) between economic wealth (GDP/head) and some social indicators, in the years 2000.
Source: Personal calculations on Urban Audit data and Eurostat (NUTS2 proxy).
Remark: While *Urban Audit* data allow considering more cities, they are biased because only some countries are available for the indicators while NUTS2 proxy data allow a complete picture for cities allowing such proxy (that is 45 LUZ).

3. Conclusions

In this chapter we identified the main trends and main driving forces according to social cohesion in European cities. The growing social and socio-spatial polarization appears to be the most noticeable evolution of social cohesion in European cities. It relates to different driving forces:

- a professionalization and/or polarization of the job offer, especially in major cities, in a context of knowledge-based growth and globalization;
- the household de-composition and the concentration of deprived international immigration in cities play an important role in the social exclusion process;
- a shift from welfare policies toward entrepreneurial cities and from households-oriented policies towards intra-urban place-based policies (flagship project, social mix policies…).

It is very difficult to give a precise geography of these processes but it is certain that the national context is the main driving force behind this geography. It means that while these processes have been common to all European countries and cities, national differences are still decisive:
- social polarization is still limited in Nordic countries;
- North-western countries (Germany, Belgium, France…) have also growing but more limited social polarization. However, we find here huge differences in the intra-urban socio-spatial inequalities with for example limited neighbourhood differences in Netherland (because of the high share of social housing) and Germany as compared to Belgium or France;

- Eastern countries have gone through a growing social polarization (starting from relatively low level) but socio-spatial polarization is still limited by the characteristics of the housing markets, except in Poland;
- social polarization reaches the highest level in Anglo-Saxon and Mediterranean cities because of weaker welfare state.

What can we expect in the future according to these major trends and their driving forces?
1. The crisis has changed the conditions in the past few years. It is thus very difficult to tell whether the social polarization process will continue in the near future, while it is certain that the crisis will intensify social exclusion. The answer to this question mainly relates to the level of welfare state we may expect in the future. The issue of the crisis might either be new reduction of social redistribution because of the state of public finances or the emergence of a new social compromise. The former evolution has already been implemented in the countries which have been strongly hit by the crisis: Ireland, Baltic countries, Greece. The latter could take years to happen.
2. According to the socio-spatial polarization, we believe that its geographic reshaping – if not its intensity – will continue in the future. It mainly concerns "urban renewal" or "gentrification" which relates to the new attractiveness of core areas of the cities for the wealthy populations. This process often results in negative consequences for the most deprived populations. This conviction relates to the fact that this "renewal" process is the more intense in the most urbanized parts of Europe ("the blue banana"), especially in England, which in the past have often been the first to go through new intra-urban processes (such as suburbanization).
3. One of the main conclusions raised by our study, in line with the literature is that we observed a decoupling between social cohesion indicators and economic evolutions. It means that, having reached such a high development level, social cohesion in the European cities is no more related to the pure economic wealth of the population, except concerning the gap between Central-Eastern and Western cities. In this case, the persistent economic gap is still correlated with differences in social cohesion.

In line with these general conclusions, we propose some preliminary reflections about policy options. First it is important to recall that urban policies are not the main driving force in terms of social cohesion, and that the state level policies are much more decisive. Second, concerning urban policies, the cities are nevertheless in charge of some important aspects. It seems to us that social housing is one of the most important. High shares of social housing potentially reduces not only housing difficulties but also tend to limit socio-spatial inequalities, such as in Holland, which obviously limit the concentration of disadvantaged in specific areas. Third, urban social cohesion policies have been more and more oriented towards place-based policies. This urban policy orientation raises important issues, especially because such policies might fail to reach the most disadvantaged and may possibly have negative consequences on these populations, when the focus is on renovation of the public space without protecting the local residents.

Bibliography

Atkinson A.B. (2003), "Income inequality in OECD countries: data and explanations", Cesifo Economic studies, vol49, 4, p. 479-513.

Atkinson A.B., Marlier E., Nolan B. (2004), "Indicators and targets for social inclusion in the European Union", JCMS, vol 42, 1, pp47-75

Badcock B. (1997), "Restructuring and spatial polarization in cities", *Progress in Human Geography*, 21-2, pp251-262

Buck N. (2005), "Social cohesion in cities", in Buck, Gordon, Harding and Turok, *Changing cities?* Palgrave MacMillan, p. 44-61

Castells, M. (1996), *The rise of the network society*, Cambridge: Blackwell.

Cox R, Watt P. (2002), "Globalization, polarization and the informal sector: the case of paid domestic workers in London", *AREA*.

Donzelot J. (2004), « La ville à trois vitesses: relégation, périurbanisation et gentrification », in Esprit, N°303, pp 14-39.

Duménil G., Lévy D. (2001), "*Sortie de crise, menaces de crises et nouveau capitalisme*, *Une nouvelle phase du capitalisme?*, Syllepse : Paris.

Esping-Andersen *(1990), The Three Worlds of Welfare Capitalism*. Cambridge: Polity Press & Princeton: Princeton University Press.

Fujita M, Krugman P., Venables, A.J. (1999), *The spatial economy. Cities, regions and international trade*, Cambridge: MIT Press

Growing regions, growing Europe. Fourth report on economic and social cohesion. European Union. Regional Policy. May 2007.

Hamnett C. (1996), "Social polarisation, Economic restructuring and welfare state regimes*"*, *Urban studies*, p 1407.

Hamnett C. (2003), "Gentrification and the middle class remaking of inner London 1961-2001", *Urban studies*.

Harvey D. (1990), *The condition of postmodernity*, Cambridge, Oxford: Blackwell.

Harvey D. (2006), *The Limits to Capital*, The University of Chicago Press, Chicago, 478 p..

Harvey, D (2005) *A Brief History of Neoliberalism,* Oxford University Press

Husson M. (2008), *Un pur capitalisme*, Editions Page Deux.

Jessop, B (1997) *Survey Article: The Regulation approach*, in the Journal of Political Philosophy volume 5, number 3, 1997 pp. 287-326

Kazepov Y (ed) (2004), Cities of Europe: Changing Contexts, Local Arrangement and the Challenge to Urban Cohesion, Blackwell Publishers.

Knox P.L., Taylor P.J. (1995), *World cities in a world system*, Cambridge: Cambridge University Press, 1995, 335 p.

Lees L., Slater T., Wyly E. (2007), *Gentrification*, London, New York: Routledge.

Madanipour, A., Cars, G. & Allen, J. (eds.) (1998), *Social Exclusion in European Cities. Processes, Experiences and Responses*. London: Jessica Kingsley.

Marcuse P and van Kempen R(eds) (2000), *Globalizing Cities: A New Spatial Order?,* Oxford: Blackwell, 2000.

Mingione E (1999), *Urban poverty and the underclass: a reader*, Blackwell, Oxford et Maleden.

Moelaert F., Rodriguez A., Swyngedouw E. (2003), *The Globalised City: Economic Restructuring and Social Polarisation in European Cities*, Oxford University Press

Moulaert F. (2002), *Globalisation and Integrated Area development in European Cities*, Oxford University Press

Musterd S and A.Murie (2004), *Social exclusion and opportunity structures in European cities and neighbourhood*, Urban studies, vol.41, n°8, 1441-1459.

Musterd S., Ostendorf (2004), "Social exclusion, segregation and neighbourhood effects", in Buck, Gordon, Harding and Turok, *Changing cities?* Palgrave MacMillan, p. 170-189

Musterd, S. and M. de Winter (1998), "Conditions for Spatial Segregation: Some European Perspectives", *International Journal of Urban and Regional Research*, 22:4, pp. 665-673.

Musterd & Kesteloot (2003), *The spatial dimensions of Urban Social Exclusion and Integration*, Fourth framework program

OECD (2006), Territorial Reviews: Competitive Cities in the Global Economy

OECD, International migrations outlook 2007, www.oecd.org/els/migration/imo

Parlement Européen (2008), *Régions en déclin : un nouveau paradigme démographique et territorial*.

Sassen S. (1998), *Globalization and its discontents*. New York: The New Press

Sassen, S (2001) *The Global City,* Princeton University Press

Smeeding T. (2002), « Globalization, Inequality and the Rich Countries of the G-20: Evidence from the Luxembourg Income Study (LIS) », *Working Paper No. 320, Luxembourg Income Study*.

Smith N. (2002), *New globalism, new urbanism : gentrification as global urban strategy*, Antipodes, Blackwell.

State of European cities Report. *Adding value to the European Urban Audit. European Union*. Regional Policy. May 2007

Swyngedouw E. (2007), *The Post-Political City* in: *Urban Politics Now: Re-Imagining Democracy in the Neoliberal City* (edited by BAVO) Nai Publishers Rotterdam

Vaattovaara M, Kortteinen M. (2003), *Beyond polarisation versus professionalisation ? a case study of the dvlpt of the helsinky region, Finland*, Urban studies.

Van Criekingen (2008), « Réurbanisation ou gentrification ? Parcours d'entrée dans la vie adulte et changements urbains à Bruxelles », *Espaces et sociétés*, n°134.

Van Criekingen M. , Decroly J.-M. (1998), *Vers de nouvelles politiques urbaines: le modèle entrepreneurial*.

Van Hamme G., Vandermotten C., Medina P., Wayens B. (2004), *Migrations in the European Union: from the last decades to the new trends*, Edition Maison de la géographie, 120p.

Van Kempen E. (1994), *The dual city and the poor: social polarisation, social segregation and life chances*, *Urban studies*

Veltz P. (1996), *Mondialisation, villes et territoires: l'économie d'archipel*, PUF, Paris, 264 p.

Wilson (1987), *The truly disadvantaged: the inner city, the underclass and public policy*. Chicago, IL: University of Chicago Press.

Chapter 4 – Benchmarking of cities competitiveness: an approach combining different sources

Gilles Van Hamme, IGEAT

1. Revealed competitiveness: GDP per head and GDP growth

1.2 GDP per head in 2005

This map first highlights the gap between Eastern and Western Europe in terms of GDP per head. Second, it shows lower GDP per head in Southern cities. Third, in Eastern and Mediterranean countries, big metropolitan areas have at least reached the average GDP per head EU level, except for Sofia and Bucharest.

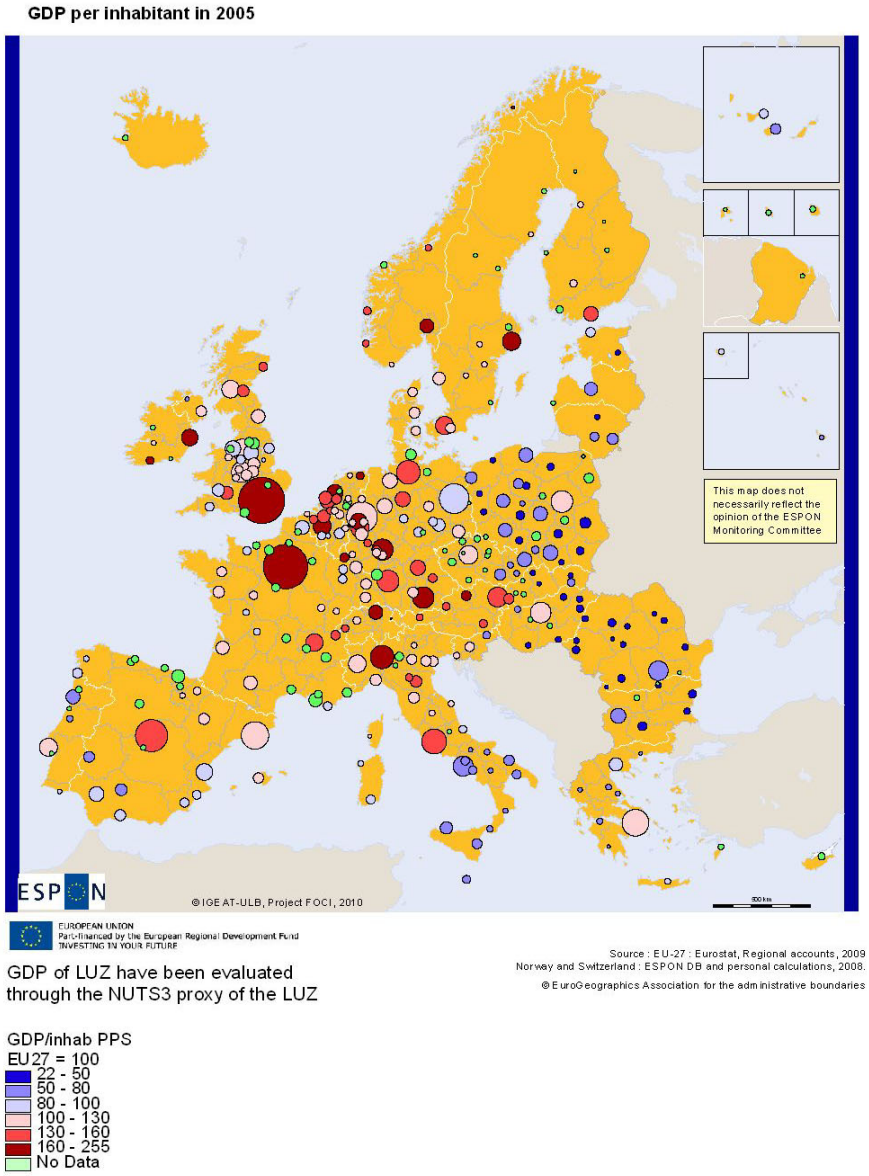


Figure 1 GDP per inhabitant 2005

2. Evolution of the GDP per head between 1995 and 2006

The picture of urban economic growth in the 1995-2006 largely reflects macro-regional and national dynamics. According to the general process of catching up in Eastern Europe, Eastern cities had much higher growth rate than Western cities. Inside the EU-15 space, strong differences appear between German, Italian or Swiss cities, on the one hand, and Irish, Spanish and to lesser extent British cities on the other hand, largely in line with national economic dynamism during this period. This interpretation is confirmed by the variance analysis on cities economic growth for this period. Table 1 shows that between 1995 and 2006 most of the variance of the GDP growth of the cities is due to national differences, while the growth differential between cities inside the countries only accounts for 26% of the total variance. From this perspective, we also observe a very big difference between the end of the nineties and the 2001-2006 period: during the latter, the importance of the national level is much higher than during the former (see also Figure 3).

	1995-2006	1995-2001	2001-2006
cities in countries	26	41	18
countries in EU25	74	59	82

Table 1: Share (%) of the variance in total GDP (pps) growth between cities (NUTS3 approximations of Urban Audit cities, n=224), decomposed as variance between all cities within each country and variance between countries. Data for Romania and Bulgaria not taken into account as it does not allow the longer time series.
Source: personal calculations on the base of Eurostat and Espon DB data

Due to the importance of the national context, it is interesting to draw the map of relative economic growth according to national rather than EU average (Figure 4). This map shows in general, but very clearly in Eastern Europe, a process of concentration of wealth in big cities, mainly the first national cities. However, as shown in Table 2, the metropolization process – simply defined as a higher growth rate in big cities – is mainly to be observed during the nineties and slow down in the years 2000. According to national average, we even observe slower growth rates in the big/main cities of Western Europe during the 2001-2006 period; even in Eastern Europe, the polarization process in favour of the capital region is slowing down in the years 2000. This result is also coherent with Table 1 since, during the second half of the nineties, the strong process of metropolization – concentration of wealth in the main city(ies) – went together with a more limited impact of national context on urban performances.

		1995-2006	1995-2001	2001-2006
Evolution regarding EU average	EU27+2	8,0	6,9	1,1
	NMS	33,8	15,5	18,3
	EU15+2	1,5	4,4	-2,9
Evolution regarding national averages	EU27+2	5,8	5,7	-0,1
	NMS	33,7	24,9	7,9
	EU15+2	6,6	6,6	-0,4

Table 2: Evolution of the GDP per inhab. (PPS) of the main European national cities* according to European and national average, 1995-2006
* The first national city of each country has been considered, as well as Rome in Italy, Barcelona in Spain, Frankfurt, Hamburg and Berlin in Germany. Results are very similar if we consider other range of cities, for example the 50 biggest cities of Europe whatever their position in their national context. Source: personal calculations on the base of Eurostat and Espon DB data

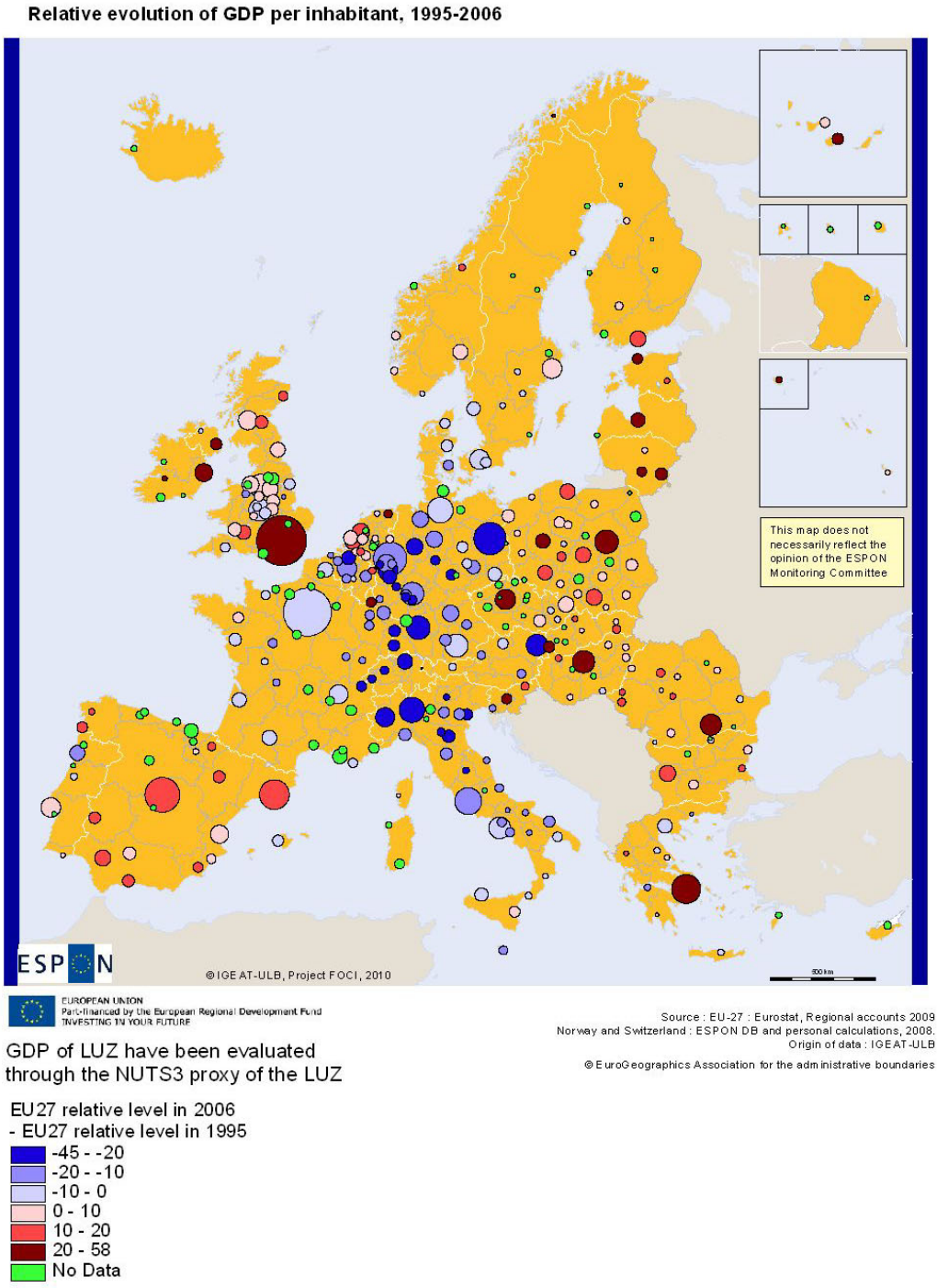
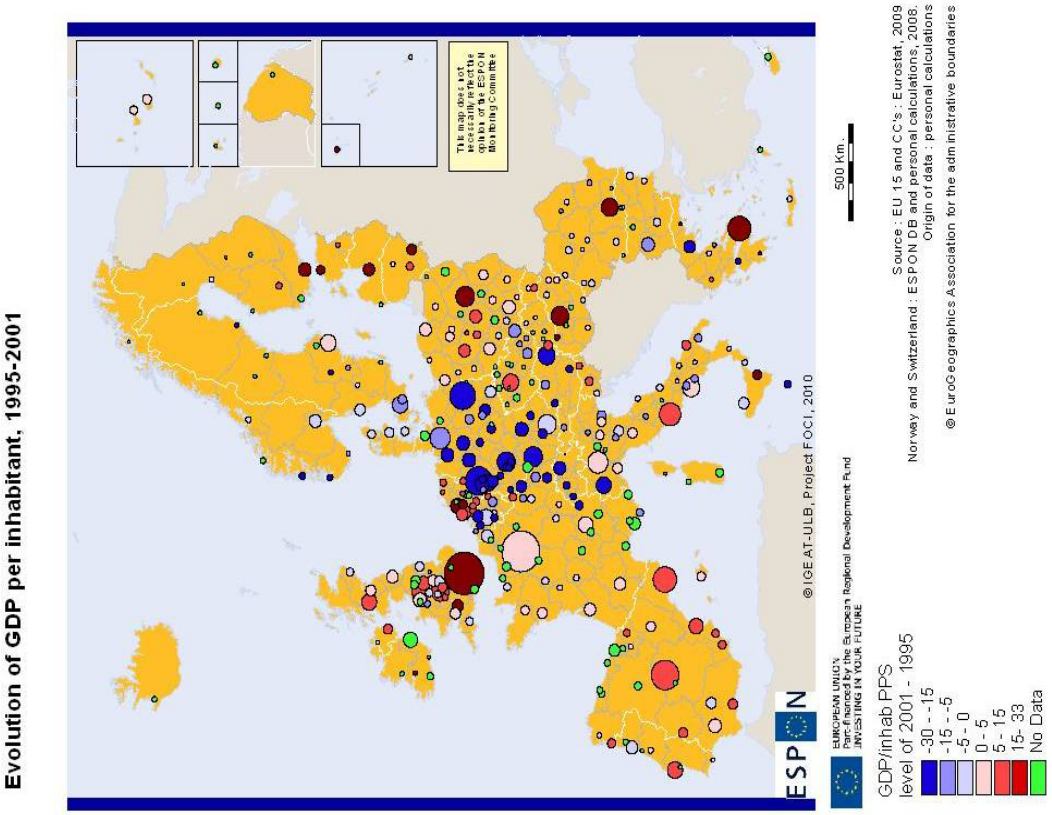


Figure 2 Evolution of GDP per inhabitant 1995-2006



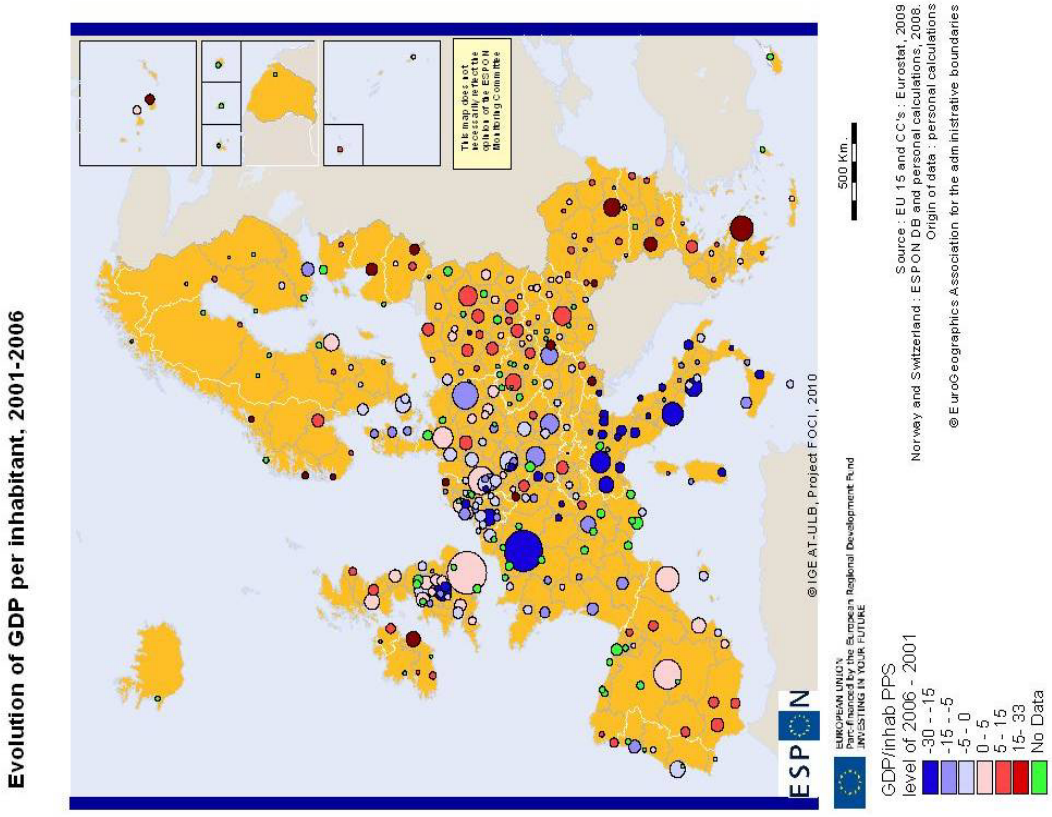


Figure 3 Evolution of GDP per inhabitant, 1995-2001 – 2001-2006

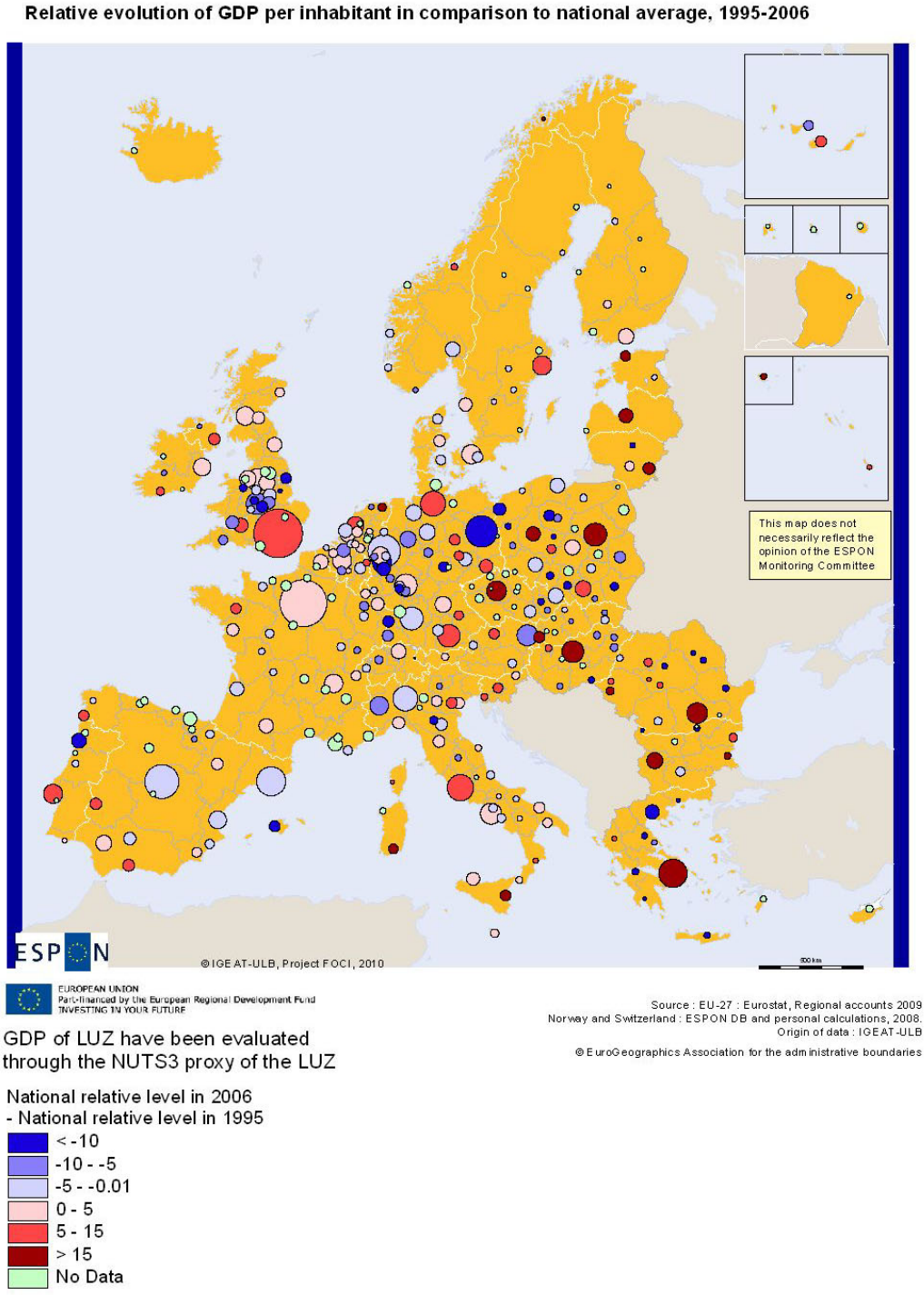


Figure 4 Evolution of GDP per inhabitant according to national average, 1995-2006

3. Basic factors of competitiveness

3.1. Economic structure

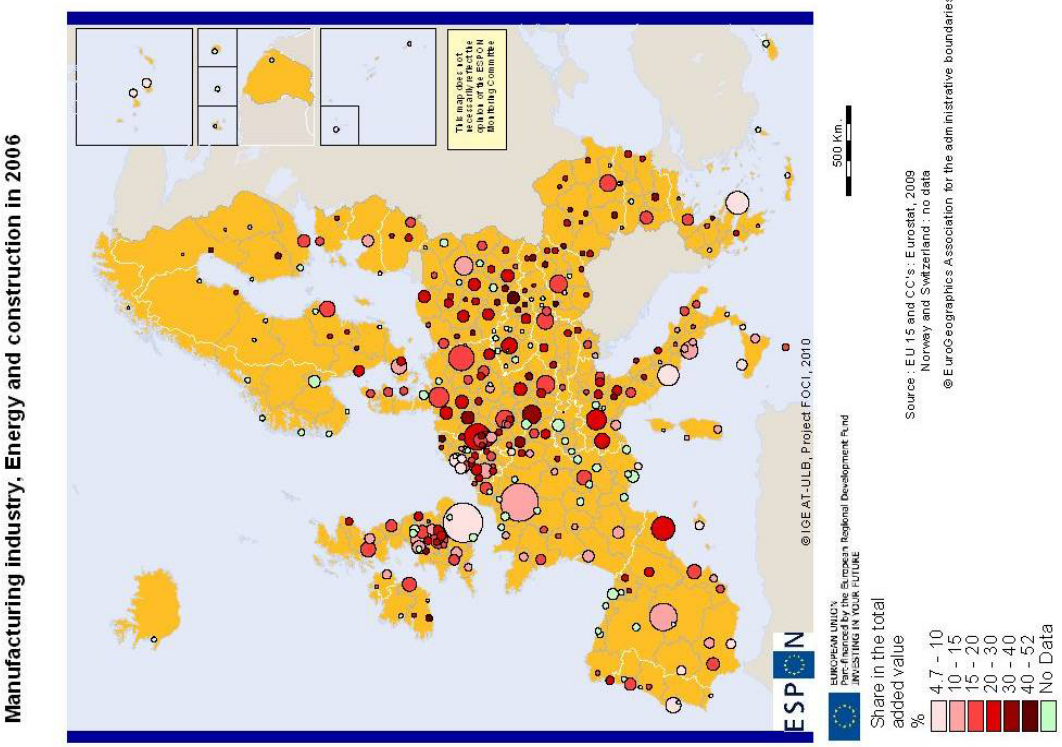
Different sources can be used to study the economic structures of European cities:

- Eurostat provides economic structure in six economic sectors at NUTS 3 and NUTS 2 level. It allows to produce data for the LUZ approximated by NUTS3;
- We built a matrix of economic structure in 25 sectors combining NUTS2 and NUTS3 according to the country (for the methodological details on this matrix, see ESPON342 or the DG Regio study on regions vulnerable to globalization). These data allow to provide data for the LUZ according to NUTS2;
- AMADEUS provides the sector of all European enterprises at the NACE4 level. These data allow providing statistics according to the LUZ definitions. They also allow defining the specialization and diversity of the urban economy according to different levels of classification.

Data	Sector	Source	Scale	Number of LUZ
Matrix 1	6 main sectors	Eurostat	LUZ approximated by NUTS3	254 Urban Audit cities
Matrix 2	25 sectors (NACE 1 with disaggregated manufacturing industry)	IGEAT with Eurostat and national data	LUZ approximated by NUTS2	Around 50 urban audit cities
Matrix 3	NACE 4	AMADEUS	LUZ	All Urban audit cities

3.1.1. High level services and Industry in 2006

With the first set of data, we propose two important indicators of the economic structure in European cities: the share of high level services – which include finance, business services and real estate – and the share of manufacturing industry, including Energy and construction. None indicator can be considered as a competitiveness indicator, they reflect major geographical divides within economic structure of European cities. High level services are clearly more present in the large and rich metropolitan areas of Western Europe, the highest level is to be found in the four major world financial cities in Europe (London, Paris, Amsterdam and Frankfurt). This map also shows a clear centre/periphery pattern at both European and national level. The share of industry has a much more complex geographic pattern. Of course, the lowest percentages are to be found in the big financial and business centres of Europe. But we must underline that in some parts of Europe, the manufacturing industry remains important even in the richest cities: this is the case in Germany and Northern Italy but also in some Scandinavian cities. By contrast, most of Mediterranean cities, with relatively low GDP per inhabitant have low share of manufacturing industry. Finally in Eastern Europe, some small and medium cities have the highest share of industry while the most developed capital regions have already gone through a deindustrialization process.



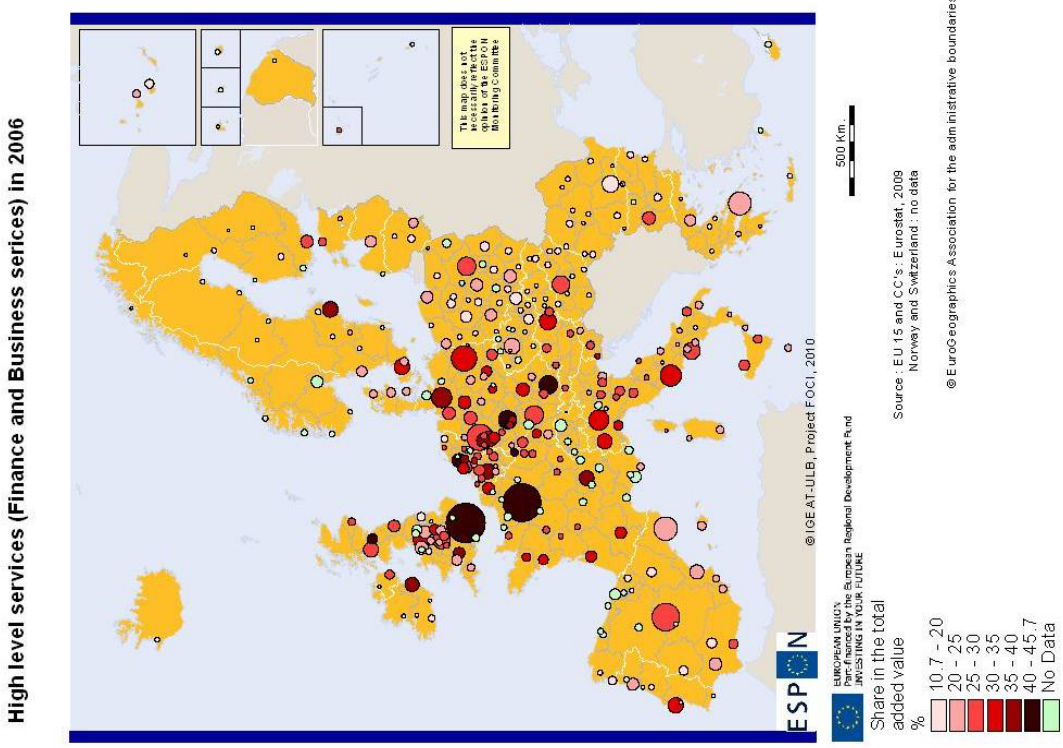


Figure 5 High level services (Finance and Business services) in 2006 – Manufacturing Industry, Energy and Construction in 2006

3.1.2. Synthetic indicators of economic structure for the biggest European cities

In order to synthesize the economic structure of the cities, we run a Principal Component analysis on the 25 sectors of the NACE1 classification. The 4 first components take more than half of the initial information into account and we also observe a gap between the fourth and the fifth component.

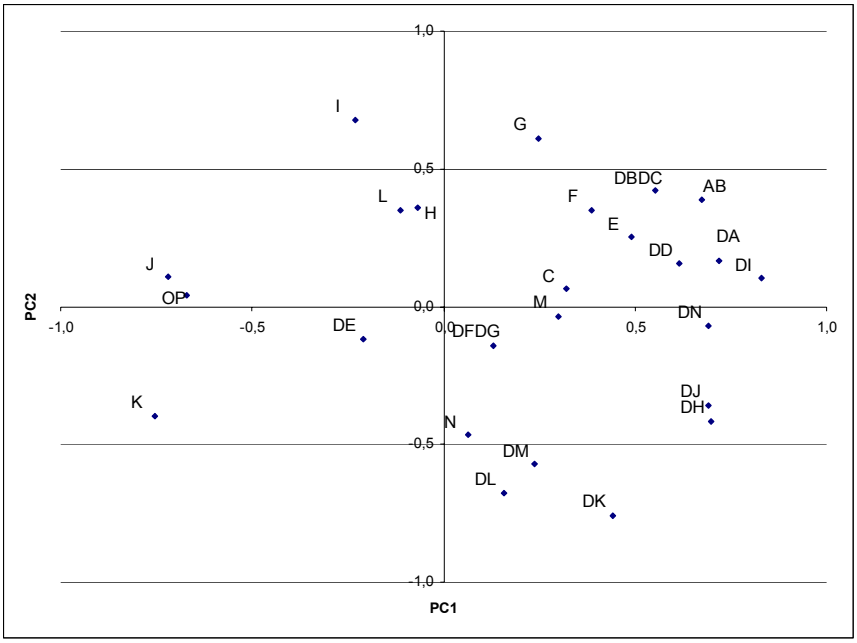
	Total	% of Variance	Cumulative %
1	6,4	25,5	25,5
2	3,8	15,0	40,6
3	2,2	8,7	49,3
4	2,1	8,4	57,7
5	1,5	5,8	63,5
6	1,3	5,1	68,6
7	1,2	4,7	73,3
8	0,9	3,7	77,0

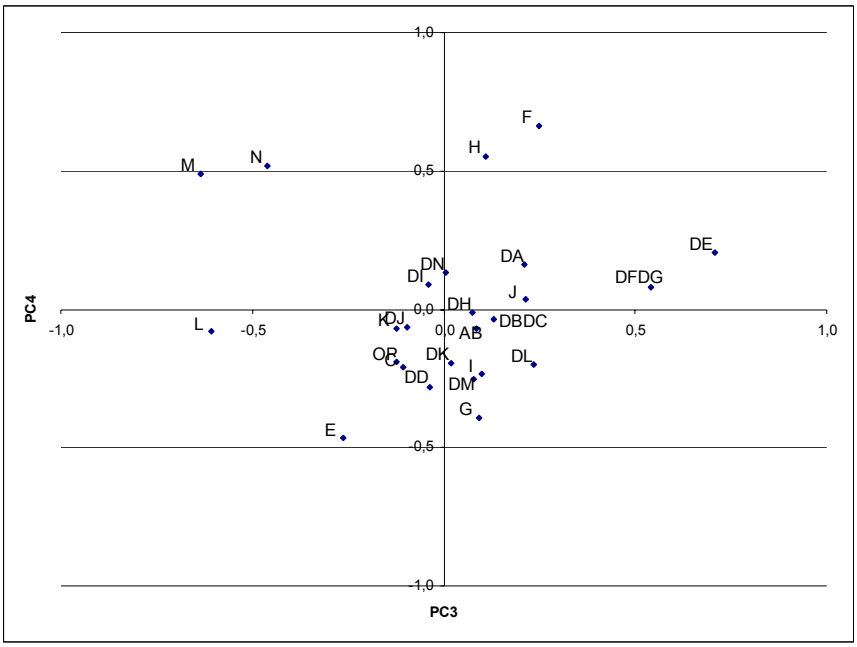
Table 3. Share of variance taken into account by the first eight components

From the graphs presented below, we can interpret these four components as follow:

- the first component highlight the opposition between service cities with high share of business services, the highest scores being in London and Paris, with more basic industry oriented cities;
- the second component opposes cities with high share of technological manufacturing industry to basic services oriented cities;
- the third component isolates cities with high share of public services (administration, health or education);
- the fourth component is difficult to interpret and opposes construction, hotels-restaurant, health and education to trade and Energy sectors.

The spatial picture of the two first components is similar than the one proposed by figure 5: big business international service cities are highlighted (PC 1) as well as cities which keep a strong manufacturing base, in the technological sectors (see PC2). High scores on the second component are showing cities with high percentage of market-oriented basic services.





Graphs 1 and 2: Position of the sectors on the 4 first components

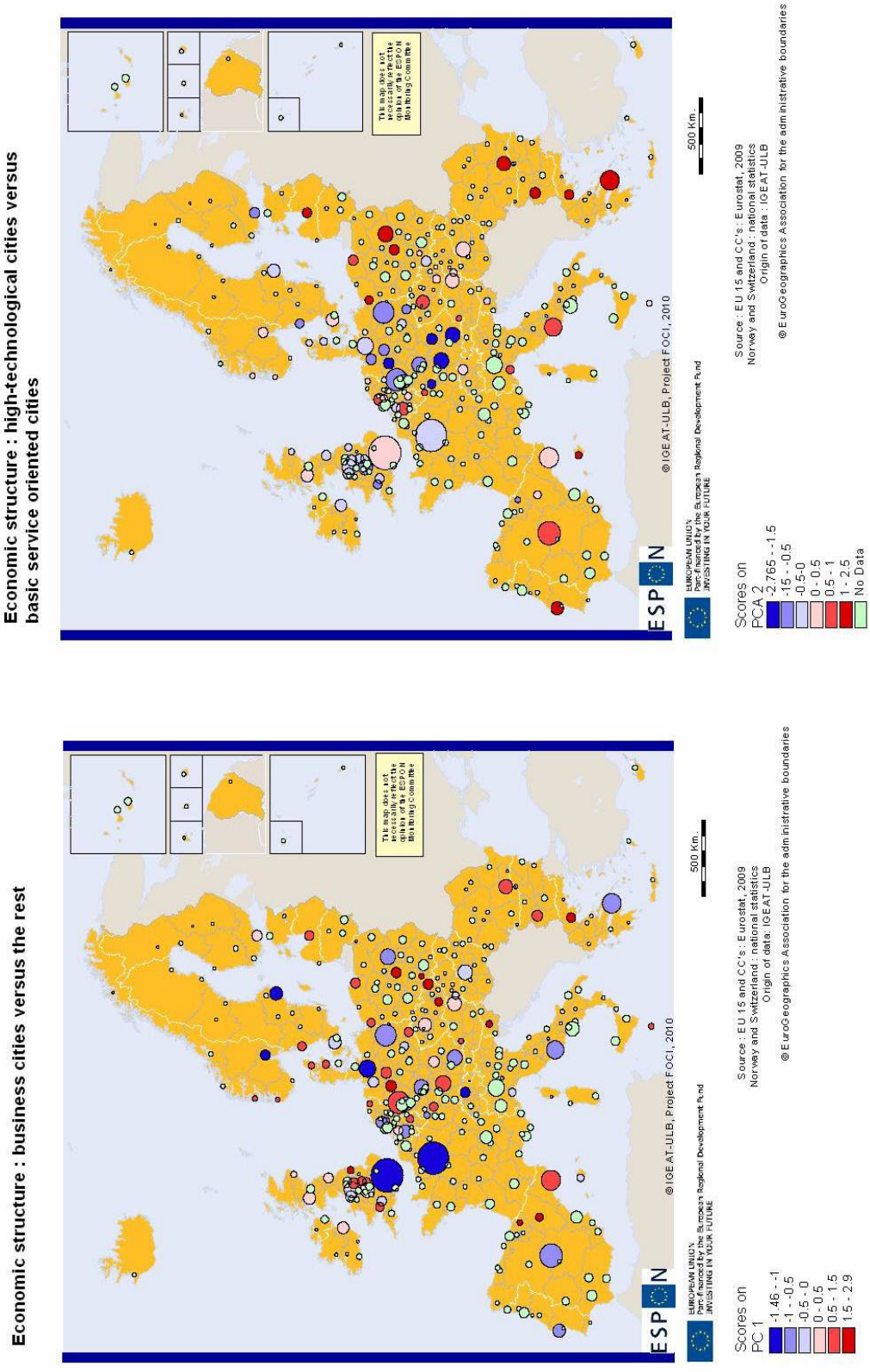


Figure 6. The two first components in the PCA on 25 sectors for large European cities, 2004.

Data dans pca_struc_nuts2.xls à cartographier

Carte faites dans « compet_luznuts2.apr »

3.2 Human capital

3.2.1. Qualification of the workforce

Data about qualification are very partial, even when approximated by the level of diploma. Censuses are generally the best sources but data are incomplete and sometimes not reliable from one country to another. The most homogenous and reliable source is the labour Force survey but it only allows to get data at NUTS2 level with a certain margin of error. Eurostat provides data on this basis but it only enables us to have statistics for a limited number of generally big cities.

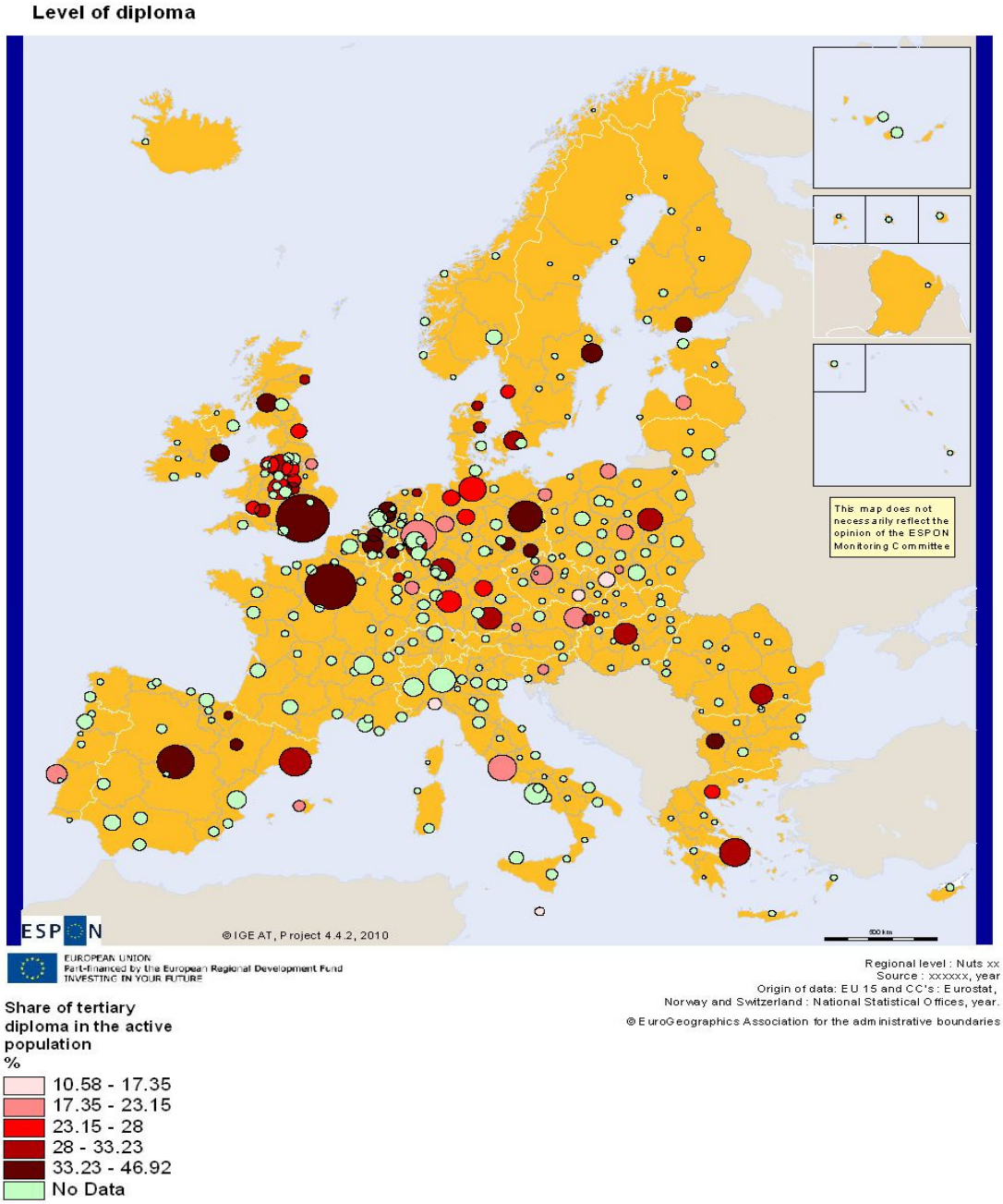


Figure 7. Level of diploma

3.3 Accessibility

Accessibility indicators are provided for the core cities by the Urban Audit for the last period (2003-2006). Data are based on core cities approximated by NUTS3. This is why some cities are missing: some core cities cannot be approximated satisfactorily by the surrounding NUTS3. Four indicators are available: air, road, rail and multimodal accessibility. The picture is of course a very expected one with higher accessibility in core Europe and lower scores in non capital regions of peripheral Europe.

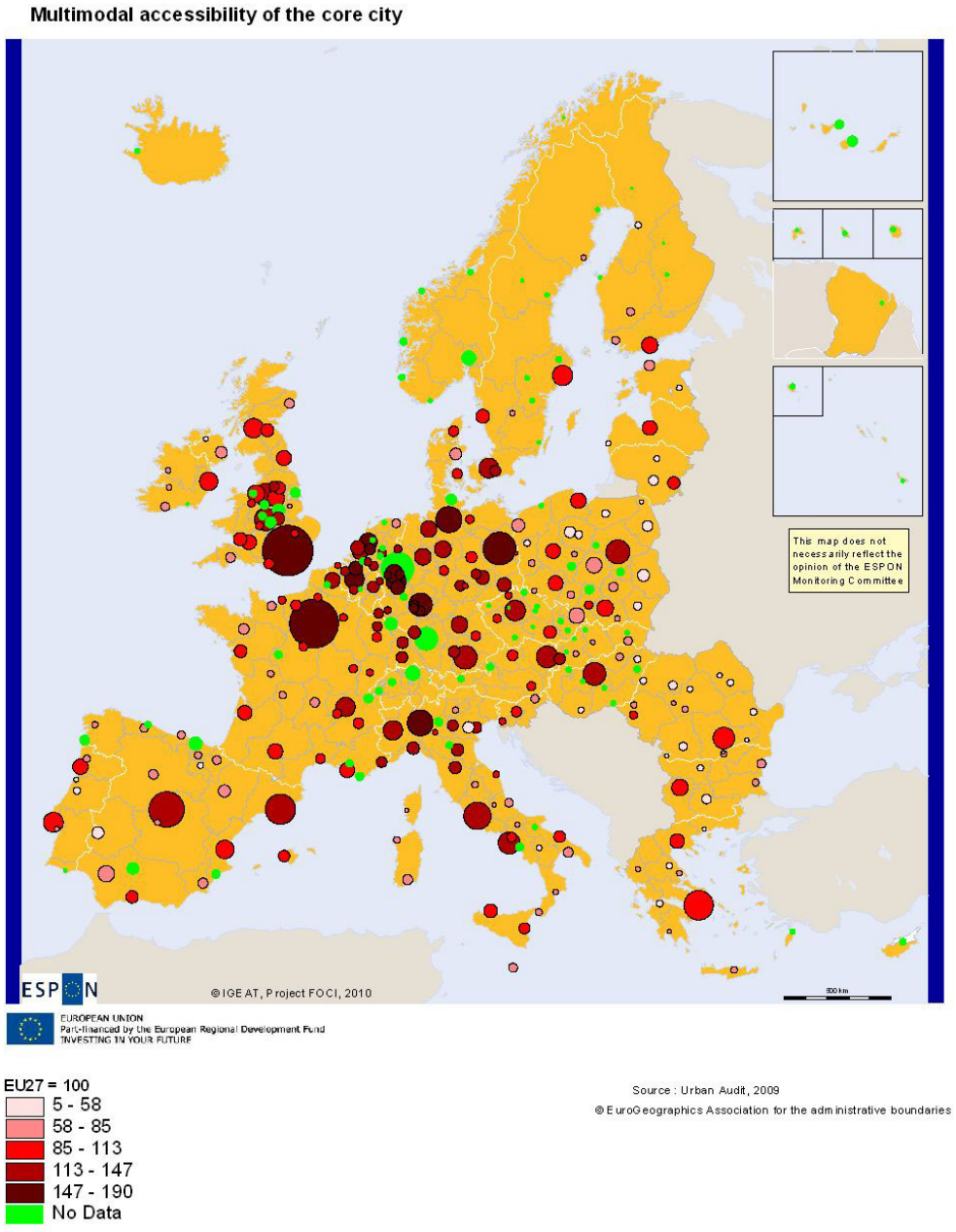


Figure 8. Multimodel accessibility of the core city

Modern factors

3.4 Cultural milieus

Entrepreneurship

While there is no satisfactory indicator of entrepreneurship, we can consider the share of non agricultural self-employed as one possible indicator. On the one hand, it illustrates a kind of reservoir of entrepreneurs since new businesses are often created by self employed. On the other hand, it is also a sign of backwardness, for example when self employed are located in basic services. Through the labour force survey, NUTS2 data are available but, of course it only enables us to produce data on a limited number of cities.

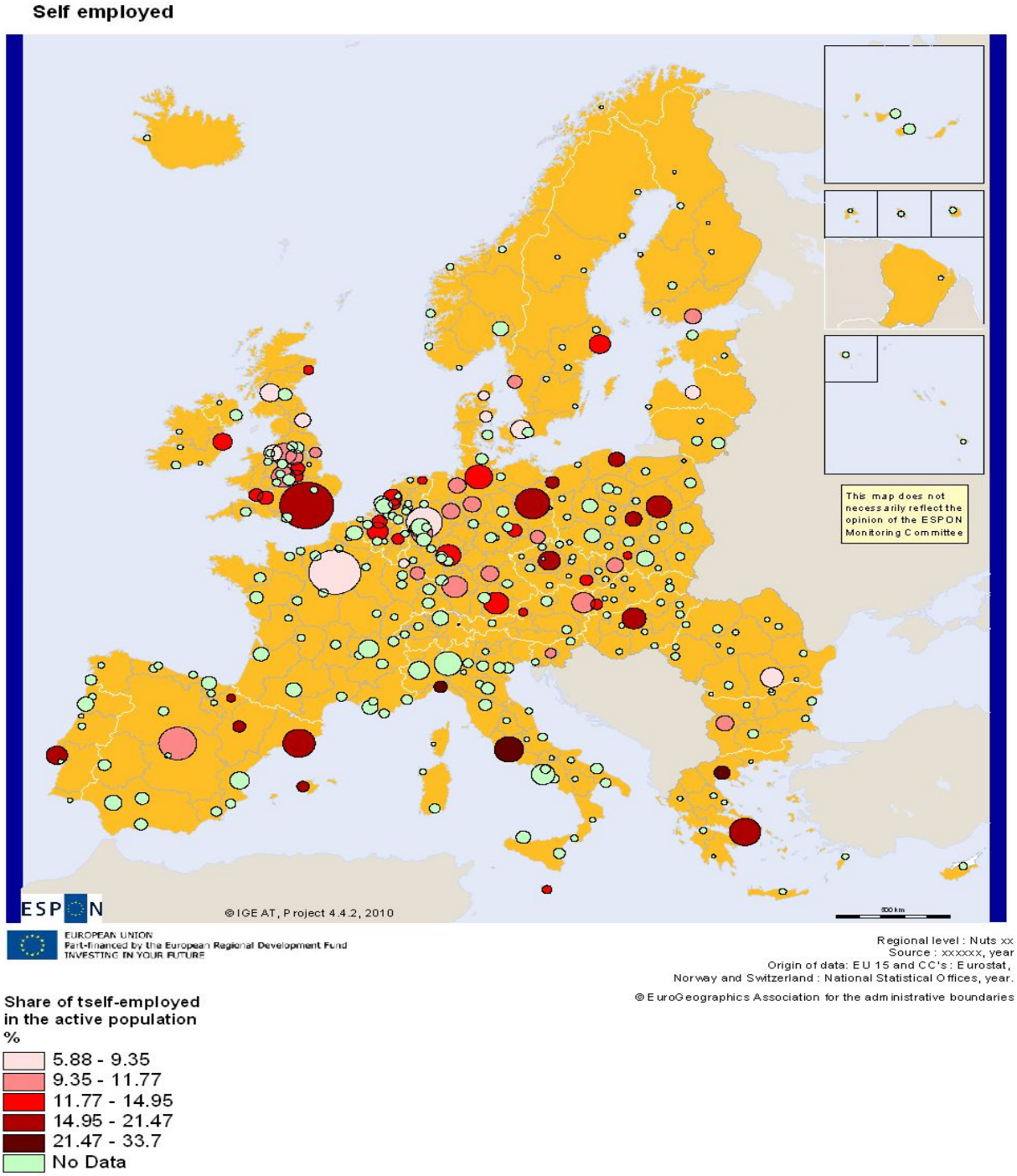


Figure 9. Self-employed

3.5 Innovation

We propose here three indicators of innovation (R&D; scientific personal; patents) for the cities which allow a NUTS 2 approximation.

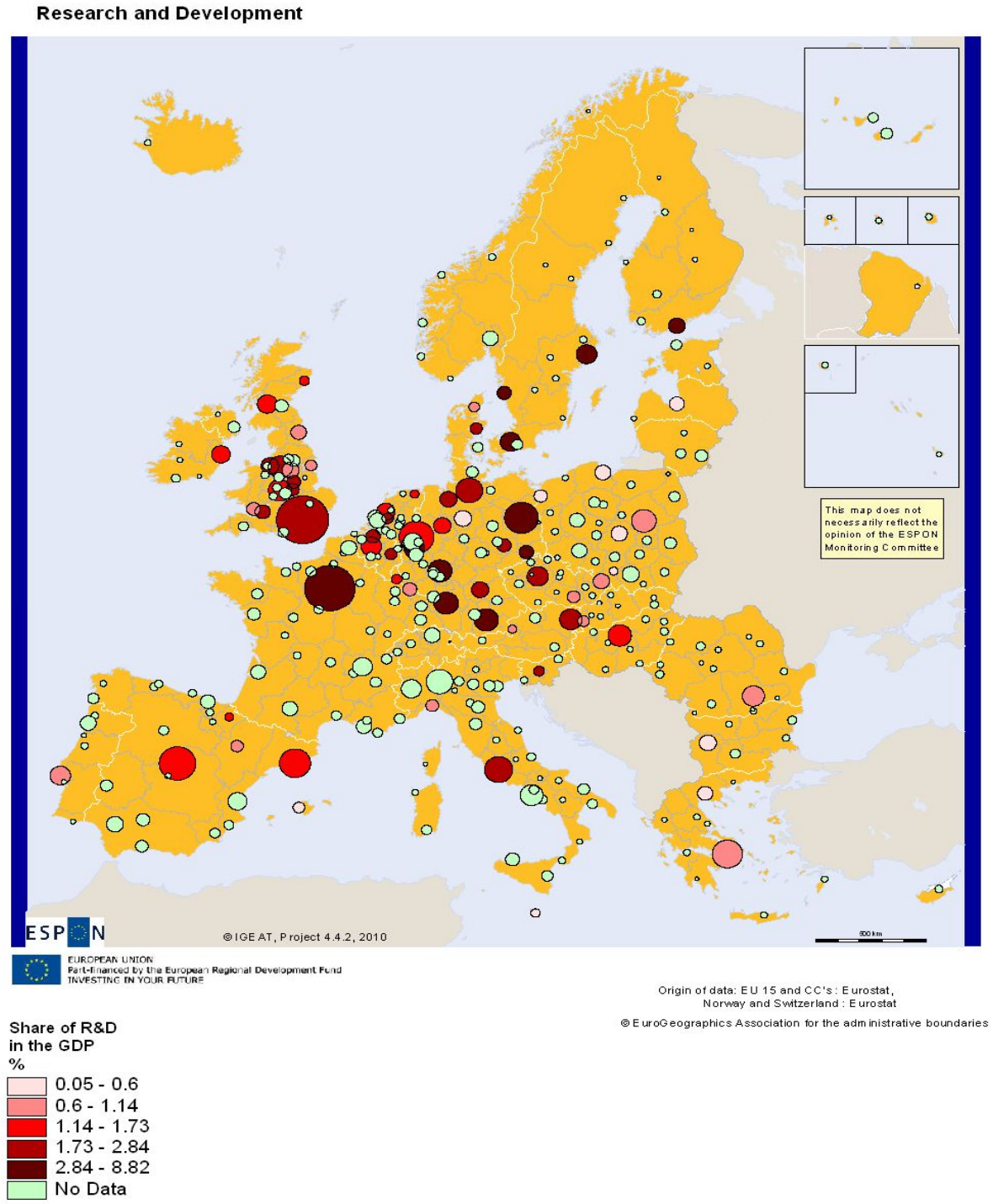


Figure 10. Research and development

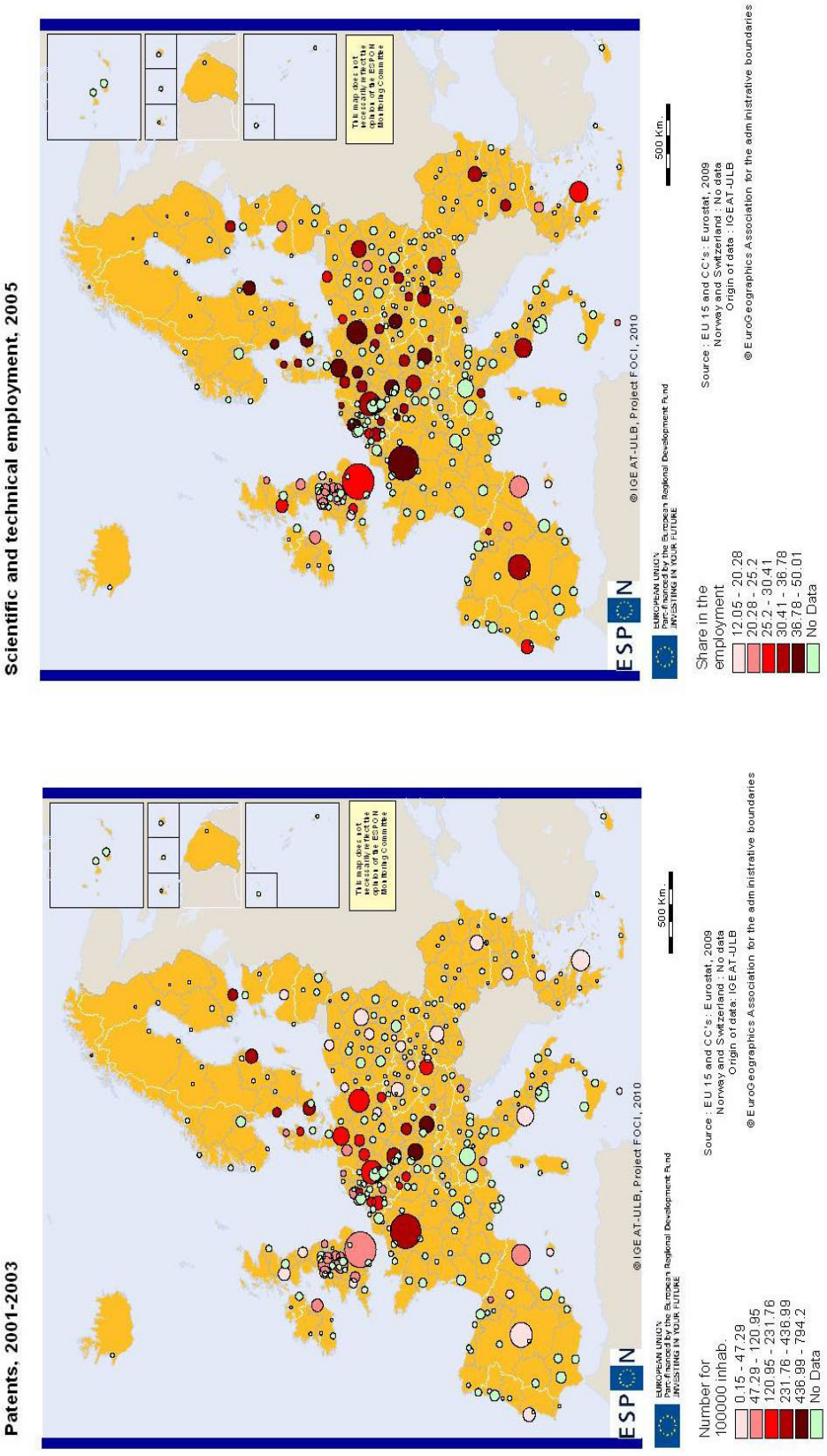

Scientific and technical employment, 2005
Share in the employment
12.05 - 20.28
20.28 - 25.2
25.2 - 30.41
30.41 - 36.78
36.78 - 50.01
No Data
Source : EU 15 and CC's : Eurostat, 2009
Norway and Switzerland : No data
Origin of data : IGEAT-ULB
© EuroGeographics Association for the administrative boundaries
© IGEAT-ULB, Project FOCI, 2010
500 Km.
ESPON
EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE
Patents, 2001-2003
Number for 100000 inhab.
0.15 - 47.29
47.29 - 120.95
120.95 - 231.76
231.76 - 436.99
436.99 - 794.2
No Data
Source : EU 15 and CC's : Eurostat, 2009
Norway and Switzerland : No data
Origin of data: IGEAT-ULB
© EuroGeographics Association for the administrative boundaries
© IGEAT-ULB, Project FOCI, 2010
500 Km.
ESPON
EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Figure 11

4. Urban specific factors

4.1. Commanding functions

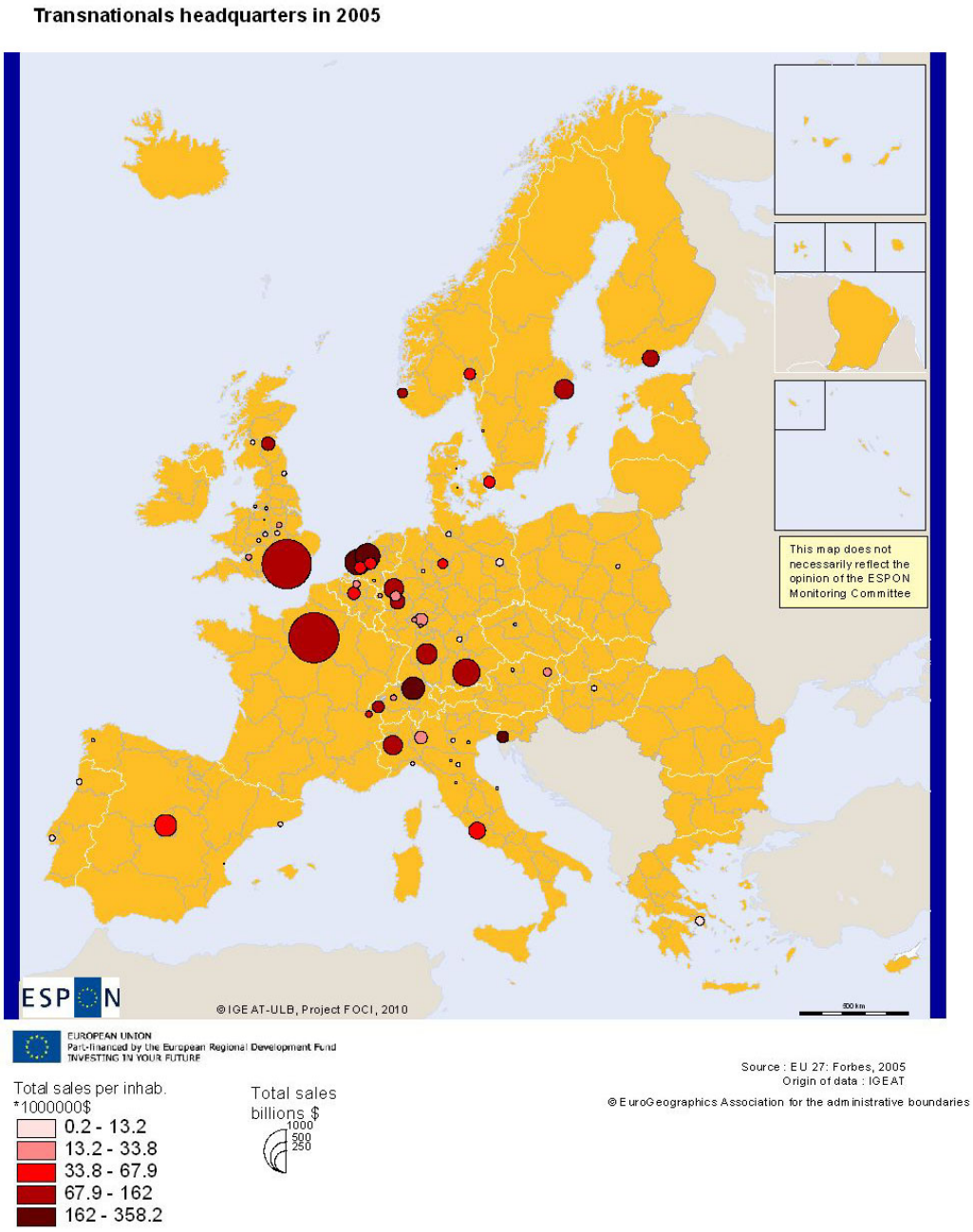


Figure 12: Transnational headquarters in 2005

Chapter 5 – Accessibility measures for assessing urban competitiveness

Sandra Bozzani-Franc, Alain L'Hostis, Laurent Terral, Université Paris-Est , LVMT, Inrets

Transport, being an indispensable support for economic and social interaction, has a major role to play in the structuring of urban regions all over Europe. Accessibility is one of the basic factors of competitiveness, but also of access to services, while at the same time it is one of the major sources of pollution and of energy consumption.
Accessibility is one of the major factors of city development. Accessibility constitutes a necessary condition for the economic and spatial development, and accessibility is one of the key sectors where public action plays a major role in infrastructure as well as in service provision in interaction with the transport operators. Developing tools that are able to assess the quality of the accessibility is then a major stake for decision help dedicated to urban stakeholders.
In addition accessibility represents a necessary condition for the development of exchanges between cities and between cities and their hinterlands. Measuring accessibility constitutes a step in the study and the identification the potential for development of cities; it also allows for identifying those links that already permit the development of cooperation between cities and those links that lack the minimum service provision to support polycentric development.
The analysis of transport services across Europe will give much importance to the air mode as the privileged long distance mean to link cities. If we consider that the intensity of the links decreases with distance, we observe that proximity OD pairs are of major importance to city development, and to polycentric organisation. On these shorter distance high-speed rail, and to a lesser extent conventional rail, can play a prominent role.
Most of the recent and dramatic development of the air mode in Europe has to be credited to the rise of the low-cost airline model. Recent literature shows that the low cost airline model seems to benefit to medium or small size airports serving intermediate cities. This hypothesis will be investigated through the analysis of the contribution of the low-cost airlines to the present accessibility.

1. Metropolises and communication: the role of high speeds

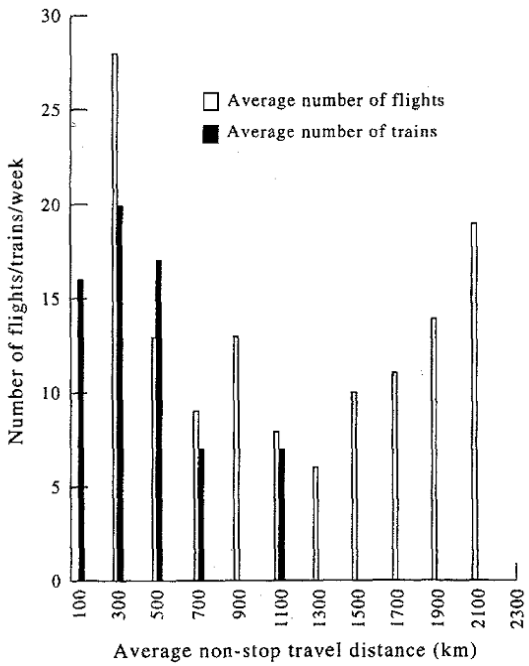
Globalisation, considered together with metropolitanization as its urban counterpart, is being made possible by the development of efficient, long-haul and short-haul transport systems. If metropolises can be defined as urban entities that communicate on a global scale, the air mode constitutes the major passenger transport system associated with globalisation (Haggett 2001)(Sassen 1991). Indeed, the equipment of metropolises with airport infrastructure, the number of flights and destinations available or the air distances are often used as indicators of the position of cities in the global competition (Rozenblat et Cicille 2003)(Taylor 2004)(Grubesic et Zook 2007). Nevertheless, the development of the air mode during the 20th century and beyond has not lead to the replacement of other slower transport systems. Each transport mode has developed inside its own space of predominance, with fierce competition in the margins. On the scale of metropolitan spaces, the road system can be considered as the major mode, even if regional specificities can be stressed (Kenworthy et Laube 1999). The overall picture of mobility involves two distinct levels with the agglomeration or local level dominated by car and the longer distance dominated by air. This typology has to be put in correspondence with the functioning of urban systems having intra-metropolitan and inter-metropolitan components associated with privileged transport modes. In order to complete the

analysis, this picture has to be enriched marginally with the development of other transport systems, urban public transport and regional and high-speed rail, each of them operating as a complement to, rather than in substitution for cars and planes.
For a long time now sociology researchers have highlighted the importance of weak ties, i.e. relations with acquaintances as opposed to relations with friends and relatives, in the processes of evolution of individuals (Granovetter 1983). Recently, after theoretical developments made in the domain of networks analysis , these approaches have been diffusing in the field of geography[6]. This direction of researches indicates that in order to understand the territorial dynamics, the study of major flows highlighting the hierarchical relations, should not prevent from considering the minor relations, sometimes on longer distances, since the can constitute the support for thematic cooperation between distant cities. *Small world* analysis of air networks[7] suggests the existence of less hierarchical longer distance sets of relations able to promote networks of cities where kilometre proximity is not the only horizon.

2. Analysing air and rail networks in Europe

Accessibility through fast transport systems, a key feature of the metropolitan fact, is all but independent of the sustainability issues. A particular focus can be put on sustainability by studying the roles of road, train, high-speed train and planes in their respective contribution to metropolitan accessibility. Recent researches have shown the key role that can be played by the high-speed rail and air association to develop city accessibility. To which extent the rail mode can substitute to less sustainable modes road and air remains an open question that we propose to investigate in the light of European urban development.
Janic studied the quality of service in the European railway network, highlighting the speed of relations, the frequencies and the delays according to the hierarchical level in the network (Janic 1996). This analysis focussed on the quality of the transport service.
Janic studied the two networks air and rail in Europe, comparing the distances of relevance of each mode (Janic 1997). In this paper he considered trains between locations and flights. Since most long distance trains and flight link major cities, this dataset can be considered as relevant in the analysis of the accessibility of (major) cities at the European scale. The number of existing trains on origin-destination (OD) pairs is maximum for distances of 300 km, which is also the case for air. For shorter distances one can find more trains than flights, while beyond 500 km, air becomes the dominant mode.

[6] Ref to Rozenblatt (en others) works
[7] SpanGéo book on preparation



Cattan (Cattan 1995) as shown that the analysis of flows in the air and rail networks in Europe reveal privileged relations between cities potential support for territorial cooperation, and also helps identifying the barriers that a voluntarist transport policy could aim at overcoming.

a. A timetable database

Concerning the collective transport systems –rail and air– the main data considered is the timetable information. The assumption is made that short travel times and high frequencies are necessary but not sufficient to guarantee the daily accessibility level, and that an adequacy of timetables to mobility rhythms must be tested.

The data necessary to compute these indicators are timetables for the air transport system and for the rail transports system.
Concerning air transport we have used the OAG database of flights operated in the winter 2009.
Concerning the rail system an automatic query of the major cities and major rail nodes has been executed on the Deutsche Bahn website[8]. It covers all direct trains between cities in Europe for a typical weekday of the winter 2009. The base of the urban grid is constituted by the Urban Audit list of cities. Currently further investigations are conducted to assess the possibility to complete the database to include smaller cities, in order to develop a detailed analysis at the scale of city-hinterland relationships. The territorial base include all countries of the ESPON space up to Moscow.
Extra data is used to connect transport nodes –station and airports– to cities, in order to attain a door-to-door approach. In addition several nodes where air to rail transfer is possible have been introduced. The criteria to introduce such possibility relies on the presence of long distance trains inside airports. Therefore, we have not introduced dedicated airport-city rail link in the analysis.

b. Time geography and the concept of contactability

The time-geography framework refers to the works conducted around the geographer Hägerstrand (Hägerstrand 1970). The question raised in this domain of research is the necessity of considering time when one wants to analyse space (Chardonnel 2001). This

[8] The website : http://www.bahn.de/

framework is relevant when one wants to analyse "the interrelationships between activities in space and time, and the role of transportation and communication technologies in facilitating and constraining these relationships" (Miller 2004).
Contactability is defined by Haggett (Haggett 2001) as the possibility to contact people in a distant city. The contractibility is considered, in a regional scale by Swedish geographers Hägerstrand and Tornqvist when it is possible to meet for 4 hours during a normal weekday. This indicator refers to an idea of spatial cohesion inside a territory.
Contactability analysis in a regional space was studied with specific indicators allowing for daily journey-to-work between majors cities (L'Hostis, Menerault, et Decoupigny 2004).
In the ESPON project on transport and territorial cohesion contactability indexes were developed under the aspect of daily accessibility. These indicators have been reused in several contexts including the definition of global integration zones as proposed in the ESPON atlas[9]. This illustrates the potential of such indicators to help propose a spatial support for territorial cohesion concepts.
We will now propose a series of indicators to assess the relations between cities, based on the measure of contactability.

c. Indicator of daily accessibility from a city: contactability

According to the time-geography theoretical framework initiated by Hagerstrand, and the concept of contactability, the quality of the link between two poles can be assessed through the possibility to go from the pole A to the pole B, to have enough time for an activity related to work, education or other purposes, and to come back to pole A in a single day. Reciprocally, one can assess the possibility for a city to foster an event gathering people from remote metropolises. The same criteria are used but inversely, to allow for people from city A to get to city B, and to held a meeting there. The indicator expresses the attractiveness of city B to organize a conference, an event with several persons.

A high level on this indicator will be necessary to develop a congress activity of a city.

This direction of the relation is also useful for universities, research centres, firms headquarters that need to gather persons from several remote cities, for seminars, colloquium and board of administration.

[9] Ref to ESPON atlas BBR 2006 http://www.bbr.bund.de/cln_007/nn_149732/BBSR/EN/Publications/SpecialPublication/2006__2001/DL__espon-atlas,templateId=raw,property=publicationFile.pdf/DL_espon-atlas.pdf

Consequently, and following the approach adopted in earlier works (Mathis et al. 2004), we propose to evaluate the possibility of single day business trip with 6 hours available at destination and within the time windows 6h-22h and 5h-23h, in a door to door approach and detailed as follows.

Structure of the return trips:

First take-off: 6h30
First arrival: 6h40 on Bruxelles-London (without considering GMT)
First departure back: 6h40 + 8h30 = 15h10
Last possible departure flight (in case of a ten minutes flight): 21h50

Structure of the rail return trips:

For the case of trains:
First departure: 5h45 (45 minutes + security time to the station)
Must stay 6 hours plus 2 x 45 minutes = 7h30 between times of arrival and departure
First departure back: 5h45 + 7h30 = 13h15
Maximum time of arrival of the returning train: 22h15

These criteria can be used to define a minimum service provision for the functioning of city networks and applies on the links in the network.

This family of indicators deals with intermodality by allowing to compare modal accessibilities (rail, air, road), and intermodal accessibility (air-rail), but also by taking into account the initial and terminal parts of the trips.

The indicator of contactability is displayed on the following map.

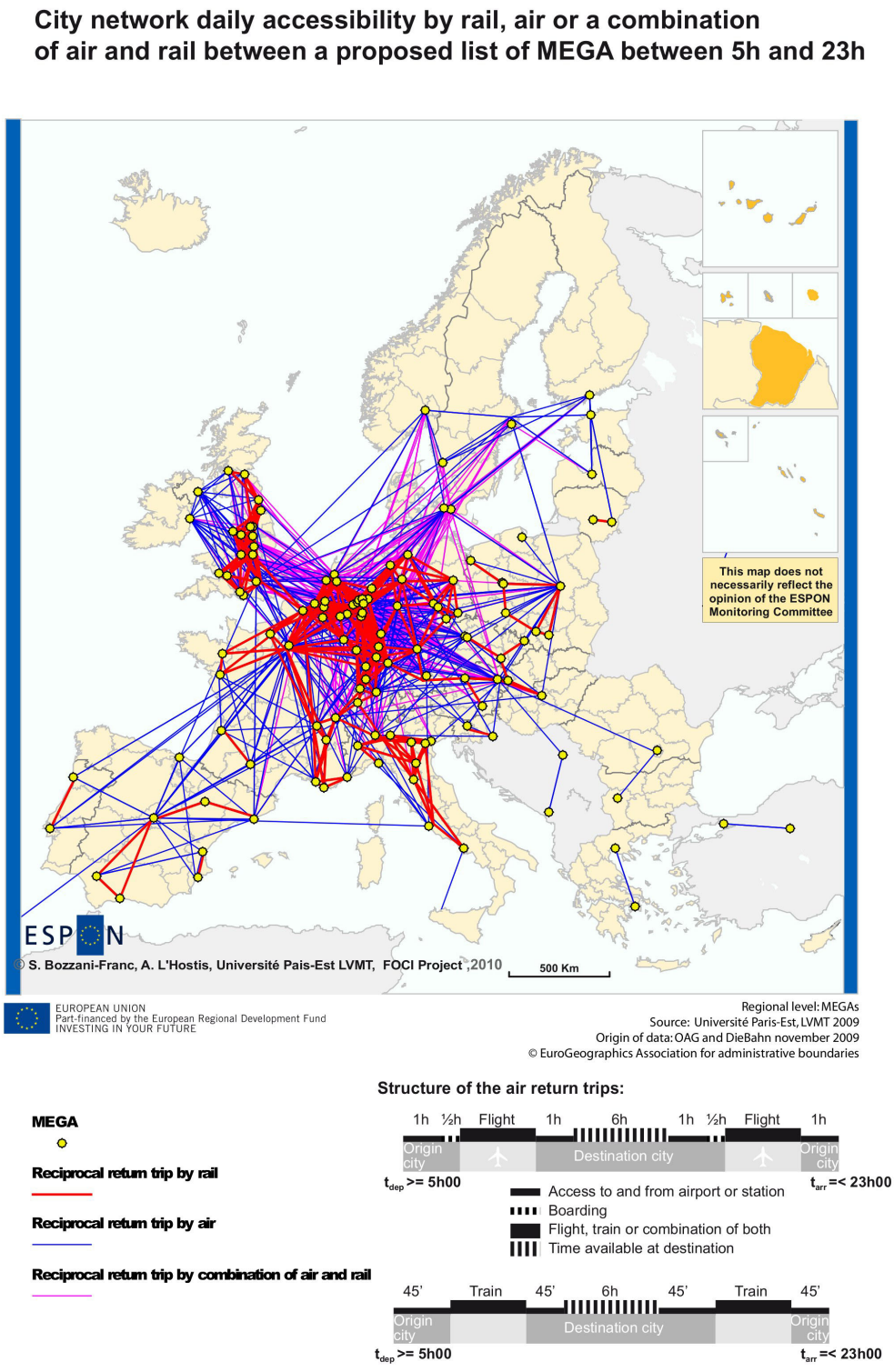


Figure 1. City network daily accessibility by rail, air or a combination of air and rail between a proposed list of MEGA between 5h and 23h

In this map, between any two cities, the modal combination that leaves the most time available at destination is chosen.

The map displays lines when a reciprocal relation is possible, i.e. when A to B and B to A relations are possible through the network. Unidirectional relations are not displayed for reasons of visual simplification.

Several key elements can be seen on this map. We can discuss the spatial distribution of the links and the transport mode distribution throughout Europe.
First element the very high importance given to rail, especially when we consider that links appearing on the map express the best spatio-temporal performance; this means that rail is able to compete with air for a large set of proximity relations. The high level of the role of rail in the inter-metropolitan relations is remarkable. One must notice though, that the national logic is very present as can be seen in the Italian case; the high-speed rail line opened recently between Naples and Milan allows for strong integration of the national city network with rail. Nevertheless Italian cross border links rely mostly on the air mode.
Second element the high level of integration of most of the European space. The Iberic peninsula is strongly linked to the Pentagon, and the relations towards eastern countries like Poland or Hungary are clearly shown, even if their intensity is much lower than what can be seen inside the Pentagon. The integration of the Eastern Balkans proves more difficult; in this part of the territory the peripheral character and a lower density of MEGAs lead to a much less intense level of potential relations.
Thirdly the combination of rail and air plays a decisive role in the integration of the network. In order to better discuss this point we proposed to measure in each MEGA the number of other reachable MEGAs by each modal chain.

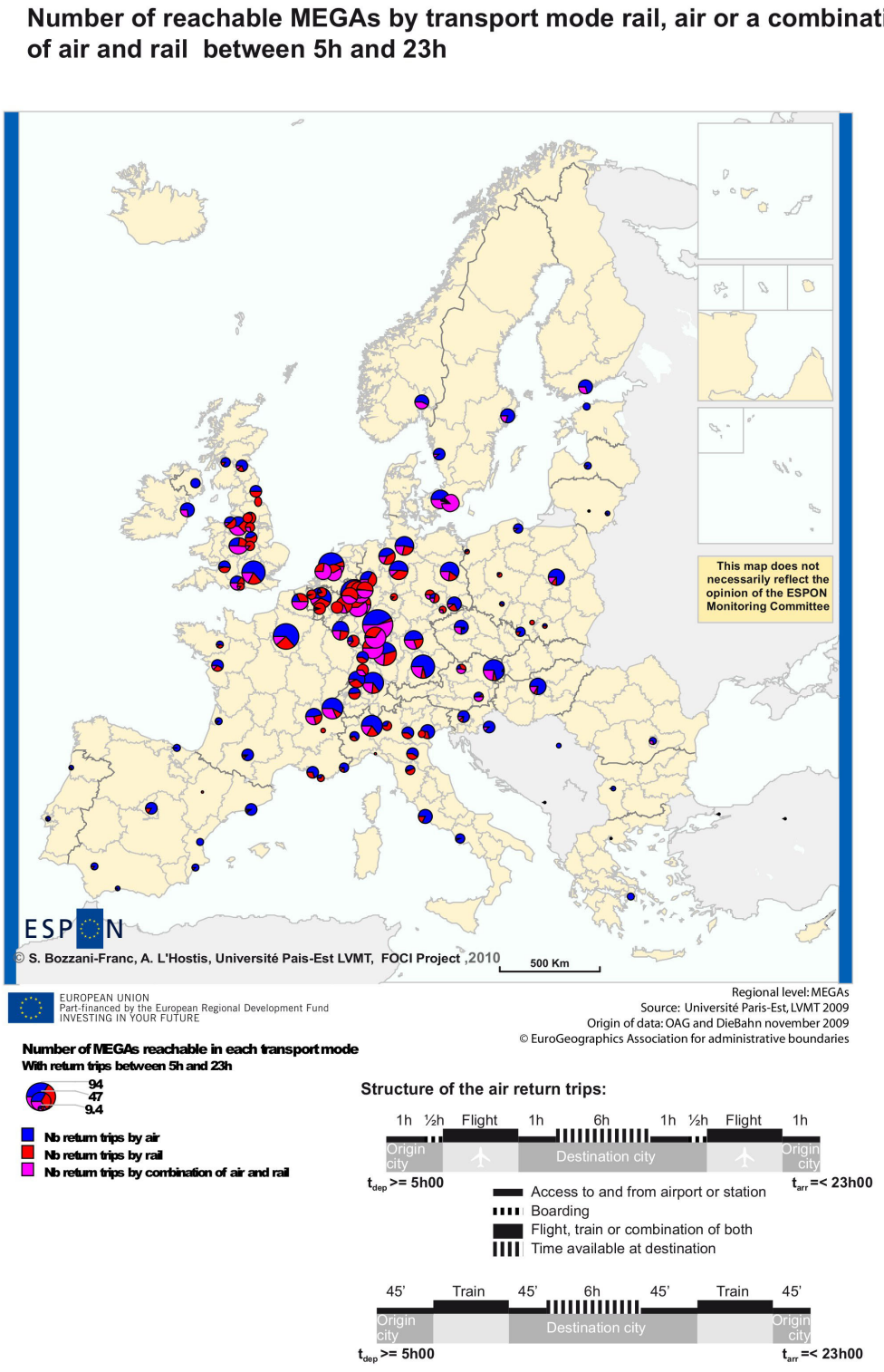


Figure 2. City network daily accessibility by rail, air or a combination of air and rail between a proposed list of MEGA between 5h and 23h

The role of each modal chain in each cities give indications on the transport modes determinants of cities accessibility. For a metropolis air is the privileged transport mode for inter-metropolises linkages. For those metropolises that do not posses an international strong airport, accessibility level is not necessarily poor as in the case of the couple Copenhagen/Malmoe. Copenhagen is a city equipped with a large airport and air counts for more than a half of its 43 possible inter-metropolitan links. From Malmoe 24 MEGAs can be reached almost all through a rail-air combination that takes benefit of the proximity with the Copenhagen airport linkd with the rail Belt bridge.
Several intermediate MEGAs like Lille, Den Haag, German Ruhr and Rhein cities benefit of high levels of accessibility by the combination of high-speed and classical rail and efficient connection to airports. It is clearly an opportunity to build high levels of inermetropolitan accessibility without relying only on an airport equipment. The indicator clearly demonstrates the potential of rail for this type of cities. Successful cases supposes to consider the position regarding the high performance rail network, the efficiency of the rail/air exchange poles.

d. The hierarchy of MEGAs according to potential emission an reception factor

The return trips can be used to determine the number of other MEGAs than can be reached from an existing city. When counting the number of reachable MEGAs potential emission and reception indexes can be build.

MEGAs	EMISSION	RECEPTION
Frankfurt	34	12
Paris	32	18
London	24	26
Munich	23	22
Stockholm	21	11
Madrid	20	13
Rome	19	10
Amsterdam	16	7
Oslo	15	12
Copenhagen	14	12
Helsinki	13	10
Milan	12	10
Belfast	12	8
Barcelona	11	8
Vienna	10	13
Brussels	10	7
Berlin	9	12
Dusseldorf	9	12
Athens	9	8
Stuttgart	8	9
Hamburg	7	12
Manchester	7	10
Zurich	7	5
Marseille	7	2
Geneva	6	6
Tallinn	6	0
Dublin	5	8
Glasgow	5	5
Nice	5	5
Prague	5	3
Strasbourg	5	2
Birmingham	4	7
Cologne	4	7
Southampton	4	7
Gothenburg	4	5
Naples	4	5
Toulouse	4	5
Bordeaux	4	4
Leeds Bradford	4	4
Nantes	4	3
Bucarest	4	2
Valencia	4	2
Edinburgh	3	7
Bilbao	3	5
Lisbon	3	3
Dresden	3	1
Liverpool	3	1
Bergamo	3	0
Hanover	2	8
Nuremberg	2	7
Las palmas de gran	2	3
Moscou	2	3
Turin	2	3
Alicante	2	2
Budapest	2	2
Graz	2	2
Porto	2	2
Belgrade	2	1
Catania	2	1
Leipzig/Halle	2	1
Munster	2	1
Palermo	2	1
Reyjavik	2	1
Zagreb	2	1
Minsk	2	0
Poznan	2	0
Basel/Mulhouse	1	5
Bologna	1	3
Bremen	1	3
Newcastle	1	2
Rotterdam	1	2
Sofia	1	2
Venise	1	2
Bristol	1	1
Firenze	1	1
Genoa	1	1
Lille	1	1
Ljubljana	1	1
Malmo	1	1
Podgorica	1	1
Thessaloniki	1	1
Vilnius	1	1
Antwerpen	1	0
Cardiff	1	0
Gdansk	1	0
Kaunas	1	0
Seville	1	0
Szczecin	1	0
Wroclaw	1	0

Table 1. potential emission and reception index by MEGAs by air: number of MEGAS reachable in a return trip 6h-22h

The potential emission and potential reception indices expresses the possibility to emit return-trips and receive return daily travels. The emission index expresses the possibility for travellers residing in the MEGA to reach other MEGAs for a business day trip between 6h and 22h. Reciprocally the reception factors expresses the possibility to held a meeting inside a MEGA with people arriving from as many distant MEGAs.

The table shows the hierarchy of air platforms but also the imbalances between emission and reception functions. Large cities tend to have better emission than reception index. The following map expresses the indicators of emission and reception indicators in the case of 5h to 23 hours return trips between MEGAs.

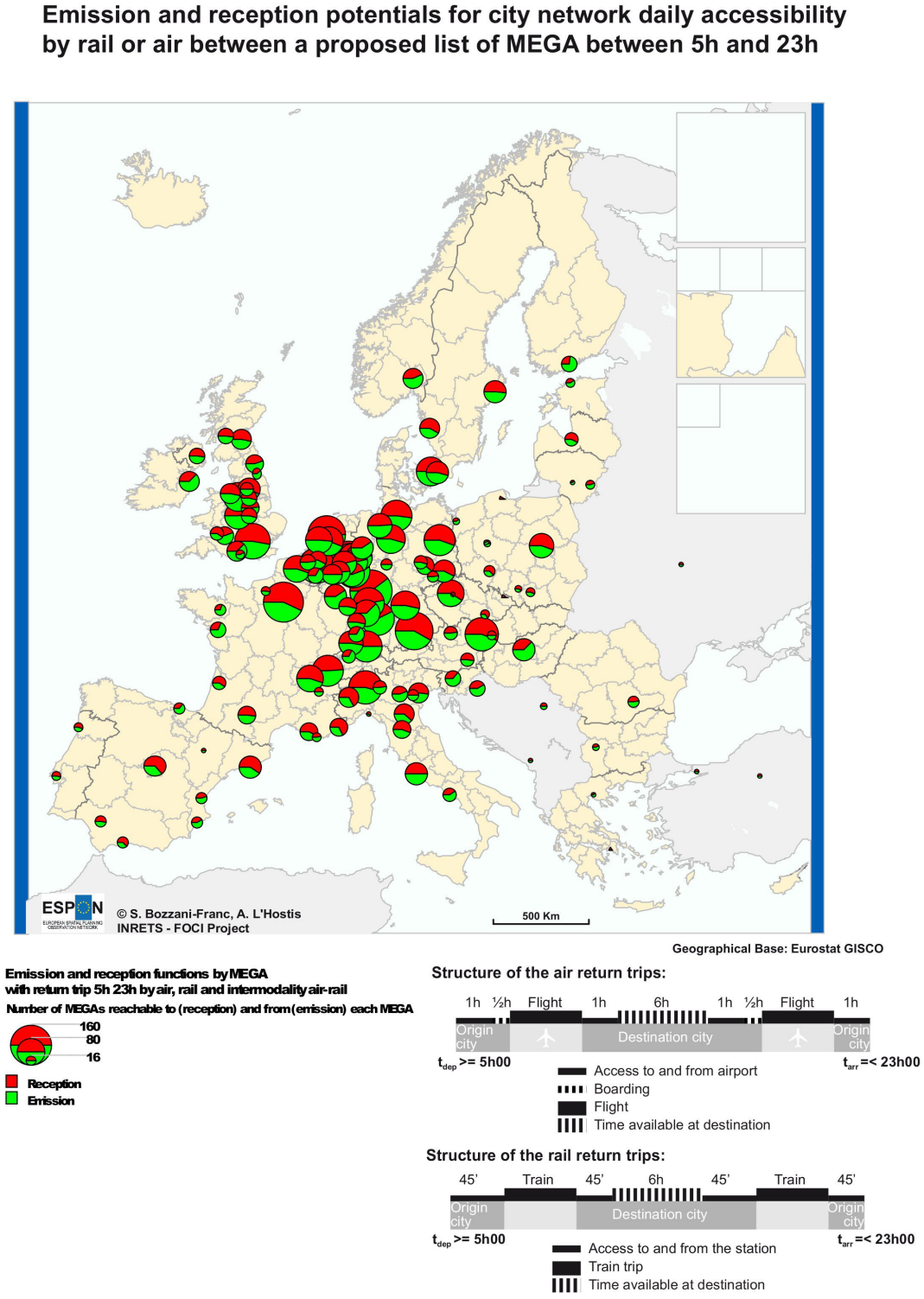


Figure 3. Emission and reception indicators for MEGAs in the case of 5h to 23h return trips

The tendency to see larger cities having a stronger reception potential than emission potential is here confirmed, despite notable exceptions like Francfort.

e. Rail for inter-metropolitan links

If air is the privileged transport mode for inter-metropolitan links, the return trips analysis shows that this type of business trips represents an opportunity for high-speed rail.
Indeed the mode combination leaving the longest available time at destination give a high importance to the rail mode, which competes with rail on distances ranging to 300 km or more in the case of high speed rail. To deepen the analysis of the potential of rail in inter-metropolitan links we produced a map of rail only relations. Between MEGAs one can find 1075 relations where rail make it possible to realise a return trip between 5h and 23 leaving 6 hours available for a meeting at destination. If we consider the number of 807 relations by rail that are better than the use of air or intermodality, we see that the potential for the use of rail is not overestimated by the global measure; it is even possible to envisage more rail for inter-metropolitan links, a tendency that is likely to evolve positively with the development of the high-speed rail network.
Cf map: A4 City network daily accessibility by rail only between a proposed list of MEGA between 5h and 23h
The map shows a high level of rail connection in the pentagon, with notably cross-alps relations possible, a better integration of the Spanish city network. As on the multimodal map, the national integration of the city networks is high in different situations:

- Dense city network and dense rail network: United-Kingdom, Benelux
- Dispersed city network and high-speed rail: France, Spain, Italy

It is worth noticing tht crossborder relations are not as well deserved as intranational ones du to a combination of factors: longer distances, physical obstacles like Alps an Pyrenees, missing links in the high-speed rail network as between France and Spain or Spain and Portugal. This map can be interpreted as in support of the development of the Tran-European railway network, which, with well positioned services, will allow for a better integration of the European city network.

f. The role of low cost airlines

Low cost airlines are an strongly emerging new actor in the European air industry landscape (Dobruszques 2005). They represent 35 % of all flights scheduled in the winter 2009 in the OAG database.
In inter-metropolitan accessibility, low cost airlines play a particular role. It is widely accepted that low cost airlines are more present on smaller airports than on major platforms where heritage airlines have build dominant positions. In addition, most low cost airlines focus on leisure market, leaving heritage airlines dominate the business travel. Consequently, the inter-MEGAs relationships should stay in majority under the influence of major airlines. Nevertheless, with the strong emergence of low cost model, especially in intra continental links, challenging the historical players, what is the importance of theses new actors?
To determine low-cost and heritage airlines we used reference works by Dobruszkes (Dobruszques 2005), and reference websites specialised in low cost ticket sales[10].

[10] Belvedair.com, bravofly.com and flyc.com, flylowcostairlines.org.

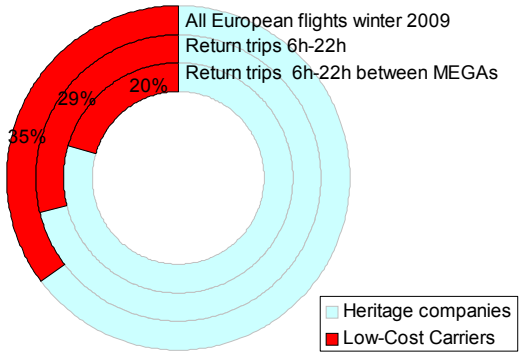


Illustration 1: Percentage of low-cost flights and return trips between airports and MEGAs

The preceding illustration indicates the percentage of flights operated by low-cost carriers in the data base and among the flights selected for realising the return flights, between all airports and between MEGAs. operating the flights used in the return trips between metropolises between 6 and 22 hours. Basically the analysis confirms the major characteristics of the supply of the low cost carriers. They are becoming major actors in the European airline industry but, so far, they are not the major actors for the business inter-metropolitan relationships. This segment of the market is mainly operated by heritage airlines with strong positions on major airports associated with the largest and most accessible metropolises in Europe.

g. References

Cattan, Nadine. 1995. Barrier Effects: The Case of Air and Rail Flows. *International Political Science Review/ Revue internationale de science pol* 16, no. 3 (Janvier 1): 237-248. doi:10.1177/019251219501600304.

Chardonnel, S. 2001. La Time-geography: les individus dans le temps et l'espace. Dans *Modèles en analyse spatiale*, 129-156. Traité Information Géographique et Aménagement du Territoire, Série aspects fondamentaux de l'analyse spatiale. Paris: Lavoisier.

Dobruszques, F. 2005. Compagnies low cost européennes et aéroports secondaires: quelles dépendances pour quel développement régional? *Les Cahiers Scientifiques du Transport*, no. 47: 39-59.

Granovetter, M. 1983. The Strength of weak ties: a network theory revisited. *Sociological Theory* 1: 201-233.

Grubesic, T., et M. Zook. 2007. A ticket to ride: Evolving landscapes of air travel accessibility in the United States. *Journal of Transport Geography* 15, no. 6: 417.

Hägerstrand, T. 1970. What about people in regional science? *Papers of the Regional Science Association* 24: 7-21.

Haggett, P. 2001. *Geography, a global synthesis*. Harlow: Prentice Hall.

Janic, M. 1996. The Trans European Railway Network Three levels of services for the passengers. *Transport Policy* 3, no. 3 (Juillet): 99-104.

———. 1997. Comparison of the quality of rail and air networks in West, Central and Eastern Europe. *Transport Policy* 4, no. 2 (Avril): 85-93.

Kenworthy, J.R., et F.B. Laube. 1999. Patterns of automobile dependence in cities: an international overview of key physical and economic dimensions with some implications for urban policy. *Transportation Research Part A: Policy and Practice* 33, no. 7-8: 691.

L'Hostis, A., P. Menerault, et C. Decoupigny. 2004. Assessing spatial planning policy with accessibility indicators: the case of Lille's metropolis scenario. Dans *Transport developments and innovations in an evolving world*, 293-312. Advances in spatial sciences. Berlin: Springer.

Mathis, P., E. Bock, J. B. Buguellou, J. Coquio, L. Guimas, A. L'hostis, S. Bozzani, et al. 2004. Transport services and networks: territorial trends and basic supply of infrastructure for territorial cohesion. *ESPON, Luxembourg* 478.

Miller, H.J. 2004. Activities in Space and Time. Dans *Handbook of Transport 5: Transport Geography and Spatial Systems*. Pergamon/Elsevier Science. C:\Travail\Bibliographie\Articles\Accessibilité\Miller Activities_Space_Time Handbook of Transport.pdf.

Rozenblat, C., et P. Cicille. 2003. *Les Villes européennes, analyse comparative*. Paris: La Documentation française/DATAR.

Sassen, S. 1991. *The Global City: New York - London - Tokyo*. Oxford: Princeton University Press.

Taylor, P. 2004. *World city network, a global urban analysis*. Oxon: Routledge.

Chapter 6 – The position of cities in research networks in converging technologies

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1. Creation of a data base on cooperative research networks in converging technologies: methodology and meaning of these new indicators

Technological innovation has acquired in Europe, as in the rest of the world, an increasing strategic importance for economic competition. It also plays a crucial role in the structuring and dynamics of the settlement systems: within the emerging "knowledge economy" the main dynamical feature that characterizes the evolution of systems of cities seems to be competition for collecting knowledge and innovations. Contrary to the largely widespread idea according to which innovation may locate indifferently, various empirical studies stress the importance of cities as nodes of accumulation, production and diffusion of scientific and technological knowledge. Thus, from the analysis of scientific collaborative networks we can derive some critical insights regarding the wider geography of European cities' interactions.

In order to study the most innovative scientific sectors, we focus on NBIC technologies (nanotechnology, biotechnology, information technology and cognitive science) commonly named "converging technologies". Such technologies are believed to drive the future innovation wave expected to emerge by 2020 (Nordmann, 2004). There are three principal types of indicators for studying technological flows between cities: (i) patents documents include references to previous patents (citation). According to A. B. Jaffe et al. (1993) patent citing earlier patents reveal knowledge flows between localized inventors. (ii) The co-authorships networks related to joint publication activities indicate intense working relations and then potential knowledge flows between localized authors. The main difficulty with these two indicators is to collect data related to the cities where innovative actors are located. (iii) In our analysis, we consider scientific and technological collaborative linkages between the organizations engaged in innovation processes (namely research organizations: public research centers, universities and firms' research centers) within European funded research and technology development projects (RTDs) dedicated to converging technologies.

Data were collected from the EC database CORDIS RTD-PROJECTS (Community Research and Development Information Service) drawn from the 2nd to 6th European Framework Programs for Research and Technological development (or FPs) (the 1st FP is much too incomplete to be used): the CORDIS data base provides information about the evolution of European research supports from 1986 to 2006. CORDIS data give information about the real location of the organizations that are involved (it is not the location of organizations' headquarters). Indeed, institutions can have several research centers located in different cities. That is why we choose to identify the precise location of each of the research centers (laboratories) that are really involved in projects dedicated to NBIC. We can thus create urban networks, by aggregating CORDIS data at the city level for measuring the links which are created between cities by these networks (see J. Hoekman et al 2008 -for UE 27 regional study-; Rozenblat and Cicille 2003 ; Besussi, 2006; Rota, 2008; and Comin, 2009 about scientific urban networks). The resulting FUAs database is named NBIC-Euro database for research networks and SPANGEO database for multinational firms.

Critical steps of the methodology used for building the NBIC-Euro database are made explicit below.

2. A methodology for selecting project that are exclusively dedicated to NBIC technologies from the database CORDIS.

The projects in the CORDIS data base include a description of the coordinator and participants with their geographical location as well as technical details and a short description of their objective (figure 1). Extraction of relevant projects from the database CORDIS was made through key-words selected from the literature on NBIC (figure 2). The projects dealing with research on NBIC were not identified through the official keywords listed in the programs but were extracted after a full semantic analysis of the text of each project.

PROJECT DESCRIPTION:	PROJECT DETAILS:
Objectives: NanoTemplates STREPS project will push the Frontiers of Science of a unique range of nano- objects made by further extending nanotechnology developed in two EU RTD projects [NanoPTMS & GMR - BE95-1761 & NanoPTT - G5RD -CT1999-00135]. It will seek an advantageous property discontinuities arising from the nano-regime and explore these through a range of novel nano-systems to identify promising areas for further development. The project will be underpinned by IPR from previous EC projects employing UCL technology based on heavy ion bombardment and track etching of polymers for nano-object fabrication. Fundamental studies of the track etching and patterning processes will be made. Nanoporous substrates (pores down to 10nm), polymeric and metallic nanowires and nanotubes in various forms (nano-objects), including particulate and embedded within coatings and self-supporting films, will be developed (UCL, Epigem, CNRS). Alternative route to nanoporous arrays will also be investigated by using AFM tip generation of pores (CNRS) in spin-coated films. The characterisation of the nano-objects will be performed and specific properties will be measured. It is intended to screen optical, magnetic and chemical properties. The response of magnetic metallic nanowire arrays to high frequency fields will be investigated (Thales, UCL), whilst CRF and Thales will explore the magnetic properties of the nano-structures. Spin dependent phenomena in magnetic nano-objects will be investigated by UCL and CNRS to explore ultimate limits of magnetoresistive effects and potential long- term applications to quantum computing. UNEW and Epigem will integrate nano-objects in microfluid nanosystems and measure biomedical properties. CRF and Durham will explore nano-objects in the form of light sources comprising light emitting polymer diodes (OLED). Confinement effects will be explored to identify benefits for the emission spectrum as well as the light extraction mechanism. ***Achievements:*** N/A ***General information:*** N/A	***Project Acronym:*** NANOTEMPLATES ***Project status:*** Execution ***Start date:*** 2004-09-01 ***End date:*** 2007-08-31 ***Duration:*** 36 months ***Project Reference:*** 505955 ***Project cost:*** 2408236 EURO ***Project Funding:*** 1500000 EURO ***Programme Acronym:*** FP6-NMP ***Programme type:*** Sixth Framework Programme ***Subprogramme Area:*** Expanding knowledge in size dependant phenomena. Engineering techniques for nanotubes and relative systems ***Contract type:*** Specific Targeted Innovation Project ***URL:*** N/A ***Subject index:*** Scientific Research, Industrial Manufacture ***Other Indexes:*** N/A ***Record control number:*** 74330 ***Quality validation date:*** 2007-06-11 ***Update Date:*** date de la dernière mise à jour
COORDINATOR:	**OTHER PARTICIPANTS:**
Organization name: Université Catholique de Louvain ***Contact person:*** Etienne FERAIN (Dr) ***Tel:*** +32-10473560 ***Fax:*** +32-10451593 ***E-mail:*** Contact ***URL:*** http://www.ucl.ac.be ***Address:*** Chemistry and physics of high polymers, 1 Place de l'Université, Louvain-la-Neuve, BELGIQUE-BELGIË ***Region:*** N/A ***Organization Type:*** N/A	***Organization name:*** THALES ***Contact person :*** NGUYEN VAN DAU Frédéric ***Tel:*** +33-0169339092 ***Fax:*** +33-0169330740 ***E-mail:*** Contact ***URL:*** http://www.thalesgroup.com ***Address:*** Thales Research & Technology France, 45, rue de Villiers, Neuilly-sur-Seine, FRANCE. ***Region:*** N/A ***Organization Type:*** Industry […]

Figure 1. Example of the description of a project in the database CORDIS: the project « Templates for engineered nano-objects for use in microwave, electronic devices and biomedical sensing application

Source: CORDIS, http://cordis.europa.eu/search/index.cfm?fuseaction=proj.simpledocumentlucene&HD_ID=7522684&CFID=2025173&CFTOKEN=76789124

Nanotechnology:	Nanotechnology
	Nanoscience
Biotechnology:	Biotechnology
	Genetic engineering
	Bioengineering
	Bioinformatics
Information technology:	Information technology
	Information systems
Cognitive science:	Cognitive science
	Cognitive neuroscience
	Neurosciences

Figure 2. Key words used to select projects dedicated to NBIC technologies

As a result, the NBIC-Euro database contains 3675 projects dedicated to NBIC. Then, a first result emerge: in twenty year of Framework Programs, the European Union funded much more projects belonging to biotechnology than projects belonging to others technologies forming the "convergent technologies". But over time, the share of projects belonging to biotechnologies tends to decrease while those of nanotechnology and cognitive science were increasing (figure 3).

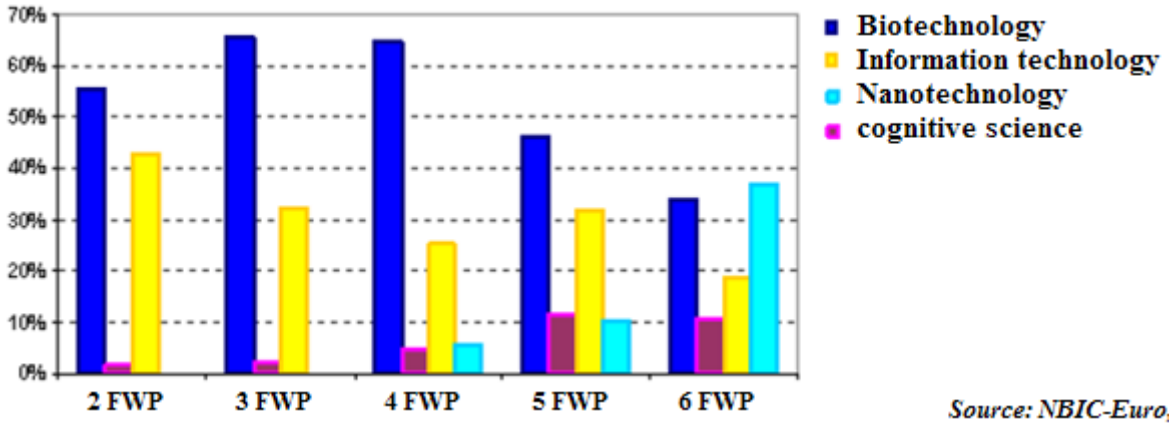


Figure 3. Evolution of the shares of the four main disciplines in NBIC projects (1986-2006)

As descriptors in our database, we collected the dates of beginning and end of each of the 3675 projects and also the name and objectives of the European programs they belong to.

We also made a typology of the European Framework Programs instruments or actions in order to classify NBIC projects. The point is to underline the type of scientific activities the consortiums do. Figure 4 shows that the NBIC-Euro database contains a large majority of collaborative research projects. This is a good point for our research because conducting a research supposes long term interactions between consortiums' partners and thus ensures technological spillovers between them. In the perspective of urban systems, these technological spillovers may strengthen the technological base of a city.

Activities	% of NBIC Projects (1986-2006)	Description
Produce, demonstrate and validate new knowledge	62	International collaborative research
Activities of research's coordination and support	18	Events (Conferences, meetings, workshops…)
Marie Curie Actions	14.5	Training, mobility, fellowship and reward
Not mentioned	5.5	-

Figure 4. Types of activities conducted in NBIC projects
Source: NBIC-Euro

About the consortiums' partners, we collected their names and location (complete postal address), and also the function they have in the projects (coordinators or participants). The partners are located in 9299 research centers. We define the legal status of the centers in two types: public or firms according to the typology of Melin B. et Esterle L. (2004)[11]. Figure 5 shows clearly that the participation of public research centers in NBIC projects is higher than the participation of firm research centers, and more over it tends to increase over time.

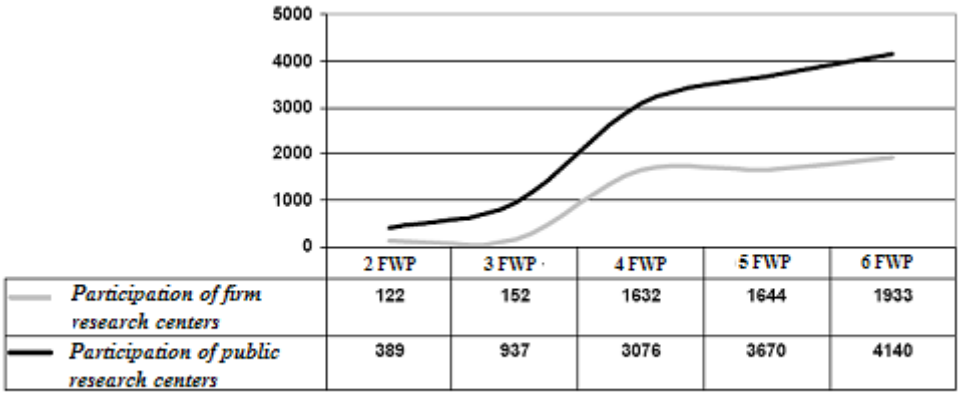


Figure 5. Evolution of public and firm research centres participation in NBIC projects (1986-2006)

2.2. Method for assigning projects to urban areas

For our research, we have defined cities as functional urban areas. Each institution appearing in the networks have been geographically localized and then aggregated to the urban area they belong to. More specifically, in Europe, there is no universal definition of FUAs. Generally, FUA is defined as a core municipality and its adjacent commuting areas

[11] Melin B. et Esterle L. 2004, Rapport d'analyse des participations françaises au cinquième Programme-Cadre pour la Recherche et le Développement Technologique en Europe (1999- 2002), Etude réalisée pour le ministère de l'Education nationale, de l'Enseignement supérieur et de la Recherche, Direction de la Technologie, Bureau des programmes communautaires de recherche. Décembre 2004, 19 p.

(ESPON 2007). At the moment, we did not select *a priori* a list of cities, but we have collected all names of the localities that were mentioned in the source data bases about financial or research networks. Then, we observe that even small towns and/or extra-European cities can have subsidiaries or research centers involved in the European networks. Consequently, we have developed two different methods to aggregate research centers to the FUAs they belong to: (i) First, we consider only FUAs defined by ESPON Project (1.1.1. and 1.4.3.) in order to build a data base that is comparable with other studies. It is a good method, but it means excluding a large part of smaller cities and/or extra-European cities involved in urban networks. (ii) Second, we have defined our own homogenous definition of FUAs in order to deal with all cities involved in research networks (even small and/or extra-European cities). To define our FUAs, we consider morphological urban areas (MUA) as the cores of FUAs (according to Géopolis database (Moriconi-Ebrard, 1994) completed and updated by the laboratory Géographie-cités, Paris, France) and then we aggregate the mentioned localities surrounding these cores. The aggregation of the fringe is made through thresholds of distance to MUAs centers because we don't have data allowing us measuring the travel-to-work areas for all European cities involved in the research networks. We can assert that the distance thresholds fixed here (figure 6) are deliberately very restrictive in order not to integrate localities that would be totally independent from the MUAs with which they could be connected, what constitutes the major risk of our aggregation method.

Number of inhabitants in MUA	**Thresholds of distance to MUA**
Between 10.000 and 50.000 inhabitants	30 km
Between 50.000 and 100.000 inhabitants	50 km
More than 100.000 inhabitants	70 km

Figure 6. Distance to MUA centers thresholds to define FUA

As a whole, the NBIC-Euro database includes FUAs with 10 000 inhabitants and more, only five of them (Suomussalmi, Argostoli, Horta, Kardla and Lerwick) have less than 10 000 inhabitants. The NBIC-Euro database contains 9299 research centers located in 799 functional urban areas distributed between 117 countries. Among all functional urban areas, 512 of them are located in UE 27 (figure 7)

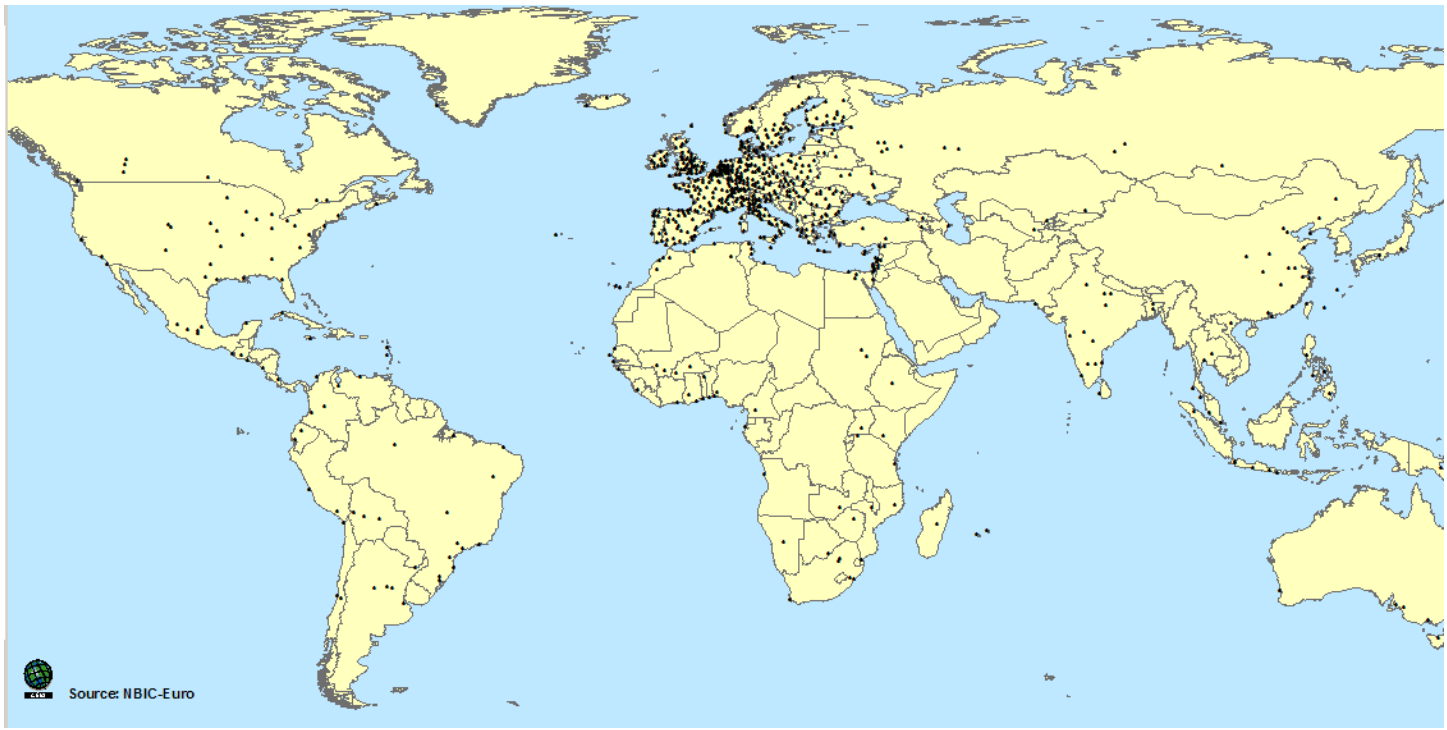


Figure7. Location of NBIC-Euro FUAs (1986-2006)

However, the distribution of functional urban areas in the European Union is highly contrasted. Indeed, they concentrate especially in the European megalopolis. Furthermore, the capital cities of European countries and more generally the large European metropolises are all involved in the research networks under study (figure 8).

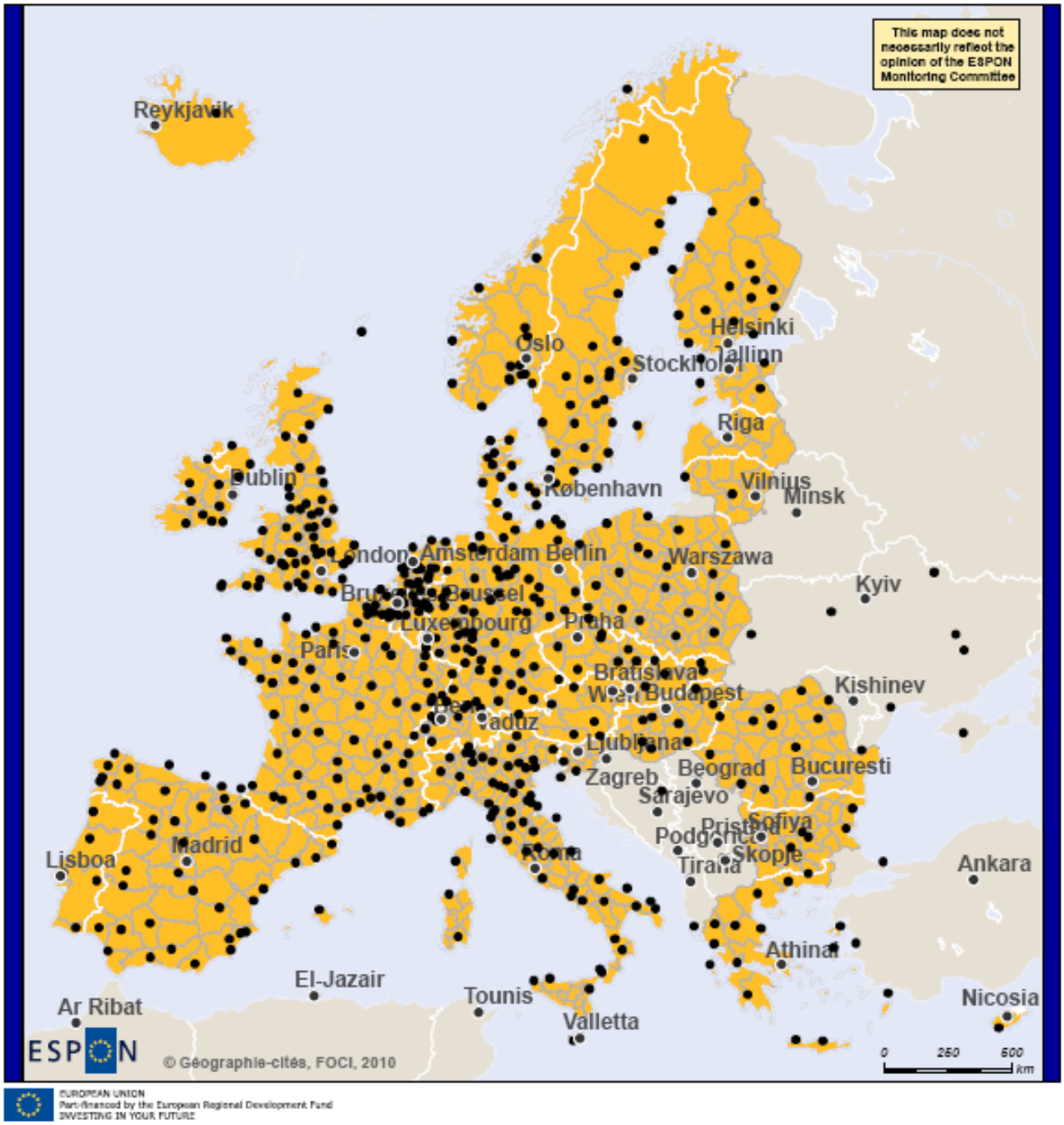


Figure 8. European FUAs involving in NBCI projects (1986-2006)

3. Measurement of the position of cities in innovative networks

3.1. State of the art

A graph is a symbolic representation of a network and of its connectivity. A graph G is a set of nodes (n) connected by edges (e). The construction of a graph depends on data and analyses. Graphs can be weighted or not, directed or undirected (Berge, 1958). Several indices and measures are used for measuring the relative importance of nodes within a graph. Each of them describes different aspects of the positions of a node within a graph. Here we propose a short presentation of the principal indices we will use table 1:

- It is possible to measure the attraction of some cities within a weighted directed graph by extracting all the strongest links for each pair of cities (Nystuen, Dacey, 1961). The more one or more cities attract the "**largest flows**" of each pair of cities, the more they **polarize** the graph.
- Two indices of centrality developed by L. C. Freeman (1977, 1979) can be used for describing the relative importance of cities within undirected graphs. (i) **Degree centrality** is defined as the number of links incident upon a node. It measures the relational activity of a city. (ii) **Betweenness centrality** measures the potential intermediary role of cities within a network: the more a node occurs on many shortest paths between other nodes within the graph, the higher is its betweenness centrality. While the Degree centrality measures the local centrality of a node compare to its direct neighbors in the graph, Betweenness Centrality evaluates global centralities according to the entire network. Both of them can take into account different weights of the links.
- Measures for weighted directed graphs enable to analyze the hierarchical relationships between connected cities. (i) The number of edges directed into a given node (or **indegree**) can be interpreted for networked cities as the extent to which a city is commanded by other cities (ii) Conversely **outdegree** (the number of edges directed out of a node) describes the degree of commandment activities on a given number of cities within networked cities. These two indices measure local centralities because they only take into account direct connections of each city. (iii) At this local scale, cities dependency is the balance between indegree and outdegree and reveals its specific relational role within the network.
- The variety or specialization of cities can be seen at least in two ways: (i) the **variety** of **geographical orientations** of cities connections (within or outside their country or Europe) evaluate their range and influence at different scales; the **variety of types of networks** (firms activities or research thematic) is a measure of their specialisation. In general, a higher variety means a positive structure of links leading to highest likelihood of innovation emergence and adaptive socio-economic structure. But also, cities will be compared regarding to their influence at each scale, which would be measured by the average distance between the city and its directly linked cities.

Type of graphs	**Measures**	**Description**
Undirected weighted graphs	Degree	the number of links incident upon a node
	Betweenness centrality	Sum of the occurrences of a node on shortest paths between other nodes in the graph
	polarization	Major flow
Directed weighted graphs	indegree or outdegree.	The number of edges directed into a node or the number of edges directed out of a node
	Dependency to another city	Highest indegree
	relational role	The difference between in and out degree of a given city, divided by the sum of in and out degree of this city
Directed and Undirected weighted graphs	variety/specialization	Specialized orientations of cities connections
	Scale specialization	Geographical scale orientations of cities connections (National, European, Worldwide).
	Interaction range and	Average distance between a

	Radiation	city and its connected cities for different scales or different specializations

Table 1. Principal relational indices qualifying cities situations within networks
These indicators enable us to examine the positioning of cities within the two types of economic networks under study (financial links in multinational firms networks, and specialized research networks for the next wave of innovative activities).

3.2. Measuring the position of European cities in the innovative networks[12]

It is self-evident that cities' position in the converging technologies research networks highlights the geographical structure of the European production of new knowledge facilitating economic competitiveness of cities in the actual "knowledge economy". The main features of the network are presented through the evolution of the values taken by the indices of connectivity (table 2). Undoubtedly, there is a general increase in the connectivity of the network, since the number of links was multiplied by a factor thirteen in twenty years while the number of nodes (i.e. cities involved in NBIC collaborative networks) increased only by a factor four. But the density of the network remained rather stable with a rather low value (only about 15% of all possible links are actual connections). This observation, combined with low values of the shortest path and diameter of the network, reveals a typical small-world structure of the network of co-participations (undirected weighted graph) as well as for the network where links measure the number of directed links between a coordinator and other participants (directed weighted graph)..

	Indices of connectivity	**2 FWP**	**3 FWP**	**4 FWP**	**5FWP**	**6 FWP**	**2 to 6 FWP**
Undirected weighted graph	Number of nodes (nodes=cities)	200	290	496	594	570	795
	Number of links (links = cities' co-participations)	2761	5986	10401	18988	25537	38074
	Density of the giant component (%)	14	14	9	11	16	12
	Diameter of the giant component	4	3	4	4	3	4
	Shortest path of the giant component	2	2	2	2	2	2
Directed weighted graph	Number of nodes (nodes=cities)	200	290	495	591	570	794
	Number of links (links = coordination)	743	1418	3443	4779	5240	11740
	Density giant component (%)	2	1,5	1,5	1,4	1,6	2
	Diameter of the giant component	5	5	6	5	5	5
	Shortest path of the giant component	2,4	2,3	2,3	2,2	2,1	2

Table 2. Indices of connectivity : a synthesis
Source : NBIC-Euro

[12] Here the results correspond to the undirect nework of cities.

3.2.1. Large cities are the hubs of the network

In graph theory, the degree (k) of a vertex (or node) is the number of its connections with other vertices. All cities (or vertices) in the graph have not the same degree. The more a city collaborates with others, the higher is its degree (direct links).

The average degree is 73 which mean that in average a city collaborate directly with 73 other cities. This result confirms that the connectedness of the graph is rather high and underlines the interdependences of cities in scientific and technological research. Nonetheless, the median degree is 24 (50% of cities collaborate with less than 24 other cities and 50% collaborate with more than 24 cities) and the dispersion (measured by STD) is rather large 112.

This large dispersion throw interest on studying which type of cities has high degrees and which type of cities has low ones. In order to study the relational role of the network of cities co-participations in NBIC projects we first computed the Degree Centrality.

On figure 9 the best connected cities or the cities with highest degrees appears to be the large cities (among the 20 first highest degrees, 14 are state capital cities with more than 1.000.000 inhabitants). Paris has the maximal degree with 760 and London has the second highest degree (674), and then Madrid (668), Athens (653), Helsinki (624) and Copenhagen (611). Among the 50% of cities which collaborate with less than 24 other cities there are only four cities which have more than 500.000 inhabitants (in Ukraine). This can be explained by the geographical situation of these cities on the margins of Europe. 88% of the other cities with a Degree centrality below the median have less than 100.000 inhabitants. Note that there are 31 cities which are not connected to others (they are excluded from the giant component), these cities are small cities: two thirds of them have less than 25.000 inhabitants.

As a whole, we can summarize these results by the synthetic index of Bravais-Pearson correlation coefficient between the number of participations of cities and their population, which is very high (0.79). Although not surprising, this result is a confirmation of the geographical urban theory, according to which "city size" has a very broad meaning, representing and summarizing a full variety of indicators about the number, variety, and complexity of urban functions. These indicators of "stocks", represent accumulation over time of flow values that are produced through a variety of relationships within networks, thus the degree of centrality of cities within these network is in accordance with the importance of their position in an urban hierarchy of sizes. We insist that it was not obvious before analyzing the data that the city rankings within networks of specialized research in NBIC should follow that hierarchical principle. The result is a confirmation of another theory about innovation in urban systems, according to which large cities are more liable to capture innovation in its first stage.

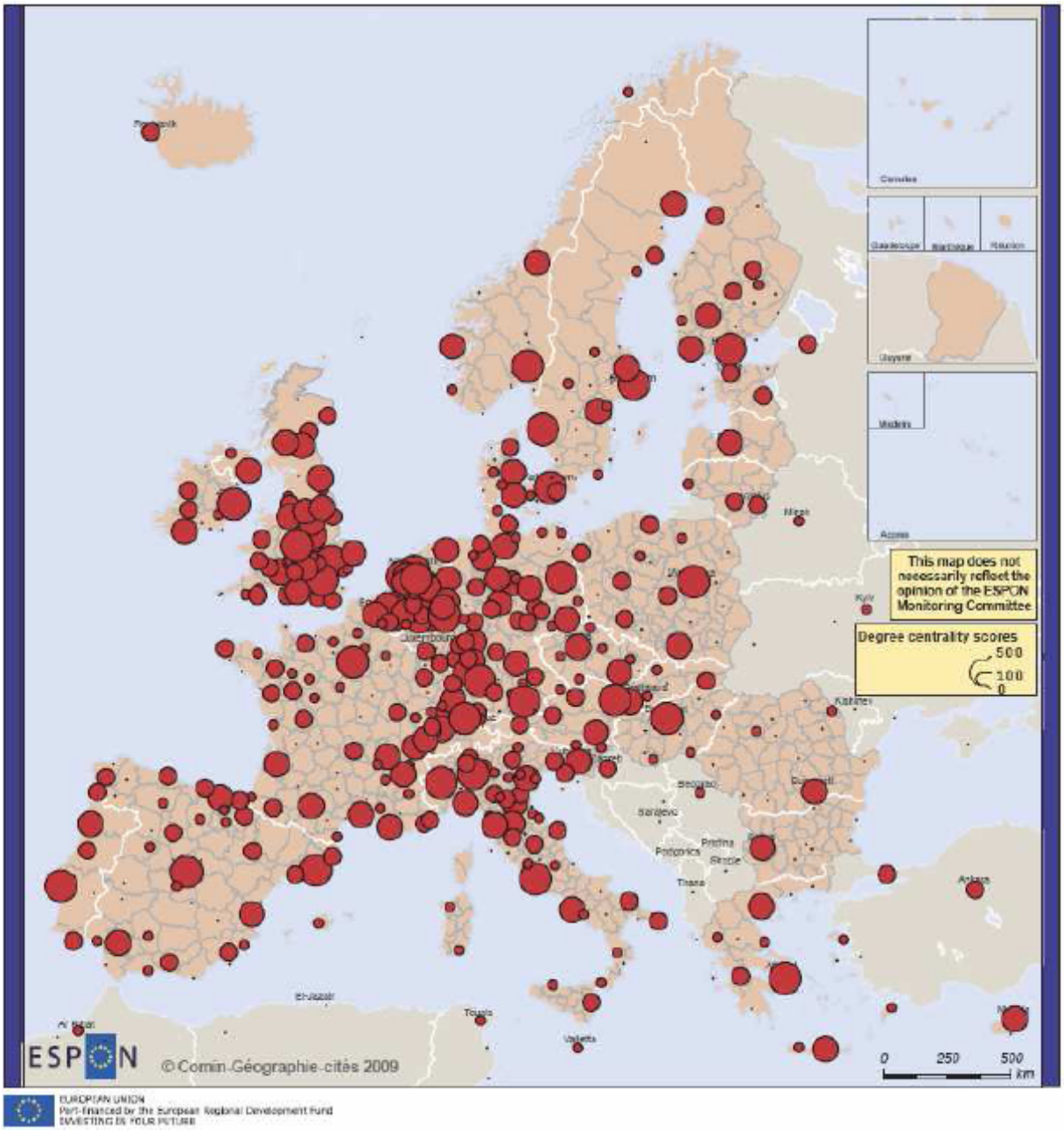


Figure 9. Participation of European cities to the research networkds about NBIC (Degree Centrality, 1986-2006)

Notes: calculated with Pajek software. Network construction: scientific and technological collaborative links between FUAs. NBIC technologies projects. Data come from the EC database CORDIS RTD-PROJECTS drawn from all Framework Programmes for Research and Technological development, from 1986 until 2006. Undirected and unweighted graph. Source: NBIC-Euro database

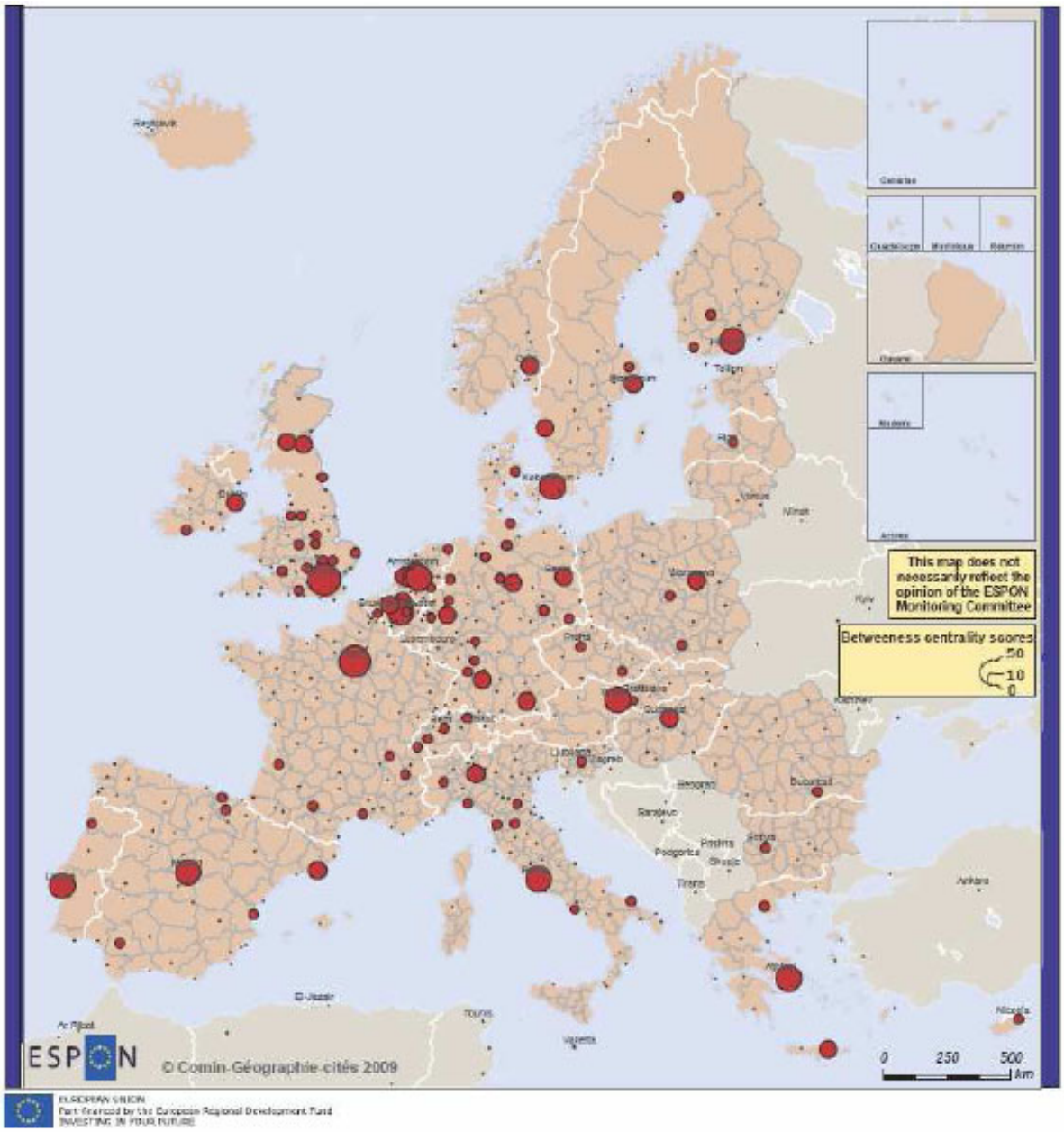


Figure 10. European cities centrality within scientific and technological networkds dedicated to NBIC (Betweenness Centrality, 1986-2006)

Notes: betweenness centrality measures the potential intermediary role of cities within a network: the more a node occurs on many shortest paths between other nodes within the graph, the higher is its betweenness centrality. Here, betweenness centrality (X 1000) calculated with Pajek software. Source: NBIC-Euro database

Another measure of centrality within networks gives even a sharper view of the very prominent role of large cities regarding the adoption of technological innovations. While the degree measures a centrality locally, the index called "Betweenness Centrality" gives a more global view of the role of cities within the whole research network. It measures the total number of shortest paths between pairs of cities that pass through a given city. It measures the centrality or the influence of a vertex in a graph: a city is more central or has more influence if it is a link in many collaboration chains between other cities in the network.

Beetweeness Centrality indicator clearly identifies a subset of major urban actors in innovative research networks on NBIC. Figure 10 shows that Paris and London, and more generally European national capital cities have strategic positions within scientific networks dedicated to NBIC, which can be interpreted as their potential capacity to control the circulation of knowledge spillovers that flow between European cities.

Bravais-Pearson correlation coefficient between Degree distribution and Betweenness centrality is high (0.72). A closer analysis of the results reveals that the high value of the Bravais-Pearson correlation coefficient is more due to cities belonging at the top of the urban hierarchy (larger cities) than to the cities belonging at the bottom of the urban hierarchy (small cities). Even if small towns can succeed in getting a sufficient number of participations, they fail to enter the restricted club of highly controlling urban positions within the innovation networks. Indeed, Betweenness Centrality highest scores do rank cities in the same order as the Degree Centrality index for the twenty first cities.

The evolution of these relative positions in the network brings information about the trend in cities competitiveness for innovative activities. Table 3 shows the evolution of the distribution of the centrality indices. The Bravais-Pearson correlation coefficients are all high, and then we can conclude that there is a significant stability of the ranking of central cities (in terms of Degree or Betweenness centrality) during the course of the successive Framework Programmes.

Degree centrality					
	FWP 2	**FWP 3**	**FWP 4**	**FWP 5**	**FWP 6**
FWP 2	1	0,86	0,85	0,77	0,72
FWP 3	0,86	1	0,89	0,81	0,78
FWP 4	0,85	0,89	1	0,89	0,86
FWP 5	0,77	0,81	0,89	1	0,91
FWP 6	0,72	0,78	0,86	0,91	1

Betweenness centrality					
	FWP 2	**FWP 3**	**FWP 4**	**FWP 5**	**FWP 6**
FWP 2	1	0,83	0,89	0,78	0,78
FWP 3	0,83	1	0,83	0,79	0,74
FWP 4	0,89	0,83	1	0,87	0,88
FWP 5	0,78	0,79	0,87	1	0,89
FWP 6	0,78	0,74	0,88	0,89	1

Values are significantly different from 0 and they have a signification superior alpha=0,05

Table 3. Evolution of correlation between centrality measures (Bravais-Pearson coefficients)
Source : NBIC-Euro

A last useful mention is that the observed graph is much more centralized than a random network which would be constructed with the same number of edges, the same number of nodes and the same mean degree than the network of cities co-participations in NBIC projects (table 4). This information is crucial here, because the more a graph is centralized, the higher the central nodes are needed to maintain the connectivity of the graph. For our network, it means that central cities are hubs in the network and that they are crucial to link European cities together.

	Network of cities co-participations in NBIC projects		Random graph	
	Degree centrality	**Betweennes s centrality**	**Degree centrality**	**Betweenness centrality**
FWP 2	0,62	0,13	0,03	0,008
FWP 3	0,59	0,12	0,03	0,004
FWP 4	0,53	0,09	0,02	0,003
FWP 5	0,51	0,05	0,02	0,001
FWP 6	0,60	0,05	0,025	0,001
FWP 2 to FWP 6	0,58	0,05	0,02	0,0009

Table 4. The centralized structure of the graphs (2-6 PCRD)

Note : Random network made with Pajek: in the basis of the same number of edges, the same number of nodes and the same mean degree than network of cities co-participations in NBIC projects

These results so far show that the centrality in the undirected network dedicated to NBIC projects is organized in a hierarchical structure in accordance with cities population. Moreover, the network of cities specialized in scientific and technological activities are characterized by their interdependence, whatever their size. Thus the network mainly connect (i) large cities which concentrate the infrastructures traditionally facilitating material and immaterial flows and which are inserted in world networks of information; these cities are hubs in the network. (ii) and specialized cities which are characterized by their capacities of creation or training (innovative milieux, technopoles…). These cities can be more or less central in the graph, but they are certainly the ones which adapt very quickly their knowledge bases in order to keep their position in the network or to reach a better one.

Then these results raise the following question: are small and medium cities developing strategic positions in the network in order to compensate their weak centrality? We shall try to answer this question below.

3.2.2. Strategic positions of medium and small cities in order to capture original knowledge spillovers.[13]

Results so far have underlined the crucial role of large cities as hubs of the network. But does that mean that medium and small cities do not plenty benefit from their integration to NBIC European collaborative projects? Here we show that belonging to the periphery of the network can provide some advantages.

Following the works of H. White[14] and M. Granovetter[15], R. S. Burt (1992)[16] analyzed the structure of networks and more precisely the zones of networks that have only few links: the *structural holes.* He developed the concept of *structural autonomy* of nodes in networks, as being the ideal position of a node for having original information and

[13] Here we use weighted oriented graphs

[14] White, H. C., 1981. - "Production market as induced role structures", in S. Leinhardt, Ed.- Sociological methodology. - San Francisco: Jossey Bass Publishers. - 1-57.

[15] Granovetter, M.S., 1982. - The strength of weak ties : a network theory revisited, in Mardsen, P. V. et Lin, N., Ed. - Social structure and network analysis. - Beverly Hills: Sage.

[16] Burt, R., 1992. - Structural holes : the social structure of competition.- Cambridge: Harvard university press.

opportunities before the other nodes of the network. This position requires being located in a *structural hole*, i.e. to be a bridge between contacts that are not connected together. The more a node is connected to other nodes which are not connected together, the higher is its *structural autonomy* (under the condition that non-redundant nodes are, besides, well connected to the network)

Then, from this concept we identify the European cities which are positioned in structural holes. The hypothesis here is that cities do not create relationships at random, but try to organize strategically their relationships (or links of co-participations of NBIC projects) to optimize their position in the network of the scientific co-participations. This hypothesis implies that even if observing NBIC-Euro aggregated data at city level, we can detect the strategies of the individual and collective actors who compose the scientific environment of a city (D. PUMAIN 1998). The structural position of cities within the research networks as measured on a collective entity can receive this kind of interpretation, without the risk of "ecological fallacy", because the "behaviour" behind participating in research consortia is necessarily proactive, there is a very high probability that the collective behaviour here directly reflects the simple aggregation of individual or institutional initiatives. Especially, the orientations of the local governance may be granted for a responsibility when a town succeeds in getting a broader autonomy in networks than it would be expected according to its size.

Then this concept of *structural autonomy* seems to be relevant for studying innovative networks for distinguishing cities which develop a strategy to obtain this intermediary role, via weak links, in order to be able to capture information and opportunities of innovations and to have the control to diffuse them to the other nodes of the network.

Then we try to answer the following question: do weakly connected cities (or not central cities) position themselves in *structural holes*?

To calculate the degree of *structural autonomy* of a given node, we used the index of *dyadic constraint* (R. S. BURT, 1992). *Dyadic constraint* examines the advantage or disadvantage of the position of each city in their neighborhoods for the presence of structural holes. This index constitutes a measure of the pressure which a node i can exercise on a node j. The degree of constraint on a city is conversely proportional to its autonomy: the stronger is the constraint, the less numerous are the opportunities of alternative solutions in terms of contacts in the network, and the lower the city's autonomy is. Thus the *dyadic constraint* of a city is measured as a function of the relative weights of links between the cities compared to all connections among the cities.

The index of *dyadic constraint* between two cities i and j (Cij) varies from 0 to 1. The higher this value, the lower is the *structural autonomy* of the city:

$$c_{ij} = \left(p_{ij} + \sum_{k,k\neq i,k\neq j} p_{ik}p_{kj}\right)^2$$

Where :

pij = the number of direct connections between cities i and j :

$$p_{ij} = \frac{a_{ij} + a_{ji}}{\sum_k (a_{ik} + a_{ki})}$$

aij : value of edge (i,j)
aji : value of edge (j,i)
aik : value of out-degree of i
aki : value of in-degree of i

$\sum_{k,k\neq i,k\neq j} p_{ik}p_{kj}$ *: the measure of undirect connections between cities i and j* :

k : vertex directly connected to i

From this measure we calculate the *aggregate dyadic constraint* of a city I (Ci) which is the sum of the *dyadic constraints* across all adjacencies.

$C_i = \sum_j c_{ij}$

Low aggregate dyadic constraint is hypothesized to be associated with high structural autonomy, and high aggregate dyadic constraint is hypothesized to be associated with low structural autonomy. Unconnected cities have a structural autonomy =1

Figure 11 represents the *structural autonomy* of European cities displaying a different order than the usual hierarchical structure in the network. This turnover is described by table 5 which shows the 26th first cities with the higher *structural autonomy.*

With the exception of Paris (which has the higher *structural autonomy*) the 8 first cities are all medium size, under 1.000.000 inhabitants. Moreover the largest European metropolises have low ranks as London at rank 25th, or Vienna, Copenhagen and Athens respectively at 12th, 13th and 24th ranks. Other medium size European cities as Leipzig, Tampere, Torbay, Poznan, Mainz, and Saarbrucken rank high in the hierarchy of structural autonomy.

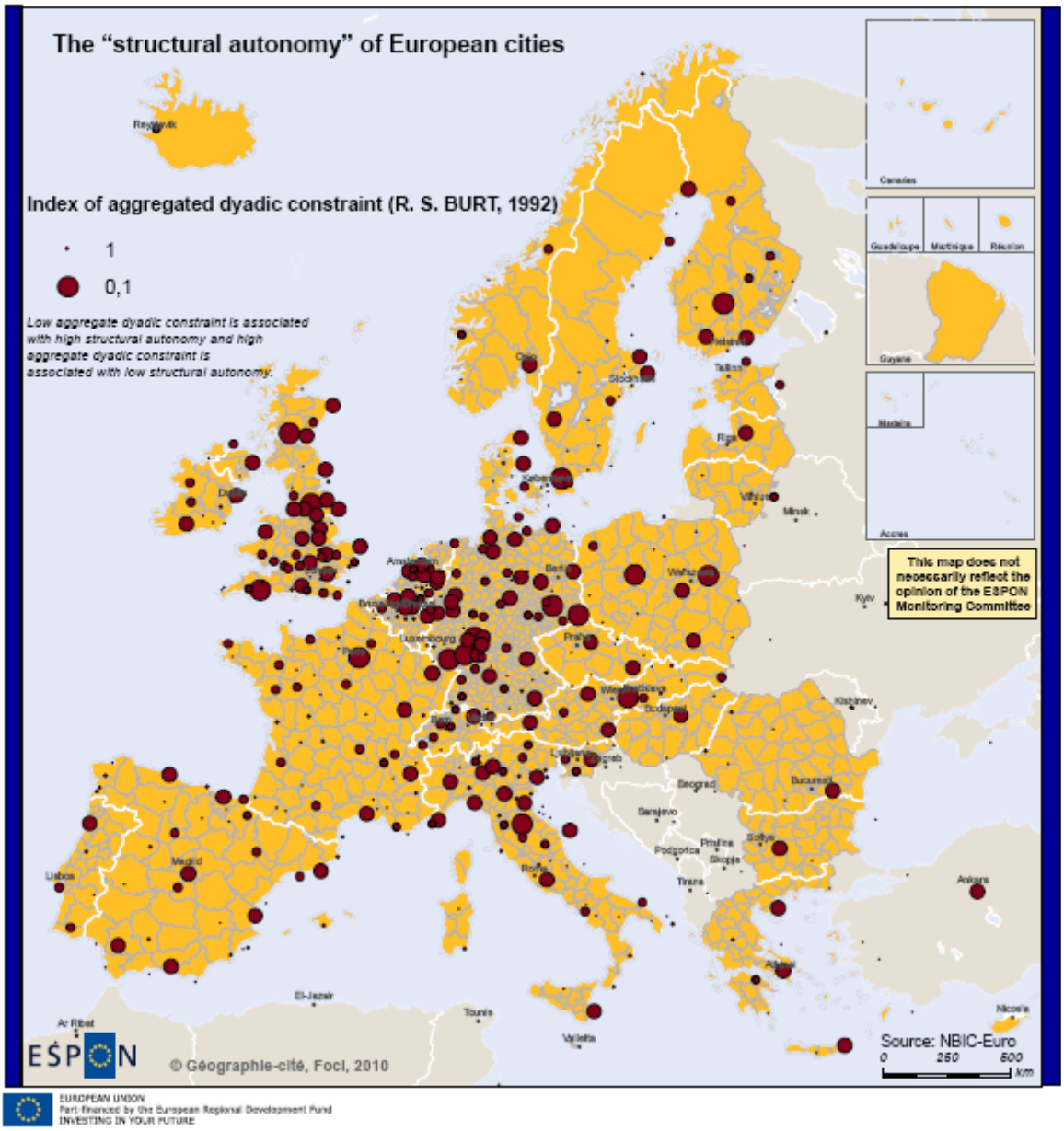


Figure 11. The structural autonomy of European cities

Rank	Cities	Population	structural autonomy (x 1000)
1	Paris	9849666	37,93
2	Leipzig	577700	41,25
3	Tampere	214000	42,43
4	Torbay	94000	42,56
5	Poznan	631000	42,88
6	Mainz	477000	43,31
7	Florence	898303	43,76
8	Saarbrucken	360487	44,37
9	Warsaw	2083000	44,65
10	Glasgow	1067000	44,67
11	Kaisers-lautern	98000	44,79
12	Vienna	1868850	45,10
13	Copenhagen	1337000	45,67

Rank	cities	Population	structural autonomy (x 1000)
14	Dresden	714360	46,44
15	Leeds	1468000	46,48
16	Utrecht	532821	46,52
17	Munster	267000	46,86
18	Goteborg	457000	47,10
19	Sheffield	635000	47,17
20	Innsbruck	176382	47,39
21	Nijmegen	211924	47,46
22	Aberysthwyth	10000	47,56
23	Dijon	240414	47,77
24	Athens	3027000	48,08
25	London	7689000	48,24
26	Manchester	2341000	49

Table 5. The 26 first cities with the highest structural autonomy

Notes : S A = structural autonomy measured by the aggregate dyadic constraint (x 1000).
Weighted direct graph of cities co-participations in NBIC projects (2-6 FWP)
Source : NBIC-Euro

We can thus suppose that the high *structural autonomy* of these cities can be explained by strategic position in the network. But what kind of strategy is used? As an example, in order to (partially) answer this question, we analyze the city of Poznan (Poland) which receives the 5th rank in our classification.

Poznan is the second financial center of Poland and since 1995 it has one of the biggest science and technological park of the country, in particular for information technologies and chemistry: the presence of the university of technology of Poznan and the university Adam Mickiewicz who supply at the same time research, innovation and training of researchers and engineers are takings advantage by innovative firms, and particularly Microsoft which developed locally partnerships with Intel (for the equipment) and Supercomputing and Networking Center (specialized in information technologies).

Furthermore, the European scientific policies strengthened the international visibility of Poznan science park (and probably its capacity to be well positioned in the network created by Frameworks programs) by implanting an European Innovation Relay Centre which has for main activities to assist companies in finding partners whatever type of partnership (SME as well as universities and (public or private) research laboratories) technology transfer, the exploitation of the results of technological research and\or finding information relative to the European financing (Polish Information and Foreign Investment Agency, http: // www.paiz.gov.pl)

Thus, from this example, we can demonstrate that cities with high *structural autonomy* present some advantages for attracting non-redundant contacts to capture original knowledge through the network. This confirms our hypothesis according to which some cities in the periphery of the network develop strategies to be advantageous positioned in NBIC co-participation networks. As a result, it seems to be relevant to take into account these cities in the analysis of the driving forces of European urban development.

Another factor is critical to understand future urban evolutions: it is the specialization of cities in converging technologies.

4. Measuring cities specialization in converging technologies

The formation of urban specializations is a second process that introduces positive anomalies within the hierarchical diffusion of the co-participation that we revealed by centrality measurements. How can we reveal urban specializations in converging technologies? Do the European cities exhibit specific technological profiles? To answer these questions, we analyze the scientific orientation of the European cities within their participations in NBIC research projects. First, we examine the specialization of cities in converging technologies through a comparison with their population size. Second, we analyze the specialization of cities according to the level of their participation in each technology belonging to converging technologies (nanotechnology, biotechnology, information technology and cognitive science)

4.1. The specialization of cities in converging technologies compared to their population size

Although there is a slight indication of non linearity in the relationship between population size and the number of participation in dedicated consortiums, we measure here in a classic way the intensity of specialization according to an hypothesis of simple proportionality to the population. The number of participations of each city in NBIC research projects (1986-2006) (i.e. the degree identified above as a measure of centrality in the network) was divided by their population, allowing observing the scientific activity of cities without size effect. Of course the city size has to be considered again as a proxy to its importance as a whole, its advantage is to be identically defined for all locations and to represent a potential benchmark for assessing the relative importance of any kind of urban activity. This measure provides an index of the level of specialization of the city in R&D on converging technologies.

The map (figure 12) emphasizes the major role of university centers in the formation of clusters that are highly specialized in converging technologies. This first insight is confirmed by the table 6 ranking the 10 most specialized cities. These ten cities are university cities, thus it seems to indicate that the presence of a university in cities constitutes one of the main explanatory factors of the specialization of cities in research about converging technologies within the framework of the PCRD. Furthermore, this figure allows distinguishing two types of specialized cities:

- Small cities having few participations in the NBIC research projects such as Aberystwyth (23 participations in NBIC projects) where is located the university of Wales and Valetta (14 participations), capital city of Malta where is located the national University. These figures may be "accidental" when considering the numbers of participations of other cities considered as specialized, that are about ten times higher.
- Medium size cities renowned for their universities and hosting significant industrial and scientific districts. These cities have an important number of participations (Cambridge, Louvain, Heidelberg, Oxford, Uppsala) and can be considered as "centers of excellence" which can compete with most large European cities.

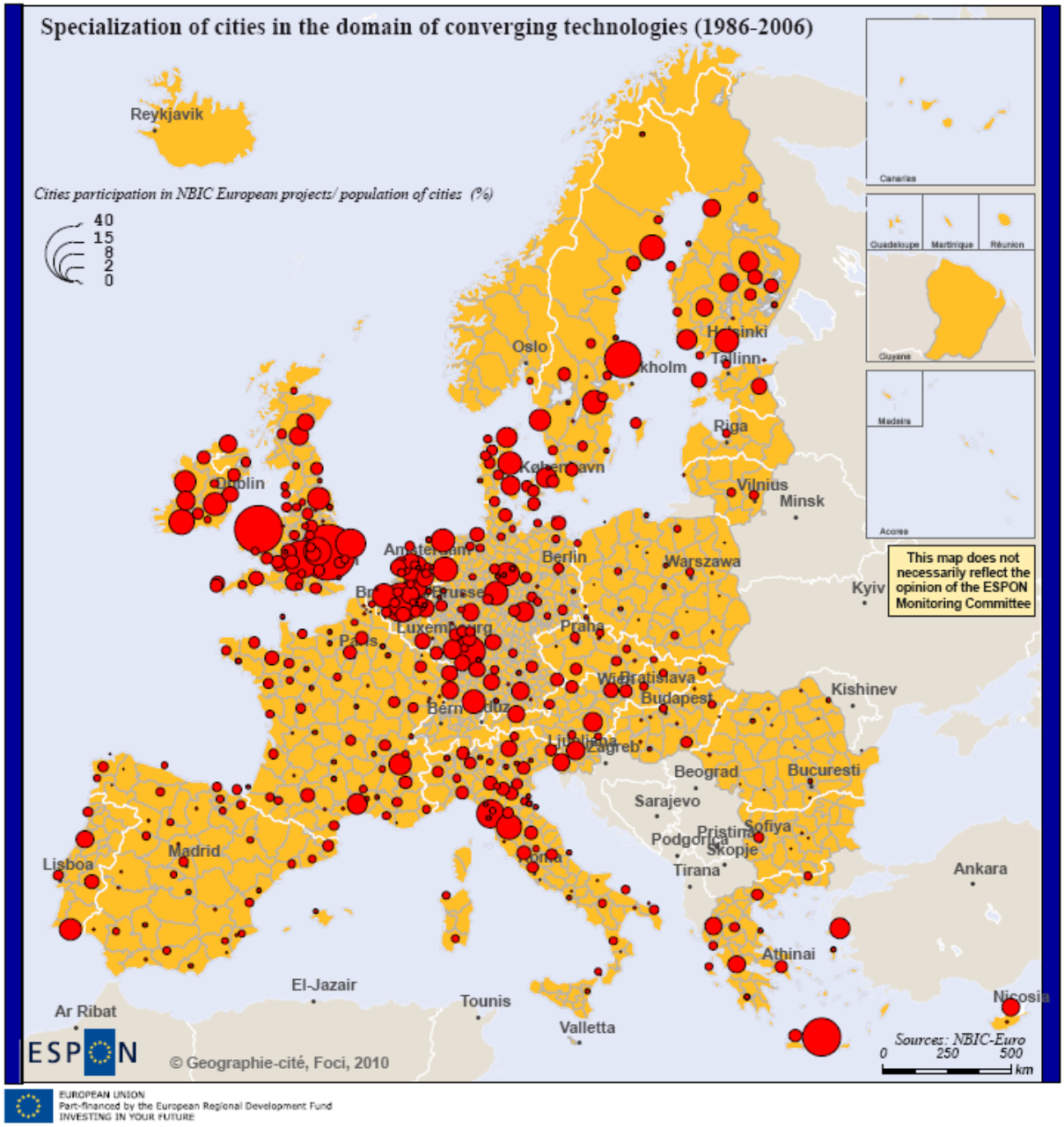


Figure 12. Specialization level of European cities in converging technologies

Cities	inhabitants	Number of Participation in Biotech	Number of Participation in Nanotech	Number of Participation in cogno	Number of Participation in Info techno	Sum of participations	Number of participation /1000 inhabitants
Lulea	43000	92	32	16	33	173	4,02
Cambridge	102000	156	70	45	45	316	3,10
Aberystwyth	10000	17	0	1	5	23	2,30
Valetta	6500	2	1	1	10	14	2,15
Heraclius	111000	125	19	5	25	174	1,57
Louvain	145000	92	55	16	57	220	1,52
Uppsala	102000	89	15	25	20	149	1,46
Oxford	114000	103	26	18	13	160	1,40
Heidelberg	200000	134	11	33	14	191	0,96

Table 6. The 10 most specialized cities in converging technologies (1986-2006)
Source : NBIC-Euro

Where are located the very specialized cities (or in other words the European centers of excellence) in NBIC? From figure 17, we can see that the most dynamic cities are especially located in the North of Europe, in particular in the **Scandinavian countries** (*for Sweden : Lulea, Uppsala, Umea, Linkoping, Göteborg, and at a lower level Stockholm ; for Denmark : Arhus, and at lower level Copenhagen, Alborg, Odense ; for Finland : Helsinki and at lower levels Kuopio, Turku, Jyvaskyla, Oulu, Tampere)*. In the **United-Kingdom** *(Cambridge, Aberystwyth, Oxford, Norwich, Bedford and at lower levels: York, Edinburgh, Aberdeen, Dundee, Southampton, Cheltenham)* ; in **Benelux** (*for Belgium : Leuven, Gent and at lower level Mol ; for the Netherlands : Utrecht, Enschede-Hengelo, Groningen, and at lower levels Leiden, Eindhoven, Nijmegen, Amsterdam, The Hague*) ; in **Germany** *(Heidelberg, Brunswick, Constance, Göttingen, and at lower levels : Jena, Kaiserslautern, Freiburg, Munich, Marburg, Aachen, Innsbruck, Wurzburg, Karlsruhe, Stuttgart*) and in **Ireland** *(Cork, Carlow, Galway and at lower levels Limerick, Londonderry, Dublin).*

in **France**, Grenoble is highly specialized and at a lower level Montpellier and the conurbation of Genève-Annemasse. In **Austria**, Graz is the most specialized city. In the **South of Europe**, specialized cities are located in **Italy** *(Pisa, Sienna et Trieste, Portoferraio et Trento)* and in **Greece** *(Heraclius, Mytilena, Ioannina, Patras*. In the **Eastern Europe countries**, only Tartu, Kardla (Estonia) and Ljubljana (Slovenia) distinguish themselves from the other cities by their performance, whereas in the majority of the Eastern Europe countries and in Spain, no city appears as specialized.

So even if cities involved in NBIC projects are disseminated all over Europe, few of them have a strong dynamism (or a strong specialization) in the research about converging technologies. These cities are in majority the most active university centers and large cities.

These results thus tend to show that cities participation to the projects dedicated to converging technologies tends to strengthen the position of the existing European

scientific "centers of excellence" and thus to strengthen their dynamism and their attractiveness.

These results are not surprising because economic studies agree about the fact that "knowledge infrastructures " as universities, research institutes and science parks are the main factors to attract the most innovative research. Of course the existence of such infrastructure is not per se an explanation of the successful positions in research specialization. Behind any distinctive urban achievement, there are always feedback effects between the initiatives and strategies of many actors and their concretization into institutions. In other words, it may not be sufficient to declare a technological park for creating a specialization in NBIC in any local spot, but once a given amount of initiatives have emerged locally it is very likely that this kind of infrastructure will help any further development. The cities that were quoted here have all the infrastructure, but of course there are many other towns owning a technopark that do not emerge here among the specialized cities. The same could be said about the other factors involved in the literature, as the skills of the population, the financial system, the networks of exchange in regions and the networks of institutions which intervene in the innovation process.

Figure 12 represents a general level of specialization in NBIC technologies, without identifying what kind of activities are responsible for this. In order to differentiate cities according to their specialization, we examine the specialization of cities in each technology constituting converging technologies, i.e.: nanotechnology, biotechnology, information technology and cognitive science.

4.2. The specialization of cities by technology

A first important result of this study is that the majority of cities participated in projects dedicated to the four technologies altogether. This is in agreement with the process of technological convergence, but it is remarkable to observe it at the level of all urban locations: the researches in the four kinds of technologies appear together everywhere. Among the 116 cities having more than 50 participations, Bergen in Norway and Norwich are the only exceptions by missing any participation in projects dedicated to nanotechnologies.

We used multivariate analysis to identify the main technological orientation of these 116 European cities that have more than 50 participations (1986-2006). We choose the method of hierarchical cluster analysis (HCA) on the numbers of participations of each city in the four technologies, using a Chi square distance for a direct comparison of the city profiles. This analysis put forward which cities have a higher share of their participations in some of the four technologies, compared to the average repartition in all cities.

On figure 13 cities are represented according to their presence in 5 groups that belong to two higher classes separated mainly by the preferential orientation towards information technologies and to a lesser degree towards the biotechnologies and the cognitive sciences

In each of these large classes, there is one profile representative of cities with a high diversity of technologies. These two groups concentrate the cities we have identified as being the most specialized or dynamic within the network. The large diversification of their profiles illustrates that the movement of technological convergence has emerged at first in these dynamic cities, according to a hierarchical process. All cities belonging to these two groups are relatively concentrated on the North of Europe.

- The first profile (pink disks on the map), entitled "Very diversified participations, with a slight weakness in the cognitive sciences", corresponds to cities that are very dynamic for three technologies with a slight preference for information technologies and

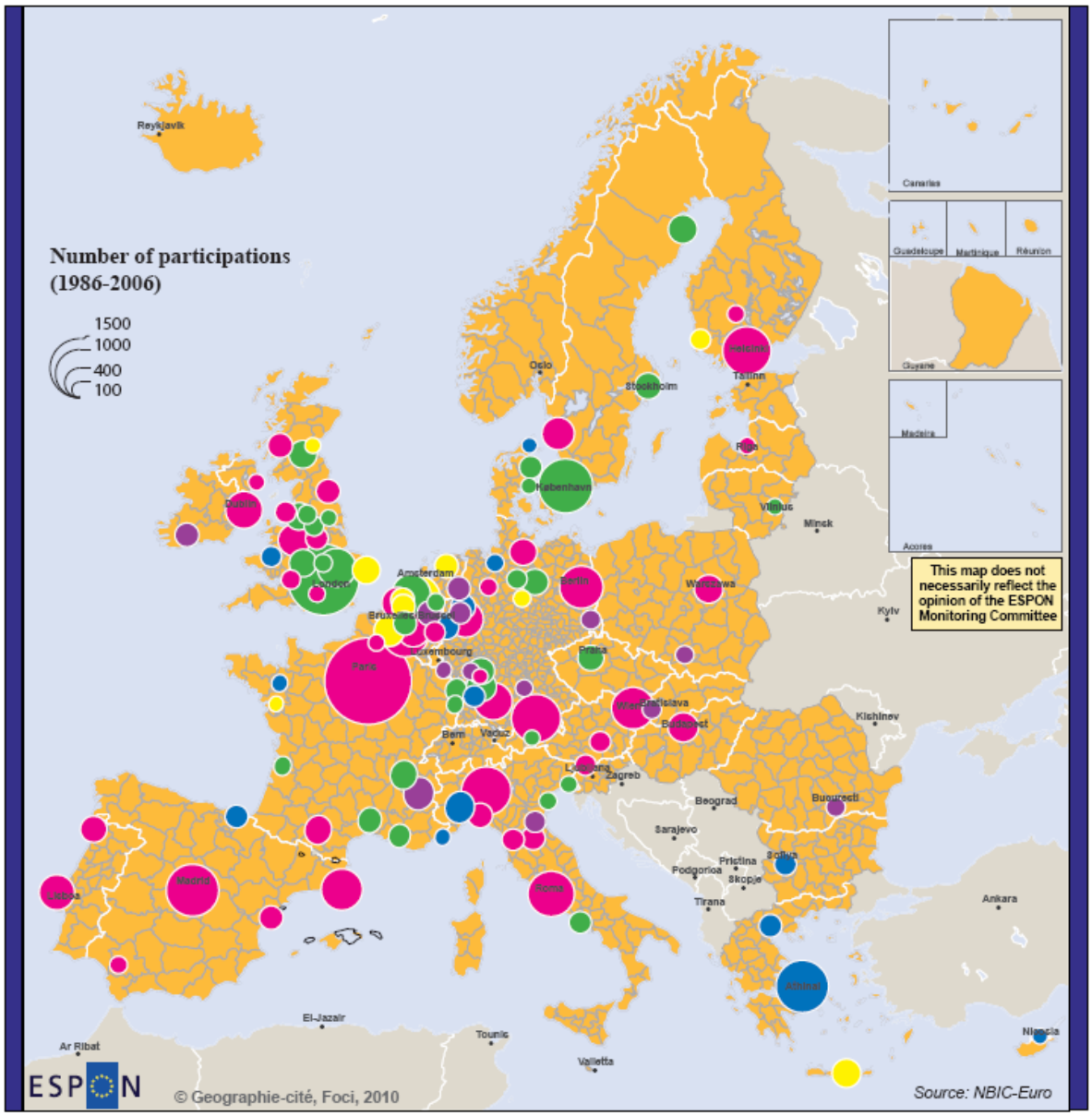
nanotechnologies. This profile includes 43 cities that have common characteristics: they are (i) State capitals (13 cities): Paris, Madrid, Helsinki, Brussels, Rome, Berlin, Vienna, Dublin, Lisbon, Budapest, Warsaw, Ljubljana, Oslo and Riga. (ii) Large metropolises such as Milan, Munich, Barcelona, Stuttgart, Göteborg, The Hague. The only exceptions are European scientific poles: Leuven, Lausanne, Pisa, Darmstadt and major scientific poles, Bielefeld with its university and a technological park, Tampere with its university of technology (Nokia owns a research center there), and Brighton that is endowed with two universities, and a big business innovation centre.

- The second profile (in green on the map) entitled "Very diversified participations, with a slight weakness in the information technologies" concerns cities that are dynamic in three technologies (and in particular the biotechnologies and the cognitive sciences), but a little weak in the information technologies. This profile corresponds to 34 cities which are also large cities (State capitals: London, Copenhagen, Stockholm, Amsterdam, Prague and Vilnius; and large metropolises such as Lyon, Manchester and Antwerp) as well as European major scientific poles, among which the most important: Cambridge, Oxford, Heidelberg and Lulea, or of more modest scientific importance such as Marseille, Odense, Innsbruck or Padua.

Next to these technological diversified profiles, three other profiles are more specialized. Cities belonging to these specialized types have research infrastructures that are dedicated to the technologies in which they specialize. These infrastructures have a real influence over their technological orientation:
- 14 cities (blue disks) specialized in the information technologies ("Participations preferentially dedicated to information technologies") are generally localized in the South of Europe. They are (i) three State capitals (Athens, Sofia and Nicosia); (ii) industrial cities which have universities of technology and more or less renowned research centers (Essen, Bremen, Trondheim and Alborg); (iii) and cities having technological poles dedicated to information technologies: Bristol, Aachen and Karlsruhe, Nice (Sophia Antipolis), Rennes (high-tech city (science park) Rennes Atalante), Turin, Salonique, Bilbao (technological Park of Biscaye).

- 12 cities (yellow disks) are specialized in the domain of biotechnology. These cities are especially located in the North of Europe, in particular in the Benelux. They appear to be university towns: Utrecht, Heraklion, Groningen, Rotterdam, Turku, Göttingen. Some other cities have a park of activity dedicated to the biotechnologies: Ghent, Norwich, Leiden (Bio Science Park), Aberdeen (Aberdeen Science and Technology Park), Dundee, Nantes (Atlanpole).

- 13 cities (purple disks) are specialized in nanotechnologies. They are on the whole located in the European megalopolis. This profile includes two capitals of the Eastern European countries: Bucharest and Bratislava. The other specialized cities have (i) technological parks in the domain of nanotechnology (Grenoble (Minatec), Eindhoven (Campus High Tech), Dresden, Cork, Enschede-Hengelo, and Bologna); (ii) universities or research centers with lead researchers in this scientific domain: Düsseldorf, Mainz, Nuremberg and Sarrebruck.



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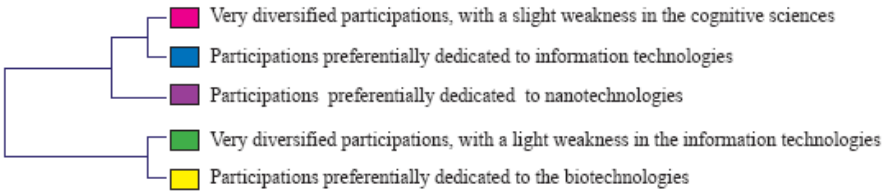
The technological orientation of the European cities

Set of 116 cities cities with more than 50 participations (1986-2006)
Method of the hierarchical ascending classification (HAC), chi² distance, Ward method



Average participations of the cities (%)

	Biotechnology	Nanotechnology	Cognitive sciences	Information technology
	44	16	7	33
	31	14	5	50
	32	35	4	29
	56	14	10	20
	76	7	5	12

Figure 13. The technological orientation of European cities (1986-2006)

5 Enlargening the scope by analysing all FP research domains

We have begun to enlargen the specific study of NBIC programs to all the programs for FP5 and FP6. Also, all 80.000 teams participating in projects have been localized in FUAs. The aim will be to compare the FP supports' spatial repartition, viewed as a mean for spatial planing to create leverages for cities' technological and scientific development.

The first data has just been finished and cleaned a few weeks ago. The data will be studied by main research program, i.e. :

- QLR: « Quality of life and management of living resources » (Codes projets : Q**)
  To link the ability to discover with the ability to produce, in order to address the needs of society and to meet consumer requirements. This will lead to future wealth and job creation and improvements in the state of the environment.
- IST: « User-friendly information society (IST) » (Codes projets : IST)

To realise the benefits of the information society for Europe both by accelerating its emergence and by ensuring that the needs of individuals and enterprises are met.

- GROW: « Competitive and sustainable growth (GROWTH) » (Codes projets : G**)
  To support research activities contributing to competitiveness and sustainability, particularly where these two objectives interact. Industry's role will not only be to identify areas for collaboration but also to bring together and integrate projects, especially cross-sectoral projects along the value chain, so that technology uptake and innovation are more effectively ensured across Europe.
- EESD: « Energy, environment and sustainable development (EESD) » (Codes projets : CRAFT/**, E**, NNE)

To contribute to sustainable development by focusing on key activities crucial for social well-being and economic competitiveness in Europe.

- ICA: « Confirming the international rôle of Community research (INCO II) » (Codes projets : COPO**, IC*, INA)
  To promote scientific and technological cooperation internationally; to reinforce Community capacities in the fields of science and technology; to support the achievement of scientific excellence within the wider international framework; and to contribute to the implementation of the Community's external policy, also with the accession of new EU members in mind.
- SME: « Promotion of innovation and encouragement of SME participation » (Codes projets : IR*, IP*)
  To improve the economic and social impact of research activities by ensuring the better dissemination of results, by encouraging the participation of SMEs, and by encouraging the transfer and dissemination of technologies from various sources, taking into account the needs of customers and users.
- HUMAN: « Improving human research potential and the socio-economic knowledge base » (Codes projets : H**)
  To improve and help develop the knowledge potential of European researchers, engineers and technicians through greater support for the training and mobility of researchers and by enhancing access to infrastructures; and, to mobilise and strengthen the socio-economic knowledge base so as to identify economic and social trends and requirements, both current and future, in order to contribute to the Community's competitiveness and quality of life of its citizens.
- NUCL: « Research and Training in the field of Nuclear Energy » (Codes projets : F**)
  To help exploit the full potential of nuclear energy, both fusion and fission, in a sustainable manner, by making current technologies even safer and more economical, and by exploring promising new concepts.

The three first maps are shown here (FP_Grow, IST QLS). Each of them count the number of participants in a program in proportion of the total participants for FP5. They reveal that the weight of each FUA in the total programs is very proportional to the size the FUA. The specialization of cities in some domains are diverse and a more synthetical classifical will reveal better the orientation of the support for each city.

Another aspect which is studied is the network created by these Framework Programs. In particular, we show here the cities where are the leaders who integrate more Eastern teams in their projects (FP_leadest). Vienna, Berlin and Copenhagen are the most open to the collaboration with eastern countries, phenomenon obviously facilitated by their proximity. The evolution for FP6 will show if there has been a diffusion to the Western part, in particular in the countries where they are quite low in FP5 such as France and Ireland.

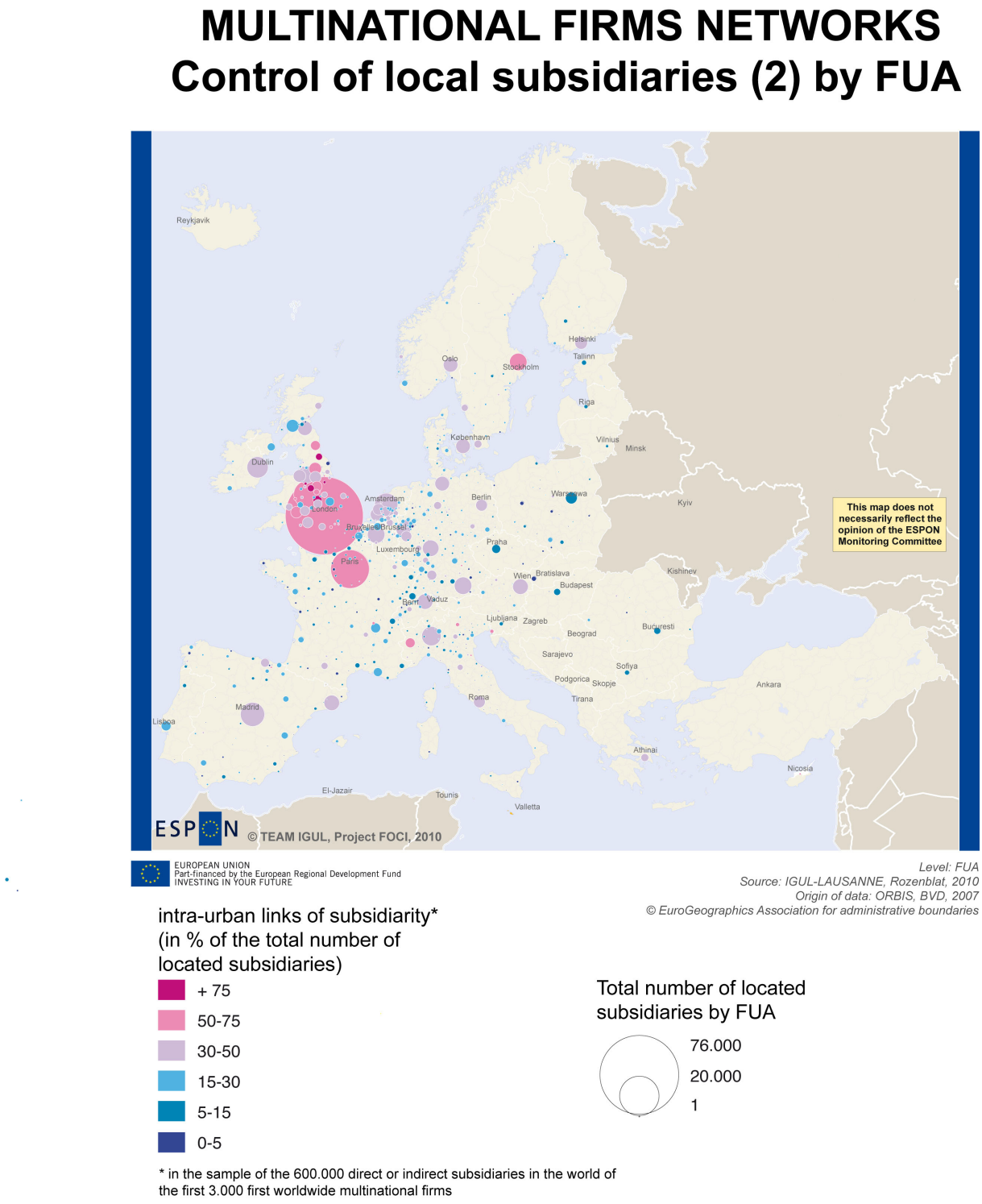


Figure 15. Multinational firms networks. Control of local subsidiaries (2) by FUA

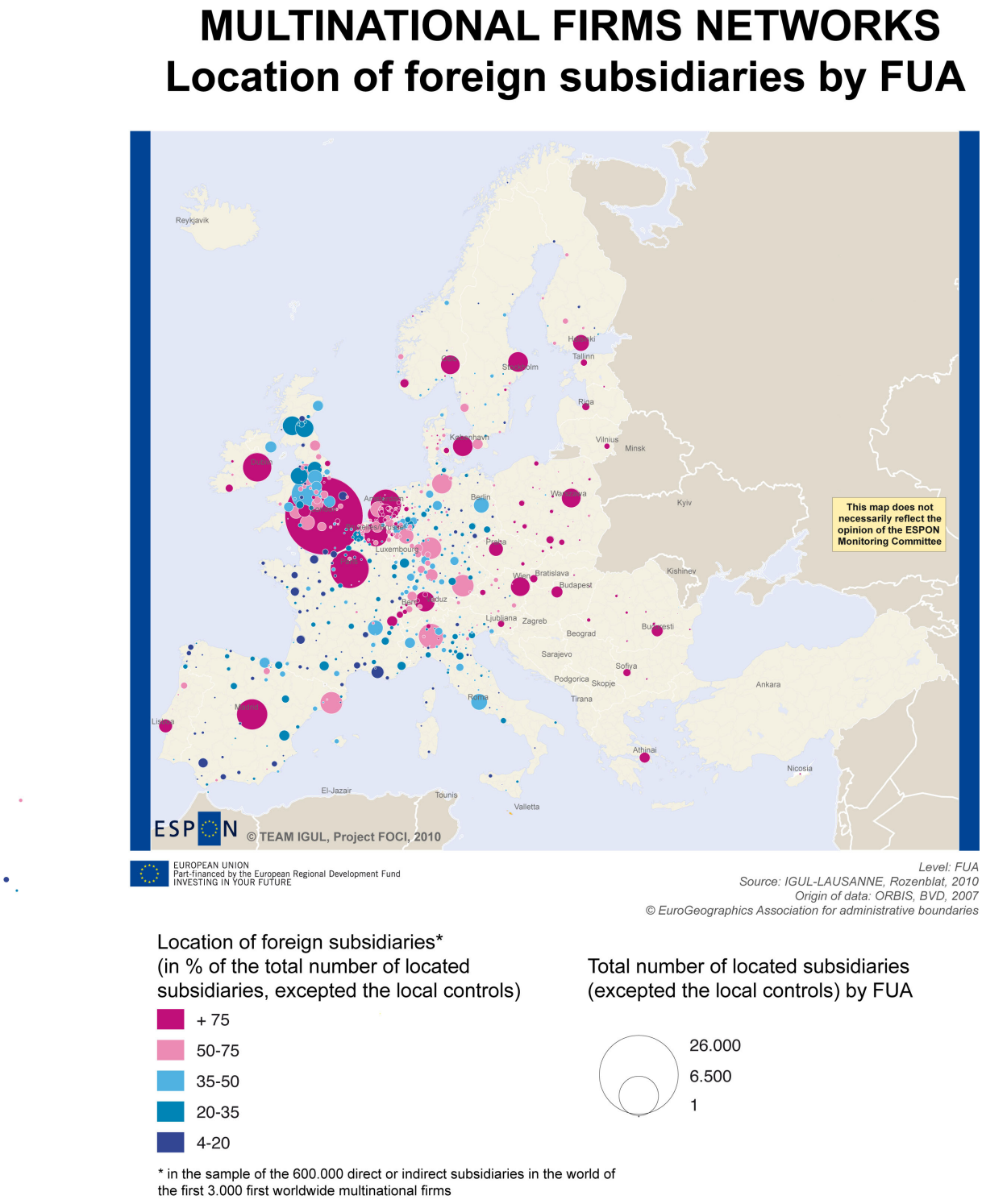


Figure 16. Multinational firms networks. Location of foreign subsidiaries by FUA

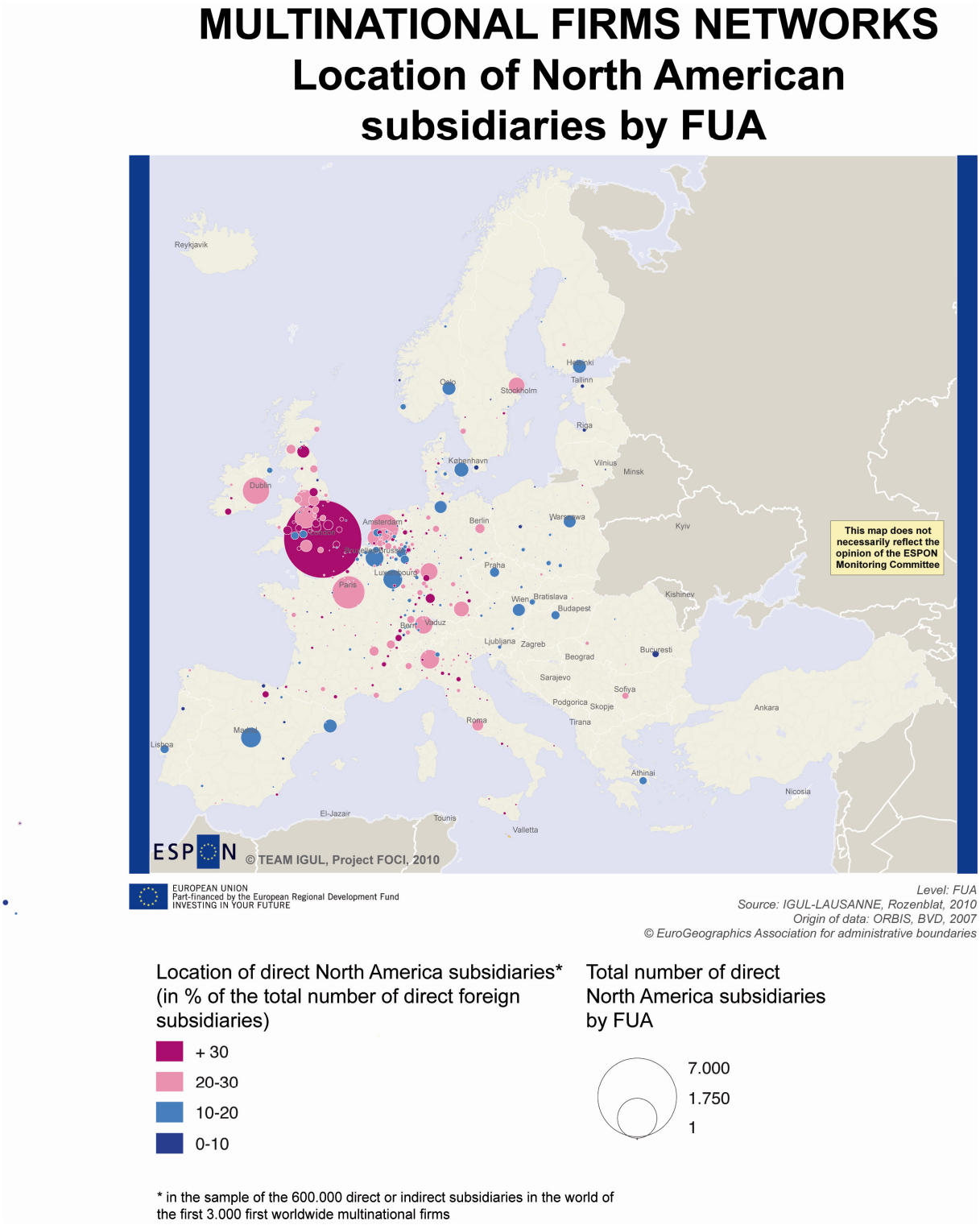


Figure 17. Multinational firms networks. Location of North American subsidiaries by FUA

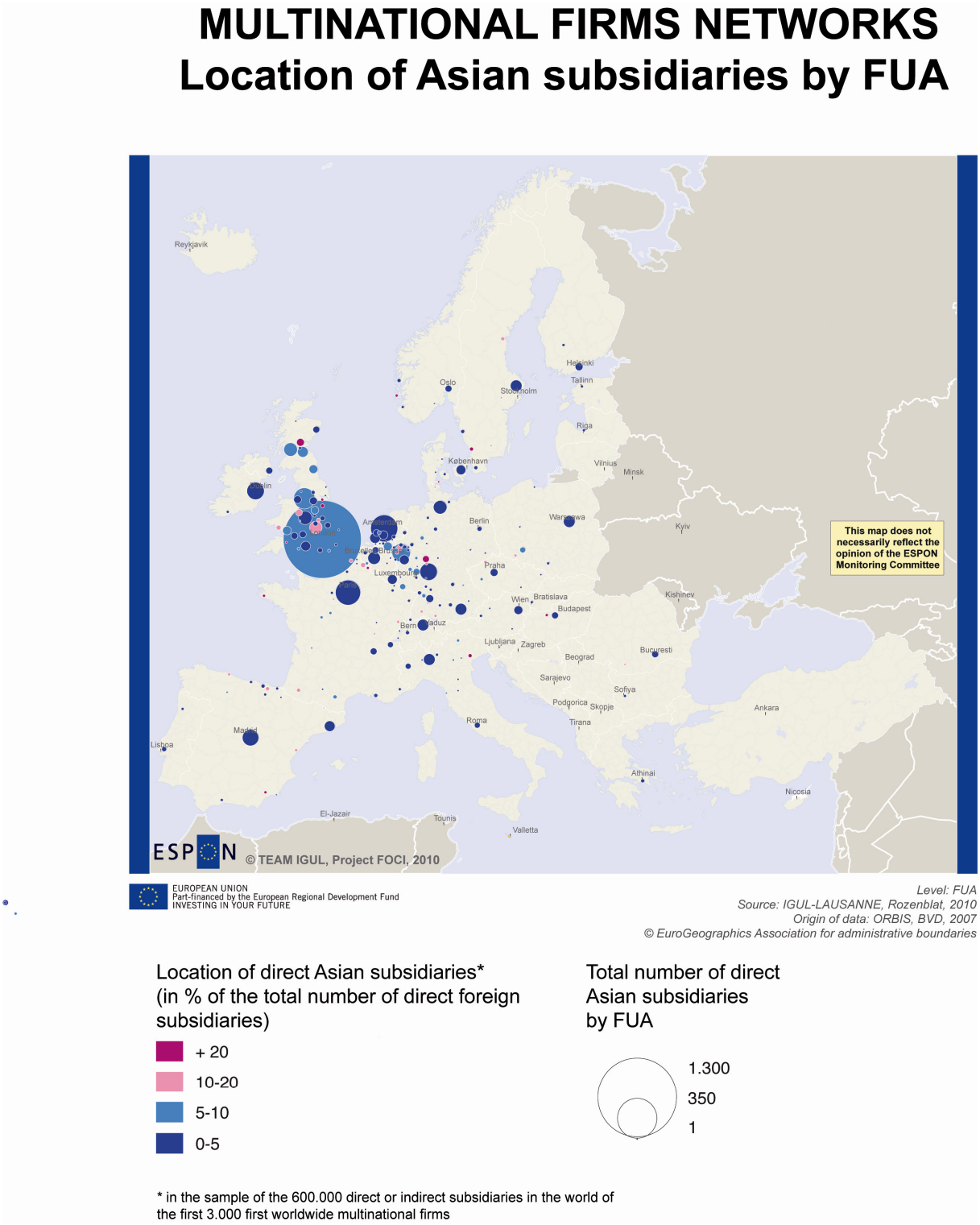


Figure 18. Multinational firms networks. Location of Asian subsidiaries by FUA

Conclusion

In this report, we have presented a synthetic image of the research networks that were built between European cities through research consortia in converging technologies. This accumulated mapping of cutting edge innovation demonstrates the strength of the structure of the urban system in assessing the potential competitiveness of European cities: the research in NBIC, which is announcing the next wave of technical innovation (as anticipated for 2015-2030), is distributed in all countries following two schemes. The major centers are the largest European capitals and economic centers. Their role is to integrate almost all other European cities within networks that accompany the diffusion of the knowledge and the know-how. Other major centers of less general economic importance but with very specific profiles regarding the knowledge economy appear as specialized nodes that could anchor further technological developments, since the next economic cycle will remain tightly associated with research activities.

These results are moreover remarkable because while referring to a very peculiar sector of the urban activities, they do confirm the two main generic processes already identified in urban theory that are structuring the systems of cities, i.e. 1) hierarchical differentiation including metropolization and 2) selection of a few specialized cities. This major observation confirms the general resilience of the processes that are shaping the urban systems, ensuring together their role of driving forward the territorial system as a whole in all its parts and their function of adaptation to the new social and technological ways in a competitive economy. The new nature of contemporary development including the universal diffusion of knowledge economy and the globalization of most activities did not change this fundamental aspect of urban dynamics.

Chapter 7 – Competitive nodes: Cities in networks of large multinational firms

Multinational corporations invest in many cities, reinforcing urban economic capital through the integration of located plants in the strategic competitiveness of the whole company group (Rozenblat, Pumain, 1993; Castells, 1996; Taylor et al., 2004; Rozenblat, 2004). They also increase interdependencies between cities by the way of financial links, global value chains and strong relationships leading to diffusions of various technologies, production modes, enterprises cultures (Gereffi, 1996; Gereffi et al., 2005). Specifically with financial links, different kinds of controls and powers of headquarters on their subsidiaries put cities where they are located, in dominant/dominated positions regarding directly connected cities, as well as in the whole network taking into account indirect paths of subsidiaries to many other cities.

In order to measure these positions of cities through such corporation networks, we built a database including all the direct and indirect subsidiaries of the first 3.000 worldwide companies groups by their turnover (Orbis, BVD, 2007). Each group is seen as a (quasi) tree, owning subsidiaries which themselves own other subsidiaries and so on. It results a sample of 400.000 subsidiaries located all over the world, linked by 600.000 financial links, which are directly or indirectly owned (at least at 10%) by the main first 3.000 groups. These subsidiaries are precisely located to define Metropolitan areas (FUA in Europe according to the ESPON definition), they are defined by their activity sector (NACE), their turn-over and number of employees when it is available, and by their owners and subsidiaries.

TOTAL	**Continent subsidiary**						
Continent Owner	Pacific Oceania	Eastern Asia	Europe	South America	North America	Western Asia	Total
Pacific - Oceania	2 803	319	1 361	111	143	40	5 546
Eastern Asia	141	30 401	5 856	1 367	3 110	45	44 128
Europe	4 271	21 305	322 445	11 351	25 499	580	468 581
South America	203	1 716	3 202	3 491	1 745	22	13561
North America	1 244	10 971	30 029	8 626	108 275	190	178 107
Western Asia	31	16	92	29	9	519	752
Total	8 737	64 943	367 799	25 060	138 869	1 402	606 810

Table 1. Subsidiaries links of multinational firms by continent (values)
Source : IGUL-2010 - Origine of Data : ORBIS, BvD, 2007

% TOTAL	Continent subsidiary						
Continent Owner	Pacific Oceania	Eastern Asia	Europe	South America	North America	Western Asia	Total
Pacific - Oceania	0.5	0.1	0.2	0.0	0.0	0.0	0.9
Eastern Asia	0.0	5.0	1.0	0.2	0.5	0.0	7.3
Europe	0.7	3.5	53.1	1.9	4.2	0.1	77.2
South America	0.0	0.3	0.5	0.6	0.3	0.0	2.2
North America	0.2	1.8	4.9	1.4	17.8	0.0	29.4
Western Asia	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Total	1.4	10.7	60.6	4.1	22.9	0.2	100.0

Table 2: Subsidiaries links of multinational firms by continent (%)
Source : IGUL-2010 - Origine of Data : ORBIS, BvD, 2007

First of all, the position of European cities in the World in such network is very strong (Table 1 and Table 2). More than the half of the total subsidiaries' links of the World, occur inside Europe, either inside each country, either between two European countries. Going further, the three quarters of the total ownership concern Europe or Europe and the rest of the world. These gigantesque proportions are easily explained by the high degree of fragmentation of Europe in the history, which nevertheless has supported the industrial revolution, resulting to a high number of independent firms which had to develop agreements or to merge, especially at the end of the XXth century to face globalization. Then, according to its national and industrial history, the European industrial system is much more complex than the Asiatic or the North American ones. The urban system supports this complexity and conversely, the urban system is very influenced by the developments of the economic networks complexity. Then it creates a very diverse and strong core for emerging and reinforcing networks between the numerous European cities, from the smallest ones to the biggest metropolises.

This complexity can be found in part at the inter-national scale, especially through the study of FDI flows, where the amount of monetary investments are especially underlined (Dickens, 1992, 2002; Mucchielli, 2008; CNUCED annual reports). But what cannot be found in FDI studies are first, the complexity of inter-connections between numerous individual firms (in particular by indirect ownerships) and second, the local urban effects of agglomeration economies that support and interact with these ownership networks. In particular, the local complexity created by many enterprises, located very closed to each other, and financially linked together, is rarely taken into account (because of the lack of data). Figure 1 represents the proportion of these "local links" where owner and subsidiaries are located in the same metropolitan area. At the world scale (fig. 7), it seems obvious that this phenomenon concerns especially European and Asian cities, but very few American cities. This difference comes from different reasons. For China, the way multinational firms settle is most of the time by buying state Chinese enterprises or building a green field enterprise in join venture with the national state. For Japan and Taiwan, conglomerates (or *Keiretsu*) were the way to build the new economy in globalization. In the meantime, Hong-Kong built its economy through the crossing and meeting of service and financial firms organizing trade of "made in China" products. For Europe, the European Community construction, permitted enterprises to exchange investments and to group their weight in order to fight at the European and global scale.

Especially London and Great Britain cities are very concerned by this phenomenon (64% of the subsidiaries owned by enterprises planted in London are local, 75% for Leeds, 84% for Middleborough or 90% for Lincoln). Great Britain is the world financial system where every firm of the world pretending to play at the global scale has to be settled, especially for North American firms, to create contact with European and Asian firms (Sassen, 1991; Taylor et al., 1996, 2000, 2004). In one hand, this could be interpreted as a very positive effect because more a milieu is complex, more it has got chance to adapt to crisis and to promote emergence of innovations. It is what dramatically lacked to the soviet system and every Eastern countries has seen increase the complexity of their productive system thanks to foreign subsidiaries and also thanks to the recent emergence of local firms (Stark, Venables, 2006). But in the other hand, every firms being linked to every other ones, it creates a vulnerability of "domino effect" allowing a very speed diffusion of lack of investments, we just experimented with the actual crisis of the stock exchange.

When one cancel the local links, one obtain a matrix crossing all cities involved in the plants the 3.000 first groups of the world. It concerns 250.000 subsidiaries which are spread in 1.500 metropolitan areas of the world, and some 10.000 places outside metropolitan areas but which concern only 2% of the total number of subsidiaries. The matrix can then be represented by a graph, showing the intensity between each couple of cities (by the number of subsidiaries on one city controlled by headquarters of the other city) (Fig.10 Centralities). We choose to measure here the total number of subsidiaries controlled from each city (out-degree: represented by the size of the nodes) and the centrality of each node measured by the Betweeness centrality (number of shortest paths of the whole graph passing by this node). Then the representation allies a local measure of the centrality (out-degree) and a global measure of centrality (Betweeness Centrality). The position of the nodes is calculated according to the intensity of relations between nodes: the cities which exchange more subsidiaries are closer than the cities not exchanging so much. Nevertheless, two cities can be positioned closely without any exchange if they both exchange a lot with the same third cities.
This representation shows at the center, the cities forming the core of the global localizations of multinational firms. If Paris, London and New York dominate, they are embedded in a dense network of cities formed essentially by European, American and only some few Asian cities (Tokyo, Seoul, Taïwan and Shanghai). In general, closest cities exchange more than those which are more distant and many geographical proximities remain in the graph. In fact, two third of the links occur inside each continent. It means that the globalization more occur until now at the continental scale (or free trade zones) than really at a total worldwide scale (Dunning, 2002). Of course, some exceptions appear with distant cities exchanging more because of specialization effects: Baltimore and London, or Boston and Frankfurt. At the European scale, Paris is much more central than London. By their privileged links, they share European cities in two groups. Cities of Scandinavia but also Athens, exchange more with London, while southern and Eastern European cities exchange more with Paris. But this division is not so strong in particular regarding the high density of relations linking European cities to each others.

Cities share together very close destinies, being closely linked to each other by the same global actors. There are then places with some functions for the industrial business system and they offer the conditions to access to the power. The position of their firms in the multinational networks confer some resources of power, which is not localized and static, but a dynamic process involving several actors in interaction. The headquarters owning their subsidiaries is a part of this power. The cities where headquarters are located encompass people and institutions, which possess the decision power and attract other people and institutions ambitioning to possess the same.

The balance between controlled subsidiaries from a city and the subsidiaries located in this city but controlled from outside is a good indicator to measure the dominant places

against the dominated ones (fig. 9). At the World scale, European cities seem to be more controlling subsidiaries than controlled from outside, excepted for the Eastern European cities. It's the same phenomenon observed in North America and in Nord-East Asia, while South East Asia receive more than control also.

At the scale of Europe (Fig. 3), the more dominant European cities are Paris and London in the size of their number of controlled subsidiaries outside their own boundaries. In general, the dominant position is correlated to the size of the cities, but sometimes, small places can also be observed in a very dominant relative position. Especially, borders-cities like Geneva, Basel, but also Trieste and Arnhem own much more subsidiaries than they welcome ones controlled from outside. Their peripheral position was a disadvantage when borders where relatively closed, but it was already an advantage as a bridge to and from the other side. This last advantage remains and even is increasing thanks to the visibility to and from each part of the border, a local knowledge of both cultures, both practices and institutions. Beside these border cities, other small cities hosting from long time very big enterprises are in the best position of independence thanks to their hosted headquarters (like Clermont-Ferrand for Michelin, Lausanne for Nestle, Exeter for Devon Partnership NHS Trust or Pistoia for Pistoia Alliance in chemical/biotechnology). Nevertheless, in the last cases, a too strong specialization around one company could be negative for the development and the renewal of the cities for middle and long term. Hosting external branches can also bring some dynamic to the local environment.

In particular, cities began in the 90's to promote their qualities in order to attract foreign companies. It was viewed as a competitive factor to offer international functions and international companies in order to attract skilled workers and increase the level and the quality of life (Begg, 1999). In fact, the integration in the global networks of companies is essential to have access to the international arena in order to promote the local economy. Clusters, assembling local and international companies, were organized by local government in "technopoles" then called "clusters" (Porter, 1996; Markusen, 2000). These clusters not only contain economic resources but must also give access to infrastructures like airports, congress centers and to high-level cultural events. This short-term history has got a high importance for today and for the future of European cities to be integrated in the globalization which represent the *sine qua non* condition to wish a future development and renewal in adequacy with the global trends. The map of the host of foreign subsidiaries in FUAs (Fig.16 of chapter 6) reveals the supremacy of London in Europe to attract foreign companies. Paris, which is ranked second only reach one quarter of the number of the London's foreign subsidiaries (5.000 against 20.000). In particular, London host many American companies (35% against 23% for Paris) (Fig.17 of chapter 6) and Asian companies (6.6% against 3.6%) (Fig.18 of chapter 6) and relatively much less European companies than the rest of European cities. It confirms that London is like a bridge of American companies in Europe, but much less integrated in Europe by the European firms' networks than Paris (70% for Paris and 55% for London) (Rozenblat, 1993; Rozenblat, Pumain, 2006).

Beside this now well-known duality of London and Paris, for the rest of the European territories a Capital cities effects dominate, particularly strong in Central Europe. The capitals concentrate most of the foreign subsidiaries: it's truth for classical "primatial" national urban systems where one city dominates and concentrates much more wealth and services than the other ones, like in France, Great Britain, Greece or Portugal. But it is also truth to a lesser extent for Spain, where Madrid concentrates much more foreign companies than Barcelona, and in Switzerland where Zurich dominates largely Geneva and the other cities. This phenomenon is exacerbated in Eastern new members capitals, where the uncertainty of the administration and the ignorance of the country has lead companies to settle first in the capital. The strategy is to be to be closed to the institutions, closed to the banks in order to build a professional local network and to acquire information, and then only find a more appropriate plant for production. The

capital plays a role of bridge between abroad and the national cities. Only strong federal countries like Germany have got much more equilibrium between the openness of their metropolises to direct foreign companies. They have thus better visibility from abroad and are more rapidly integrated in new diffusion of knowledge and practices. But the cities situated in concentrated countries also can have a good access to these networks, provided that capital cities play a good role of bridge in direction to the whole country. So, measuring here only the direct foreign subsidiaries links is not enough to understand the process of diffusion of this integration in the globalization. A further approach on the indirect links will give a more depth image of this uneven openness of the urban economies in the globalization and the capacities of capitals, but also of transversal links between middle size cities, to diffuse this advantage to other cities.

The integration of Eastern European cities is facilitated by Western companies' investments. Figure 4 shows the cities where eastern subsidiaries are controlled. If Paris, Amsterdam, Zurich and German cities, possess a lot, it doesn't represent a high part of their total ownership. At the opposite, Wien is much more oriented to Eastern Europe and of course, European cities themselves (even outside their own countries).

The integration of European cities in the Global system of cities is then very deep. London is an important bridge between world cities and European cities. In particular, as we've seen, it host many American and Asian firms. Paris is more oriented to European cities, but also very central in the World thanks to its numerous relations with European cities. Also, the ownership of headquarters of Paris, Brussels, Luxembourg and Milano is more oriented to North America (Fig. 5) while London or Torino firms privilege more Asian cities (Fig. 6).

This system of exchanges of subsidiaries is then complex and multi-scale: Europe / World, Western Europe/ Eastern Europe, exchanges between European countries and inside each country. The balance and the connection between all these level are the condition of the harmonized development of competitiveness of European cities.

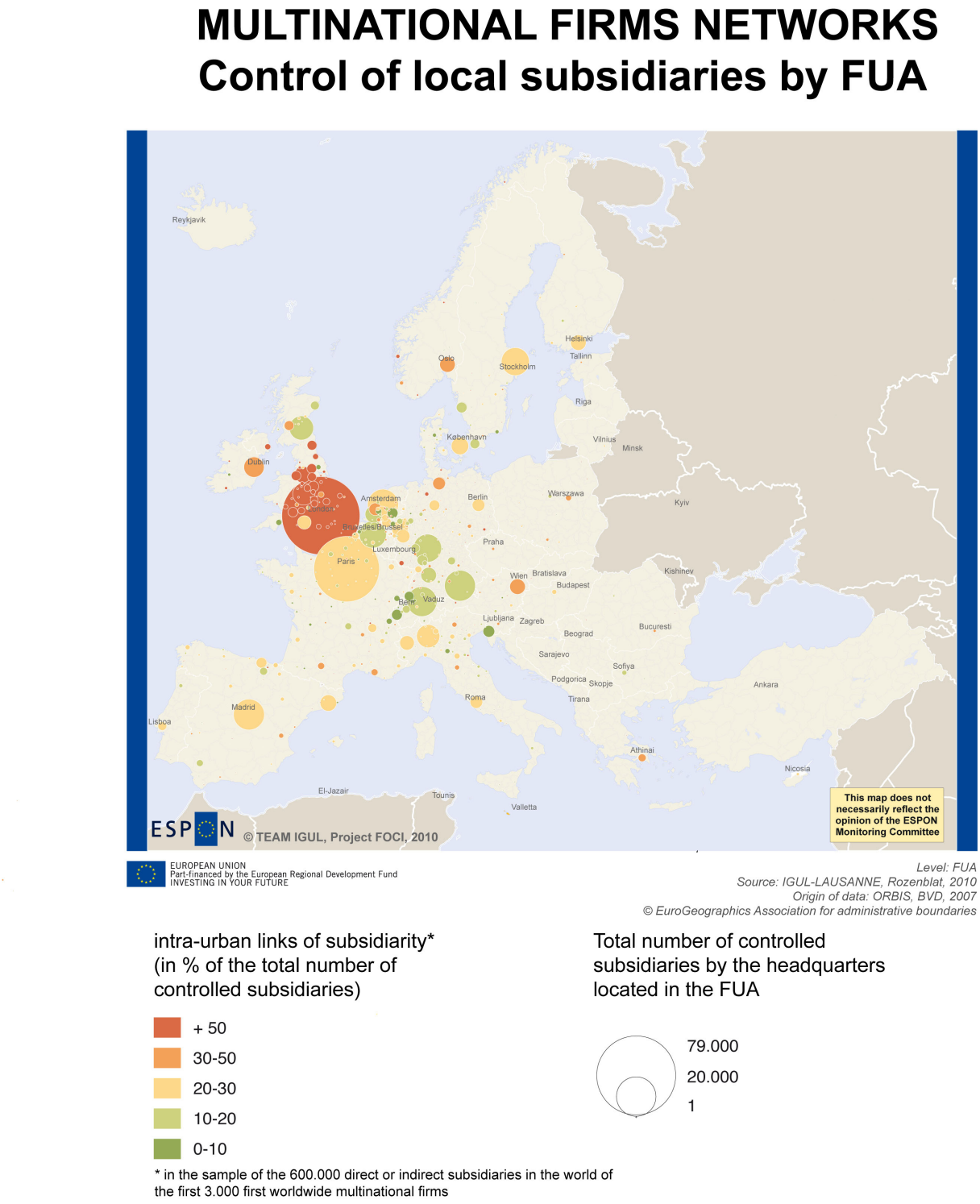


Figure 1. Multinational firms networks. Control of local subsidiaries by FUA

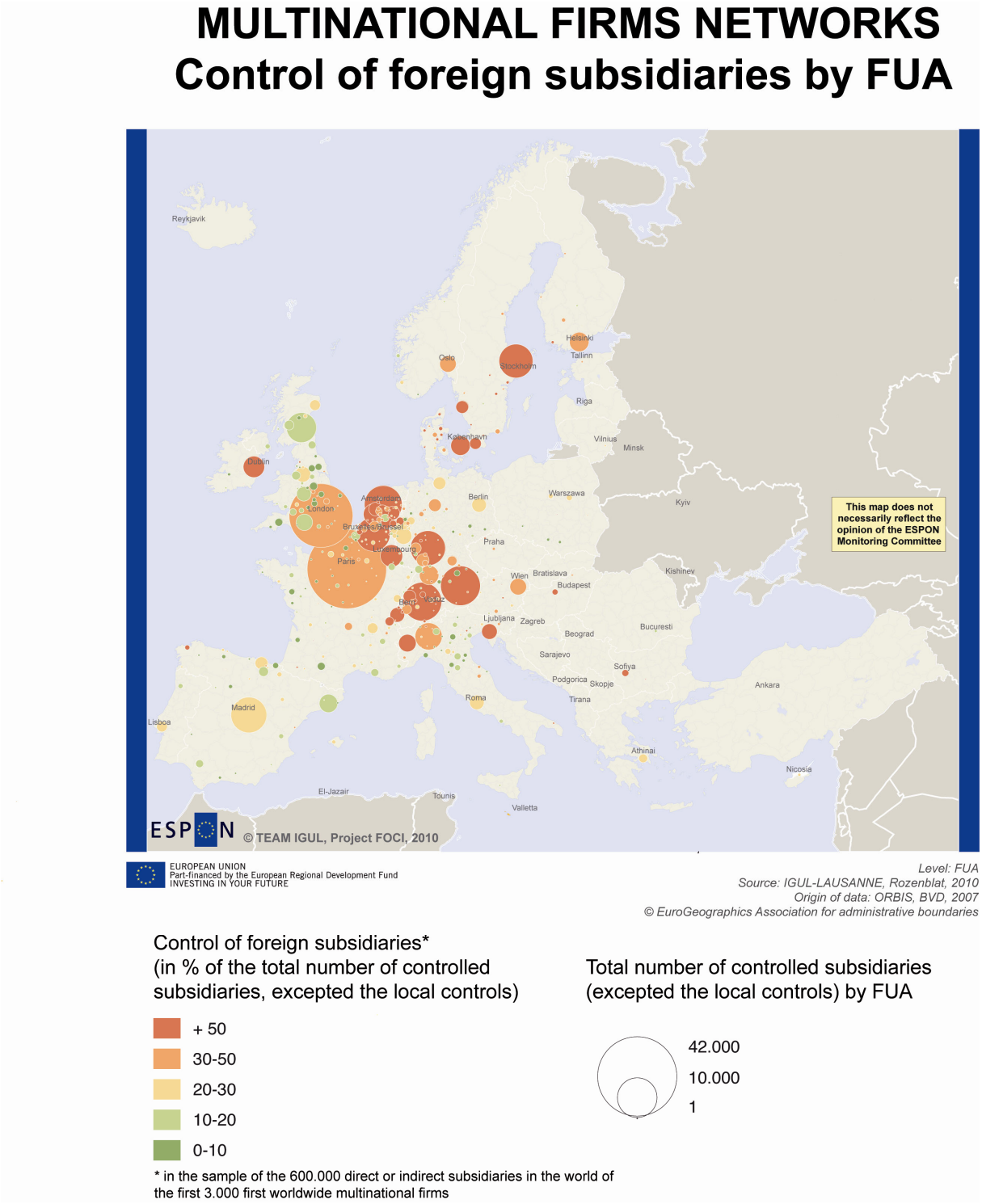


Figure 2. Multinational firms networks. Control of foreign subsidiaries by FUA

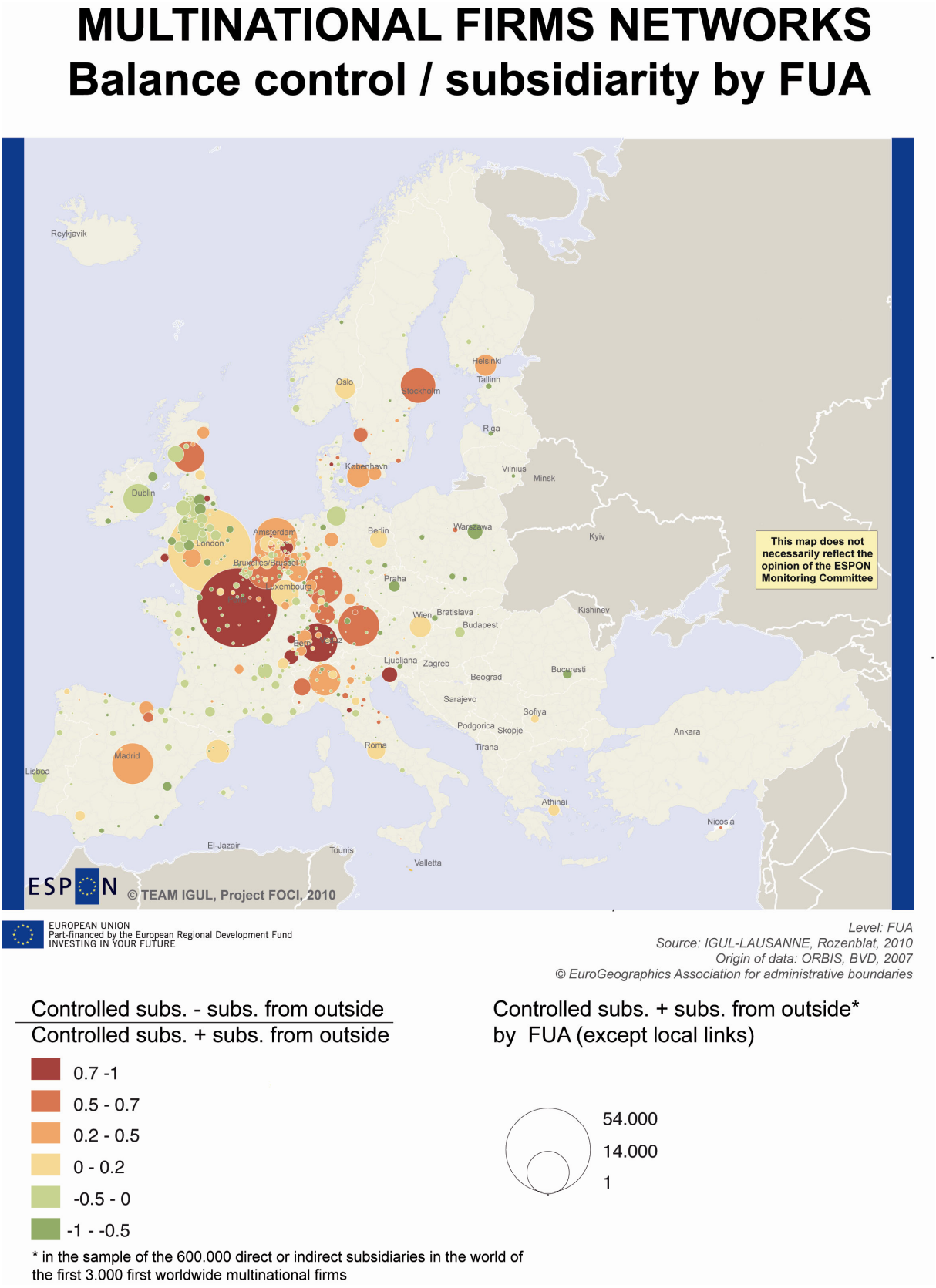
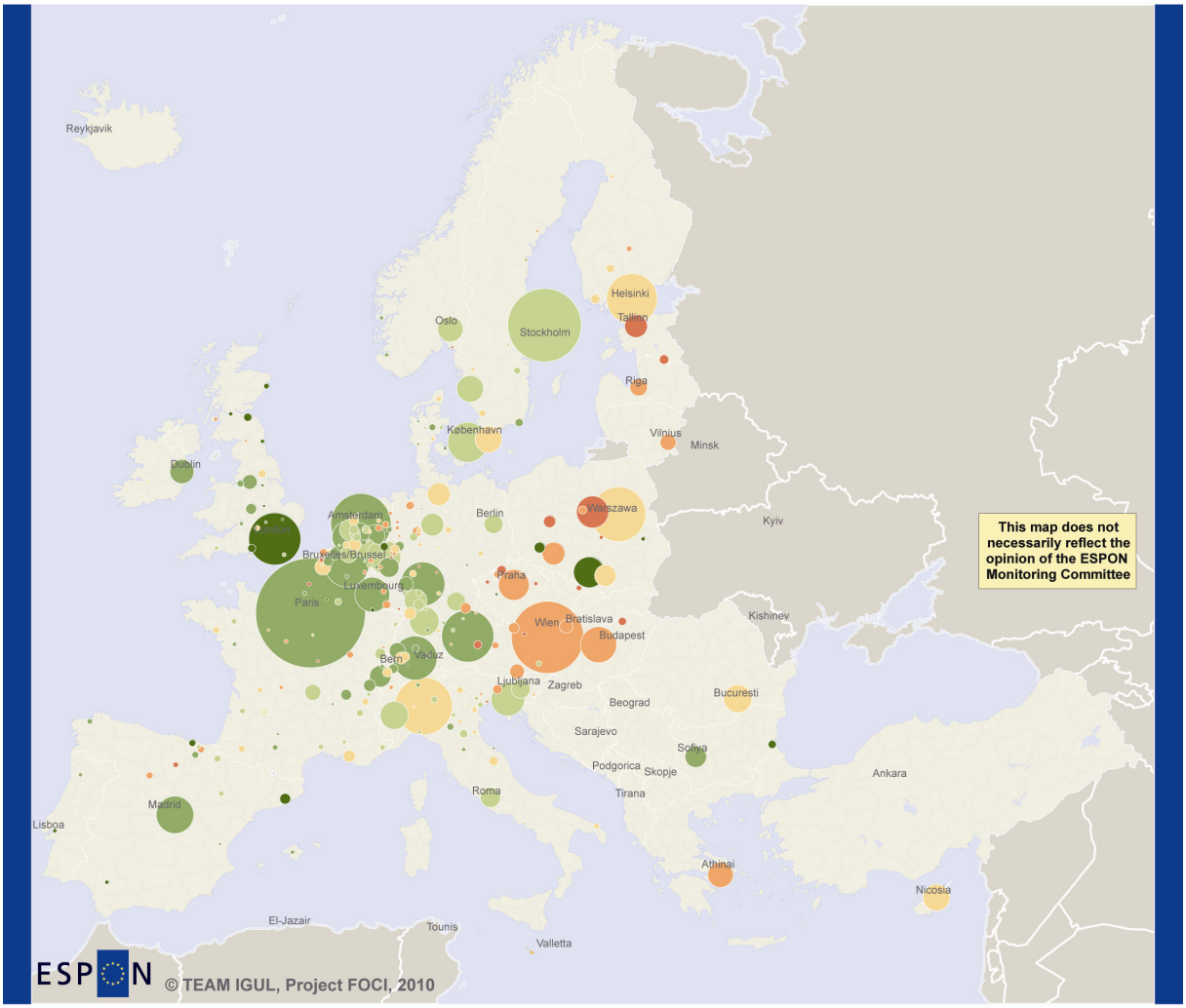


Figure 3. Multinational firms networks. Balance control / subsidiarity by FUA

MULTINATIONAL FIRMS NETWORKS
Control of subsidiaries in the new UE members by FUA



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Level: FUA
Source: IGUL-LAUSANNE, Rozenblat, 2010
Origin of data: ORBIS, BVD, 2007
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Control of subsidiaries in the new EU members*
(in % of the total number of subsidiaries controlled abroad)

- + 50
- 20-50
- 10-20
- 5-10
- 2-5
- 0-2

Total number of controlled subsidiaries in the new EU members (excepted the national ones) by FUA

- 42.000
- 10.000
- 1

* in the sample of the 600.000 direct or indirect subsidiaries in the world of the first 3.000 first worldwide multinational firms

Figure 4. Multinational firms networks. Control of subsidiaries in the new UE members by FUA

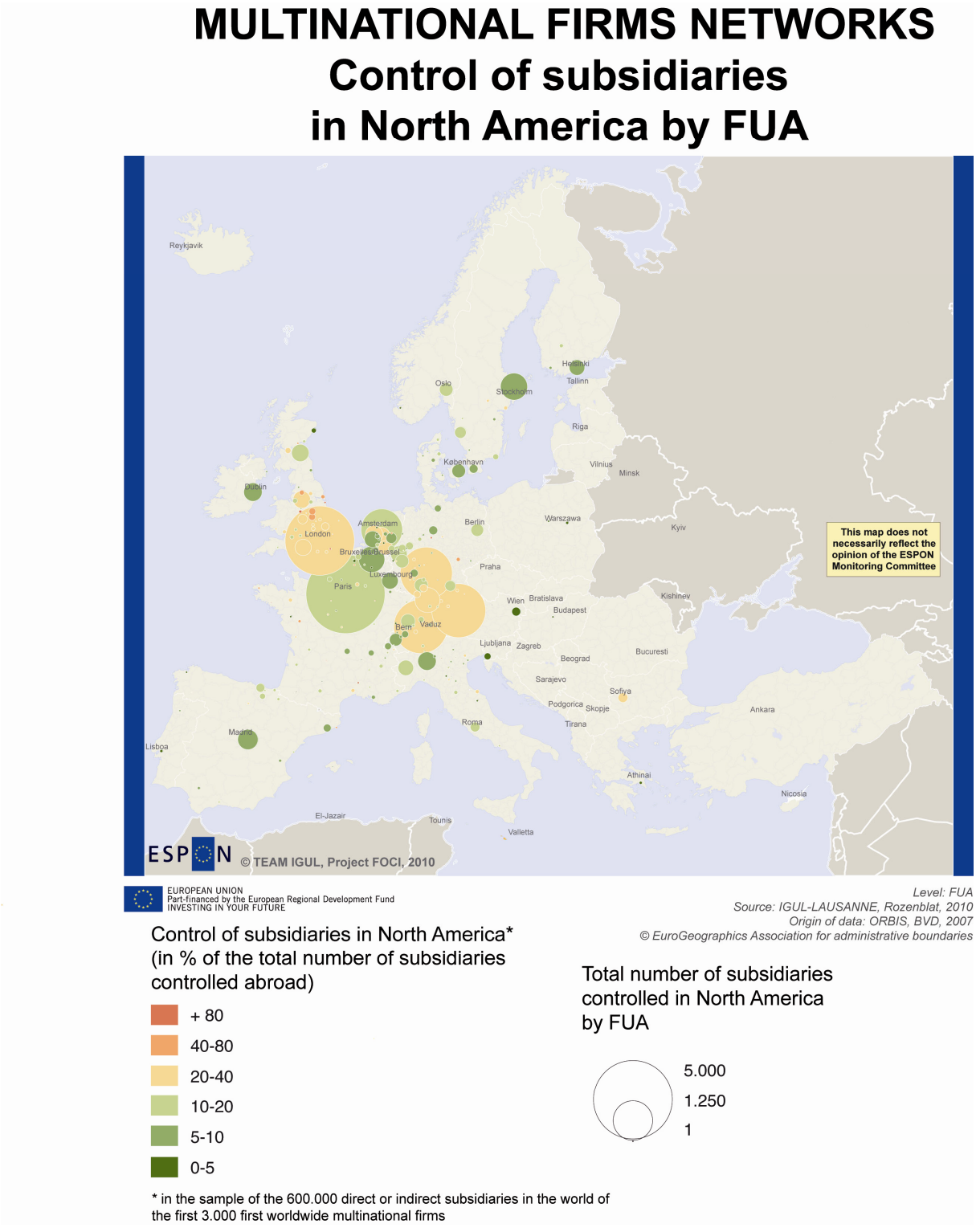
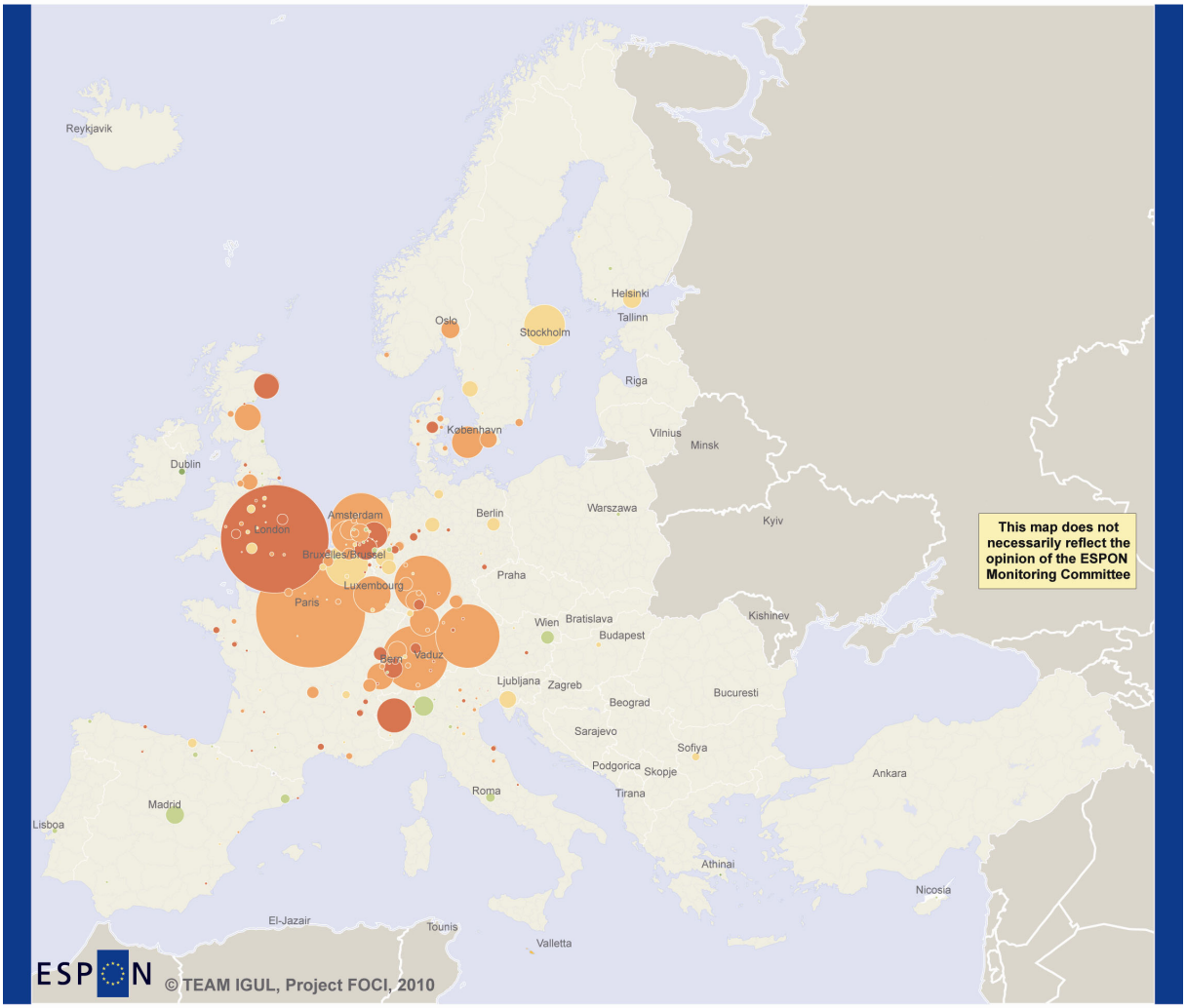


Figure 5. Multinational firms networks. Control of subsidiaries in North America by FUA

MULTINATIONAL FIRMS NETWORKS
Control of subsidiaries in Asia by FUA



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Level: FUA
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Control of subsidiaries in Asia*
(in % of the total number of subsidiaries controlled abroad)

- + 10
- 2 - 10
- 1 - 2
- 0.5 - 1
- 0 - 0.5

* in the sample of the 600.000 direct or indirect subsidiaries in the world of the first 3.000 first worldwide multinational firms

Total number of subsidiaries controlled in Asia by FUA

- 4.000
- 1.000
- 1

Figure 6. Multinational firms networks. Control of subsidiaries in Asia by FUA

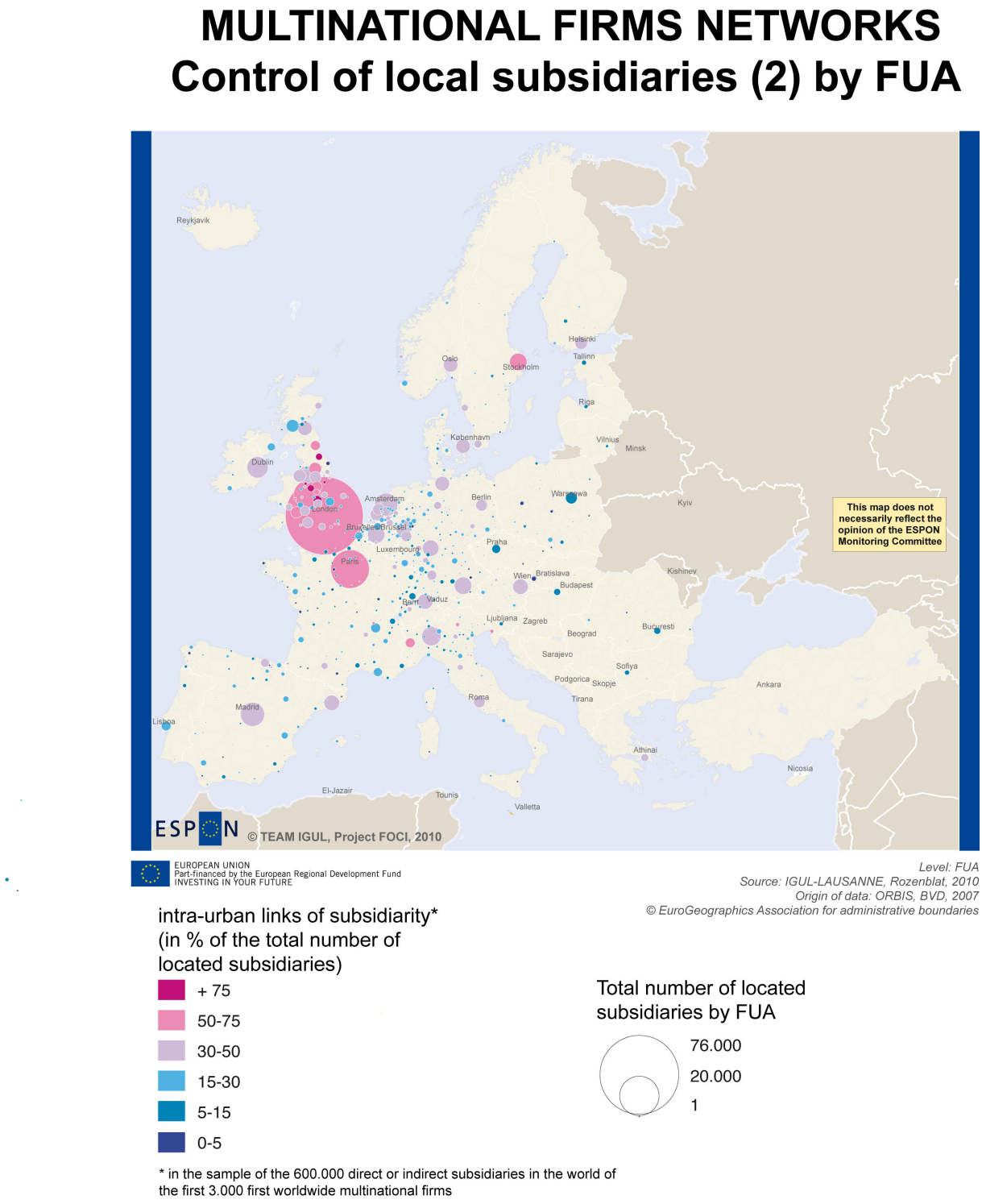
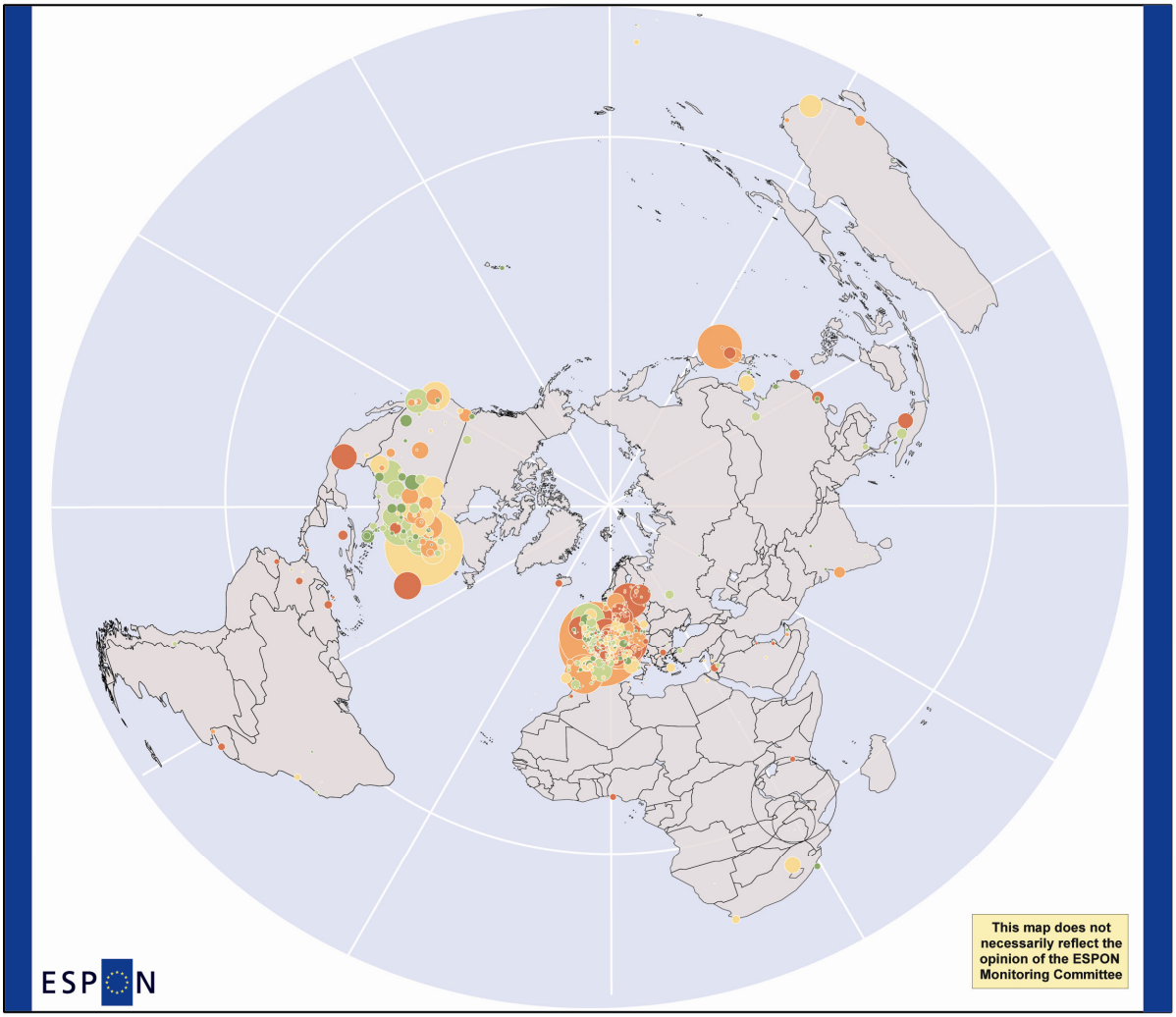


Figure 7. Multinational firms networks. Control of local subsidiaries (2) by FUA

MULTINATIONAL FIRMS NETWORKS
Foreign subsidiaries by metropolitan area



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Source: Rozenblat, IGUL, Lausanne, 2010
Origin of data: ORBIS, BVD, 2007

Control of foreign subsidiaries*
(in % of the total number of controlled subsidiaries, excepted the local controls)

- + 75
- 50 - 75
- 30 - 50
- 20 - 30
- 1 - 20

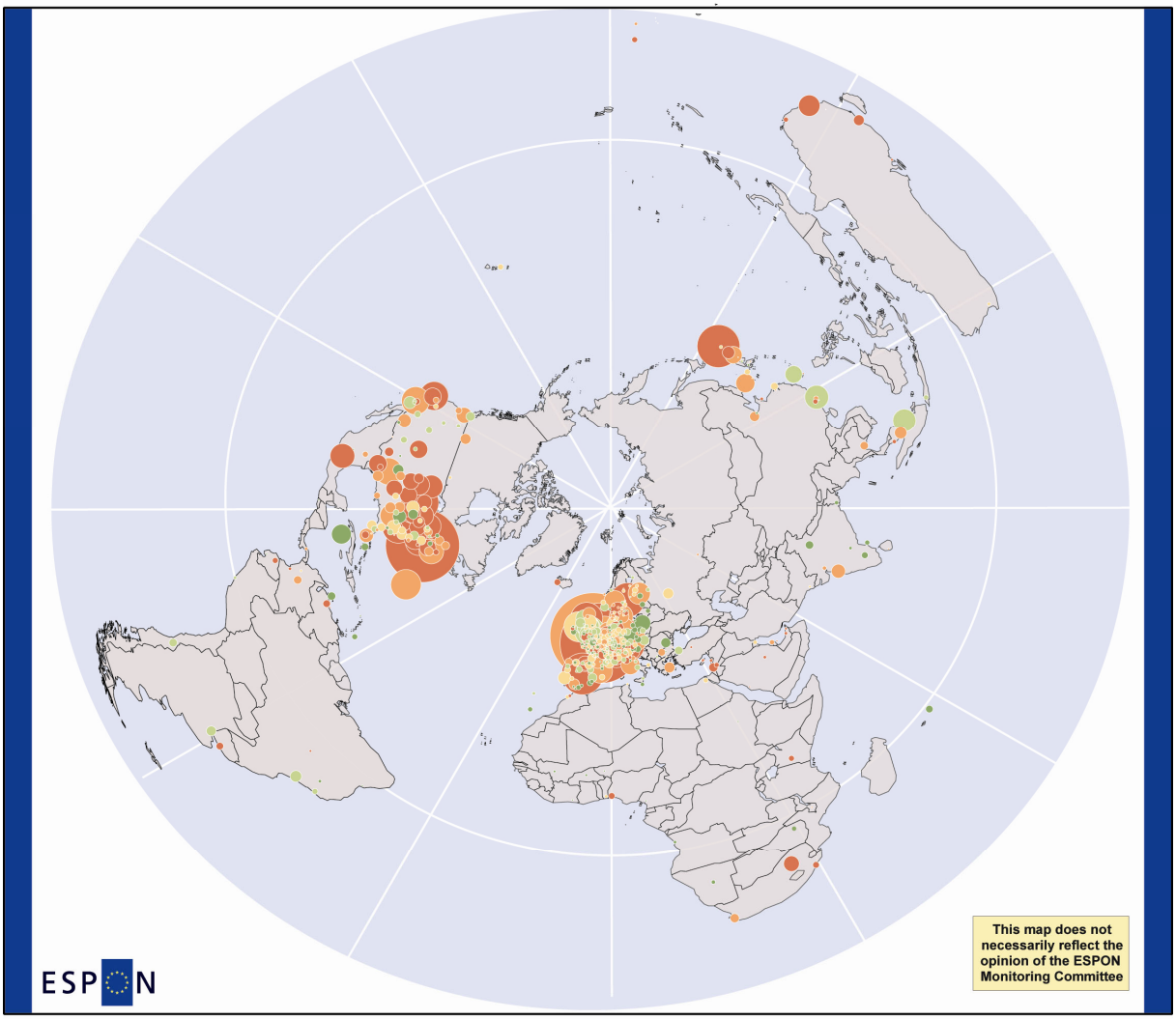
Total number of controlled subsidiaries (excepted the local controls) by metropolitan area

- 42.000
- 10.000
- 1

* in the sample of the 600.000 direct or indirect subsidiaries in the world of the first 3.000 first worldwide multinational firms

Figure 8. Multinational firms networks. Foreign subsidiaries by metropolitan area

MULTINATIONAL FIRMS NETWORKS
Balance control / subsidiarity
by Metropolitan area



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Source: Rozenblat, IGUL, Lausanne, 2010
Origin of data: ORBIS, BVD, 2007

Controlled subs. - subs. from outside
Controlled subs. + subs. from outside

- 0.3 - 1
- 0 - 0.3
- -0.3 - 0
- -0.5 - -0.3
- -1 - -0.5

Controlled subs. + subs. from outside*
by metropolitan area (except local links)

- 55.000
- 14.000
- 1

* in the sample of the 600.000 direct or indirect subsidiaries in the world of the first 3.000 first worldwide multinational firms

Figure 9. Multinational firms networks. Balance control / subsidiarity by metropolitan area

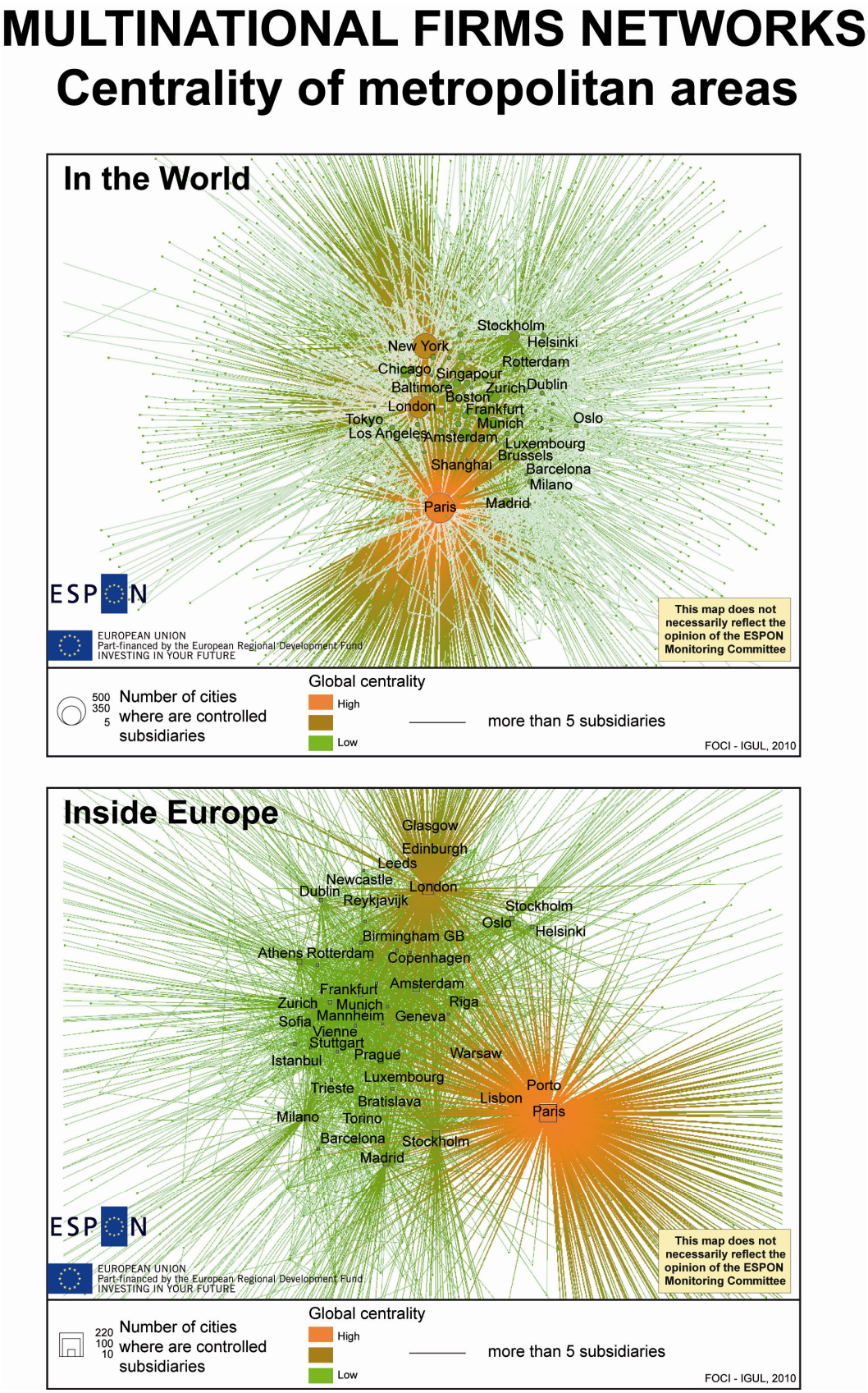

Figure 10. Multinational firms networks. Balance Centrality of metropolitan areas

Chapter 8 – Metropolitan macroregions in Europe: from economic landscapes to metropolitan networks (Cities and their Hinterlands)

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Introduction

In contemporary economy, the role of knowledge and information is constantly growing. The competitiveness of enterprises and territorial systems depends on creation of new knowledge, access to information and information processing – in other words – on broadly understood innovation. The question of competitiveness should be viewed in the global context because openness to information and capital flows and internationalisation of labour markets, epitomised by transnational corporations and their operation, is becoming a characteristic feature of contemporary economy (Cf. Gorzelak, Jałowiecki 2000).

The development of global information economy is accompanied by a dynamic growth of huge cities with international functions – the metropolises. Metropolises are becoming the key nodes of global economy, bringing together both management and control functions (Sassen 1991, Lo, Yeing 1998, Castells 1998, Taylor 2007). A multi-nodal, global system of cities is in the making, marked by robust internal ties. It is made of cities which have been able to create a desirable environment for innovation - due to a combination of economic, technological, institutional and social factors – to foster the development of the information sector. It should be noted that the information sector not only comprises higher-order services (Taylor 2007), but also knowledge-intensive industries (Kratke 2007).

The concentration of functions related to the generation and processing of information, handling capital flows and ensuring attractive location criteria for the headquarters of huge transnational corporations in selected metropolitan centres, coupled with the emergence of global and continental systems of cities, can have serious consequences for regional and local systems. Metropolisation processes are leading to changes in the cities' internal structure and to a transformation of the relationships between cities and their surrounding regions. The spreading of metropolises onto regional hinterland areas can lead to the development of a metropolitan area in which the ties with the metropolis are both strong and wide-ranging. At the same time, the economic ties between the city and its metropolitan area and the surrounding region are weakening (as linkages as part of the global or continental city network become stronger). This latter aspect of the metropolisation process is much less researched, unlike the concentration processes of central functions in cities and the consolidation process of the global network of cities, discussed above. Many authors have put forward the hypothesis that the regional hinterland is no longer needed by metropolises as it does not offer the resources that are necessary for metropolitan development (cf. e.g. Castells 1998, Jałowiecki 2000,

Kunzmann 2000, Sassen 1991), and is therefore undergoing a relative marginalisation, while the differences in the development level between the metropolis and its regional surroundings are increasing.

In light of the new development paradigm outlined above, and the recent hypotheses published in the world's literature of the subject, an evolutionary model of the metropolises' global and regional relationships could be proposed, which takes into account the type of resources and scale of linkages (Smętkowski 2005). To offer a general picture, the relationships between the city and the surrounding region in the industrial economy were relatively strong, with the region providing simple resources: unskilled labour in the form of daily shuttle migration; food products; raw materials for production and construction enterprises located in the agglomeration. In return, the agglomeration would provide its hinterland with earnings from work, processed products (shopping in the city) and higher-level services. In the industrial civilisation, the relationships between the city and the global economy were as a rule limited to an exchange of industrial goods. In the information economy, the links between the metropolis and the region have become relatively weaker. The role of the hinterland has been limited to the provision of unskilled and skilled workforce in the form of weekly shuttle or permanent migration, as well as environmental resources – potable water, recreational space, building plots, etc. the resources which were earlier supplied to the city from the region now come from different sources (e.g. food) or have lost their significance (e.g. raw materials). In the information economy, for the metropolis, now turned into a node concentrating global information and capital flows (including human capital), the concentration of such flows (frequently of a non-material nature) has become more important than the material exchange of goods or attracting workforce on a large scale (factors which played a key role in the development of the urban-industrial agglomeration).

The above hypothesis on changing relationships between metropolises and regions is well-grounded in the literature of the subject. According to K. Dziewoński (1971), urban agglomerations form a separate subsystem at an advanced development stage of the settlement system, where their inter-linkages are more vigorous than those in the regional subsystem; "huge urban complexes are not central places but represent specialised settlement urban units with individual locations." This issue is also tackled in the works of A. Pred (1973, 1975, 1976), a proponent of the thesis that contacts between large urban agglomerations increase as economic development and urbanisation processes continue. Among more recent works on linkages within the global network of cities the study by A. Esparza, A.J. Krmenec (1994), with Chicago as its case study, is particularly interesting. On its basis, a complex picture showing the ties of a huge city emerges, which could be summarised as follows: flows of services occur in a two-level

structure. The first such level is made up of global cities, for which the factor of distance does not play any considerable role, while the second relates to the national system of cities and shows the existence of a hierarchical structure in which distance adversely affects mutual interactions. On the other hand, the spatial range of demand for services does not perceptibly differ from the supply of services. Most enterprises purchase their services from suppliers operating from the city's metropolitan region. This can be seen as a proof of the significance of central functions, thanks to which the region is largely self-sufficient.

The other studies conducted in a few European cases also reveal a difference between metropolises (cf: Simmie 2001 et al., 2002; 2003) based to some extent on their position in the network of large cities. This is especially important in the case of capital cities that are far more worldwide connected (i.e. London, Paris, Amsterdam) than other regional cities (i.e. Stuttgart, Milan). In general, the higher the position of the city, the smaller significance of ties with regional surroundings for development processes of the metropolis. From a study of the linkages of selected Polish metropolises (Gorzelak, Smętkowski 2008), an overall picture emerges, which we can sum up as follows. The regional surroundings do not play any important part in the metropolitan development processes, and do not constitute any significant supplies or sales markets. Furthermore, the regional surroundings have a greater significance in the provision of simple resources: low-processed goods, low-skilled workforce, services which do not require skilled staff or generally accessible information about information rather than processed resources. The development of the metropolis is largely based on local human resources, which are subject to local deconcentration occurring as part of the suburbanisation process. On the other hand, the non-local inflow results in the draining of human capital, mainly from its the regional surroundings. However, the survey findings also indicate that certain disparities exist in the economic relations connected with the flow of goods, people, capital and information between the researched metropolises and the regions surrounding them, depending on the regional context. Nevertheless, on the one hand, because of the socialist-era heritage and lower innovativeness potential, these processes seems still to be not as advanced in Poland and probably also other post-socialist countries as in many other Western European cities. On the other hand, the intraregional differences in economic potential between core cities and peripheries are much larger in Poland than in higher-developed countries, so the impact of the backwashing of processed resources to main cities is much more severe for regional surroundings.

The other research project (Hall, Pain 2007) was devoted to access interplay between globalization and polycentricity in eight mega-city regions situated in North-Western Europe based on advance producer service evidence. This study (Cf. Hoyler at al. 2008) revealed the concentration of highly advanced functions in prime cities that was

supported by dispersion of associated functions in wider mega-city regions (Zürich – Northern Switzerland) similarly to inter-urban linkages in South-East England, but without sectoral specialization that took place for instance in case of Randstad Holland. However in some other cases (i.e. Dublin, Paris) advance producers services remains highly concentrated and interlocked within metropolitan areas. Also Frankfurt plays a role of primate city mainly in national, European and global scale.

To sum up, some differences between these cases might be observed depending on city size and its function as well as the economic potential of regional hinterland. One should also have in mind that city-region relations are very complex and strongly depend on the regional context. This calls for further comprehensive and dynamic research focused on different types of regions.

Consequently, the research hypothesis that has been the subject of verification in the empirical studies was formulated assuming that the difference in the level of development between the metropolis (the city with its metropolitan area) and its regional hinterland (macroregion) has been increasing as a result of metropolisation processes. Furthermore, the following research questions addressing mechanism of these phenomena have been raised:

- Question 1) What is the impact of linkages between the metropolis and the region on the competitiveness of these territorial systems?
- Question 2) What factors affect the relationships between the metropolis and the region?
- Question 3) What factors determine the diffusion of metropolitan development and what is the spatial range of the backwashing of development resources in metropolitan macroregions?

In its first part, the report provides a review of classical and contemporary urban and regional development theories, placing a special emphasis on the implications for the city-region linkages. As the next step, a typology of such relationships is discussed, including their current situation and recent changes. In the empirical part, the zones of influence of the central/large city were defined, and a simplified delimitation of metropolitan macroregions in Europe was proposed. First, using a selected sample of these macroregions, the degree of intraregional disparities in terms of economic development and convergence processes was analysed. Then, other dimensions of intraregional disparities were identified (demographics, economic structure, labour market) and a typology of macroregions was created; it was used to generalise the conclusions concerning convergence processes for individual groups of regions. The subsequent chapter discusses the reasons for the observable intraregional disparities in

the level of development and factors which foster macroregional divergence. Finally, the last chapter, based on purposefully selected case studies (which were intended to portray extreme typological examples) is an attempt to supplement these quantitative analyses with other aspects, associated e.g. with the quality of human capital, level of innovation as well as mutual relationships between backwashing and spreading processes. These case studies analysis should allow us to answer the question what should be done to strengthen the positive effects of the metropolisation process and weaken its negative aspects for regional hinterland.

1. City-region relationships in light of selected theoretical approaches

In many classical and contemporary theories and concepts dealing with urban and regional development, we will find some aspects explicitly or implicitly discussing the relationships between the city and the surrounding region (Table 1). In the classical references, this issue is frequently limited to analysing mutual ties between cities and rural areas, or those within a hierarchical city system. In reality, processes accompanying the development of information economy can lead to obliterating the dichotomy between urban and rural areas, also because of the now made more facile popularisation of city lifestyles and increasing role of network linkages between cities from different hierarchical levels, which in turn calls for a new look at this phenomenon, particularly in highly developed countries. New concepts which have emerged from the theory of polarised growth and the network theory can be viewed as expressions of such a novel perspective.

Theory / theories	Types of relations between city and region	The role of region in city development	The role of city in regional development

Spatial interaction theories	Complementarity Intervening opportunities Transferability	Provides resources and serves as a market for goods and services	Provides resources and serves as a market for goods and services
Urbanisation theories	Evolution of regional settlement systems as result of agglomeration or deconcentration processes	Area of origin or destination for migrations depending on current tendencies	Area of origin or destination for migrations depending on current tendencies
Economic base theory	Basic and non-basic local activities of city	There is no distinction between regional hinterland and other export markets	Not applicable. Region is one of possible markets for goods and services.
Central place theory	Good and services provided by city for the region	The importance of city depends not only on local, but also regional demand. The city is central place for its hinterland.	Region depends on city.
Growth pole theories	Positive spread effects and negative backwashing effects	Region provides simple resources and labour	Capital investments, diffusion of innovations, but backwashing of human resources
Network theories	Network linkages a-hierarchical and not depending on distance between nodes.	Region does not play important role in city development unless there are nodes of regional network.	City as a centre of nodal region.

Table 1. City-region relations derived from selected theories
Source: Smętkowski (2007).

Among classical models of spatial interactions, we have Ullman's triad (1957) and a group of gravity potential models. The former is used to analyse the following three components: complementarity, intervening opportunity and transferability, all of which determine the ties existing between regions. Complementarity means that individual regions have access to different resources. Their surplus or deficit leads, respectively, to the creation of supply and demand, which in turn triggers exchange of goods between regions. An intervening opportunity means both being able to use supplies from various regions and to sell goods to them. This component is strongly associated with transferability, which refers to the impact of distance on the strength of linkages. On the other hand, gravity potential models mainly focus their analysis on distance and its reductional impact on the intensity of relationships. Interactions between two cities or regions are in direct proportion to their potential and in inverse proportion to the distance between them. The decreasing role of distance as a factor that determines linkages between cities and regions, which can be observed today, leads to a greater role of complementarity and intervening opportunity in the spatial interactions model, while in the gravity potential model the role of distance depends on a given spatial scale. Spatial interaction theories, being general in nature, fail to highlight in detail the linkages between the city and the region. This means that exchange of goods between the metropolis and the region is dependent on the differences in their economic structure,

their mutual attractiveness as sales and supply markets, and the role of distance in such an exchange.

In the light of urbanisation theory, individual stages of urbanisation processes and the attendant changes in the distribution of population in cities and their surrounding areas represent important phenomena for the city-region relationships. The starting point here is the definition of urbanisation, which is considered to be a cultural and civilisational process that is epitomised in the development of cities, their increasing number and surface area, growing concentration of population in cities and their direct vicinity, popularisation of sources of sustenance other than agriculture, acceptance for, and absorption of 'city culture': city standards, customs, etc., which leads to an increase in city population (Castells 1982). As part of this theory, the question of distinguishing individual stages of the urbanisation process is frequently tackled. For this, such measures as changes in the population of the city and its adjoining areas (treated collectively as a city region) are most frequently used (Table 2). The main thrust of these theories is that a process of the city's spatial development involves subsequent stages of concentration and deconcentration of the population, which, however, as a rule are taking place on a constantly increasing spatial scale. As a consequence of such cycles, and depending on whether concentration or deconcentration processes prevail, the city and its region either represent, vis-à-vis each other, a source or a target area for the migration of the population, which in turn affects both the spatial extent of the city and the forms of possible uses of the city space. In this context, Jałowiecki's definition of metropolisation (1999 p. 29) should be evoked: "*metropolisation is the final stage of urbanisation, consisting in the transformation of urban space and change of the relations between the central city and its direct environment, and in a non-discrete way of using urban space. It is manifested by a weakening or severing of the city's economic ties with its regional hinterland and replacing them with contacts with other continental or global metropolises*."

Stage of urbanisation process	**Type of process**	**Population changes**		
		Core	**Periphery**	**City-region**
1. Urbanisation	1.1. Absolute centralisation 1.2. Relative centralisation	+ + + +	- +	+ + + +
2. Suburbanisation	2.1. Relative decentralisation 2.2. Absolute decentralisation	+ -	+ + + +	+ + + +
3. Desurbanisation	3.1. Absolute decentralisation 3.2. Relative decentralisation	- - - -	+ -	- - - -
4. Reurbanisation	4.1. Relative decentralisation 4.2. Absolute centralisation	- +	- - - -	- - - -

++ large increase; + small increase; – small decrease; - - large decrease; the last column is a sum

Table 2. Stages of functional development of an urban region
Source: R. Drewett et al. (1992).

The economic base theory has not evolved into a uniform theoretical system. According to this theory, urban development depends on two factors: basic and non-basic activities. While the former refer to functions provided for the local economy, the latter, also referred to as city-forming functions, are provided for the external world. The latter type of functions can include exchange between the city and the region or its further external environment. In such a perspective, the region surrounding the city is only one of many potential markets for supplies or sales of goods and services.

On the other hand, the central place theory (Christaller 1933), which in some aspects could be regarded as a specific example of the economic base theory (cf. Preston, Mitchell 1990, p. 90) is the first of the theories discussed here which directly deals with the mutual relationships between the city and the region. According to this theory, the city is a centre that offers central goods to its regional hinterland. Such goods can include administrative, cultural, healthcare, trade and financial functions, as well as the labour market, transportation or telecommunication services. It should also be pointed out that the range of individual goods can vary. This concept also implies that the role of the city, that is its regional nodality, results from the degree of centrality for the regional hinterland. On the other hand, however, the region is not self-sufficient and is dependent on the city as its functional centre. At the same time, in the light of the economic landscape theory which is an elaboration of the central place theory as developed by A. Lösh (1961), we can expect a differentiation in the density of the population distribution and business activity, characterised by an alternate occurrence of sectors with many and few urban centres.

At the same time, when the city is treated as the centre and its hinterland – as the periphery (especially on a macroregional scale), the relationships between them can be highlighted using a group of theories widely referred to as polarised growth theories. The theories of growth poles, initiated by F. Perrox (1950), underline the role of motor units, from which specific centrifugal forces emanate and towards which specific centripetal forces are directed. For instance, A.O. Hirschman (1958) distinguished positive trickling-down effects and negative polarisation effects. Beneficial trickling-down effects result from the complementarity of activities undertaken between two poles (the developed one and the underdeveloped one), from purchases and investments coming in from the developed pole to the underdeveloped one, and from the absorption of hidden unemployment in the underdeveloped pole. Polarisation effects are generated by the

existence of a competitive advantage in the developed pole and the draining of qualified personnel from the underdeveloped region. On the other hand, G. Myrdal (1957) distinguishes centrifugal progressive spread effects and centripetal regressive backwash effects. The growth pole theory has found applications in different areas, and distinguishes various types of polarisation: technological, income-related, psychological and geographical.

When we analyse the impact of such effects on the hierarchical settlement system, we can expect that they will result in a transformation of the traditional structure of central place. This process is anticipated to involve such elements as the taking over of functions typical of lower-order centres by the central agglomeration and the formation of the so-called 'shadow of the metropolis'. At the same time, as S. Sassen (2000) observed, contemporary development trends are leading to the emergence of new forms of centrality, which are expressed in the expansion of the centre beyond the traditional business centre, to include other nodes situated within the metropolitan area of a large city.

To sum up, this concept can be directly transposed to the interdependency between the metropolis (centre, growth pole) and the region (periphery), in which positive centrifugal spread effects following the development of the growth pole can be observed (mainly in the form of capital and innovations) as well as negative centripetal backwash effects whereby the periphery (region) is stripped of simple resources and labour, particularly highly-skilled personnel.

Similarly to the theory of polarised growth, there is no comprehensive network theory (e.g. Glucker 2007). The main tenet underpinning this group of theoretical approaches to the settlement system is that hierarchical relations between cities as shown in the central place theory give way to a new generation of systems – city networks. Such networks develop when two or more cities that have been independent before but have complementary functions are trying to cooperate, and on the whole manage to merge their economies, a process which is enhanced by fast and reliable transport corridors and telecommunication infrastructure (Batten 1995). American researchers (Fishman 1990) tend to depart from the terminology related to the central city and suburbanisation processes and introduce 'new cities' instead – urban regions which are characterised by the absence of a distinct centre/central node and boundaries, and which are developing along the transport corridors connecting urban centres. As a result of accelerating such linkages, the relationships between cities lose their hierarchical character and become horizontal network ties.

Territorial organisation	Network organisation
Centre, periphery	Nodes, tendency to decentralise mutual linkages
Size-dependent	No dependency on size
Boundaries	Connections
Coherence, continuity	Dispersion, separation
One- directional flows	Two-directional flows
Closedness, outward impermeability	Territorial openness
Constancy, inelasticity	Short-lividness, flexibility
Proximity, location ties – transport costs	Insensitivity to distance, omnipresence – costs of information
Territorial hierarchy, vertical links, dominance of size	Horizontal links, cooperation and competition

Table 3. Selected differences between territorial and network organisation of space
Source: based on B. Jałowiecki (1999).

The key differences between territorial and network organisation can be summarised as follows (Camagni 1994, Batten 1995, Minar 1997, Jałowiecki 1999). Firstly, there is an observable departure from the distinct spatial delineation of the centre and the periphery, and the dependence of linkages on the size of the city centre and its economic significance; instead, we have decentralised linkages concentrated in network nodes, which occur between urban centres of varying sizes. Open, continuous areas which are separated from one another by distinctly marked boundaries, between which one-directional flows used to take place, are losing in significance whereas the significance of horizontal ties between dispersed locations is growing. The constancy and inelasticity of mutual relationships in internally closed regions (which are strongly dependent on distance) is superseded by short-lived, flexible relationships between open systems lying far from one another. In consequence, the hierarchy, vertical linkages and the dominance of size are replaced by the network, horizontal linkages, cooperation and competition.

As P. Korcelli observed (2000), increased significance of non-hierarchical interaction networks within a system of cities leads to the fragmentation of traditional urban systems. As a result, the ties between the city and the region become dependent on the existence of the network's nodes in the proximity of the city. Nevertheless, due to the building of strong ties with other large nodes of the network, the role of the region in urban development is waning. On the other hand, the city is the main node of the network which consolidates the surrounding region. In this particular approach, small and medium-sized cities are of special significance as potential nodes of such a network (cf. ESPON 2006; INTERREG 2005).

Spatially dependent transaction costs Externalities	Uniformly low	Heterogeneous	Uniformly high
Low	1. Spatial entropy	2. Random dispersal combined with emerging Loscherian-Weberian landscapes	3. Loscherian-Weberian landscapes
High	4. Small interconnected clusters	5. Super-clusters	6. Small disconnected clusters

Table 4. Distribution of business activity depending on: a) spatially dependent transactions, cost-related, and b) externalities
Source: Scott (1998 p. 87).

The rise of new theories drawing on the network approach does not mean that they can absolutely explain the spatial relationships in any regional or settlement system. There is little doubt that we can still find many examples of territorially organised settlement systems, as well as systems where territorial and network organisations are intermingled. For example, A. Scott (1998) offered an interesting typology of the spatial location of business activity in contemporary economy based on such dual spatial organisation. This typology takes into account both distance-dependent transaction costs and externalities, which can result from the adopted way of information exchange and information flow, as well as factors of a socio-cultural nature. On this basis, six model situations can be distinguished, including, on the one hand, low and high externalities and on the other hand - uniformly low, heterogeneous and uniformly high spatially dependent transaction costs (see p. 87). According to Scott, the model of heterogeneous transaction costs and high externalities is currently the most popular one; it involves a differentiation of transaction costs (which, for example, are barely visible in the case of foreign currency exchange, and are relatively high if there is a need for direct, personal contacts) and high external effects related to the post-Fordist system of the organisation of production. With a sufficiently high vertical disintegration of enterprises, clusters will emerge in order to reduce transactions costs. On the other hand, low costs of some transactions enable enterprises to have access to the resources and sale markets on the global scale. In consequence, this may foster a speedy development of the local systems in which those enterprises operate. And that, in turn, leads to the emergence of a large number of such local-global super-clusters, otherwise known as metropolises. These observations are support also by selected empirical studies (i.e. Gordon, McCann 2005).

2. Types of relationships between the city and the region

The basic assumption underlying our line of argumentation is that the relationships between the city and its surroundings are expressed by two categories of flows: periodic–variable flows (e.g. commuting to work), and constant–permanent flows (e.g. internal

migrations). Permanent flows are constituents of transformations in a given spatial system, while another constituent of transformations includes internal changes in a given system, such as population increases or changes in the number of enterprises.

It should be emphasised that developing a consistent typology of mutual relationships between the metropolis and its region involves many challenges owing to the multitude of dimensions in which such linkages can be analysed. Among those dimensions, two major ones can be distinguished:

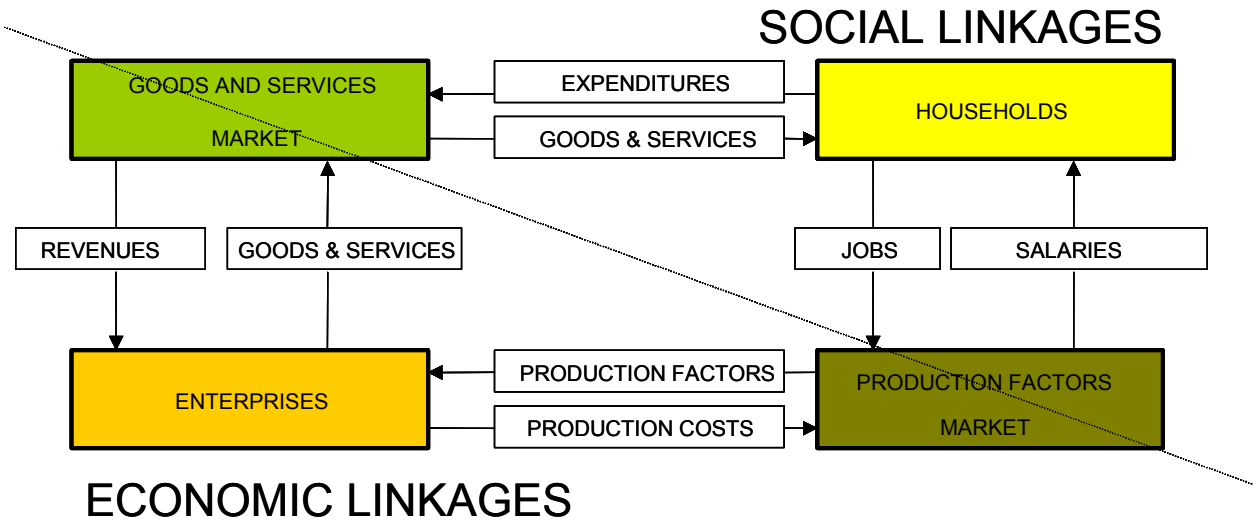
- Sectoral dimension (which inter alia includes the enterprise sector, the household sector and the public sector);
- Material dimension (which includes flows of goods, information, population as well as financial flows).

To the above, another two universal dimensions should be added: time one (which takes into account changes of flows in time, as well as their durability) and spatial one (which takes into account different spatial ranges of the linkages, and on the other – linkages between different regions).

Social and economic components which make up the metropolis-region system can be divided into the following: the enterprise sector, the household sector and the public sector, plus capital flows and trade exchange with the external environment. In traditional input-output analysis, intersectoral flows within one region including **(Hoover 1980, pp. 224-227)**. material flows of goods and services between individual sectors are associated with cash flows going in the opposite direction **(Figure 1)**. The main object of analysis is the enterprise sector where inter-branch exchange is taking place. Sales outside the enterprise sector represent the final demand, which comprises consumer goods purchases made by households, demand in the public sector, investments and sales outside the region, which we have termed exports for the purposes of this paper. On the other hand, purchases outside the enterprise sector represent basic supply which includes workforce, capital resources and purchases outside the region, which we here have called imports.

As regards the placement of individual systemic components vis-à-vis the region-the external environment model, in this approach only the enterprise sector is confined to the region; the public sector and capital flows go beyond the region’s boundaries. In addition, this can also apply to the household sector, depending on how the boundaries of a given region are delimited (dotted line in the diagram).

Figure 1. Social and economic linkages between enterprise sector and household sector



Source: prepared by the author.

The above model can be made even more specific for two sectors which are of greatest interest to us, viz. the enterprise sector and the household sector. The linkages that we refer to as economic ones will take place between the enterprise sector and the production factors market (with purchases of production factors corresponding to the production costs of a given enterprise), and between the enterprise sector and the market for goods and services (with sales of goods and services corresponding to the revenues of a given enterprise). On the other hand, the linkages that we refer to as social ones will occur between the household sector and the factors of production market (remuneration for work), and between the household sector and the market for goods and services (purchases of goods and services). This directly implies that a given phenomenon (such as for example commuting to work) may simultaneously be a manifestation of economic linkages or of social linkages, depending on whether we look at it from the perspective of the enterprise sector, or that of the household sector.

Inclusion of the spatial dimension into the classification described above produces a result shown in **Table 5 and Figure 2.** Individual, hypothetical relationships taking into account various types of flows (in the definition of which classifications of ties between urban and rural areas discussed in **SPESP (2000, pp. 38-41)** and **ESPON 1.1.2. (2004, pp. 86-90)** have been used), have been ascribed to a spatial-sectoral matrix (city, region and enterprises, households, public sector, respectively).

Region City	*1. Enterprises*	Households	Public sector
2. Enterprises	Relocation Exchange	***Work*** Consumption	Purchases Services
Households	***Work*** Consumption	Permanent migration Consumption	***Work*** Services
Public sector	Purchases Services	***Work*** Services	Cooperation Competition

Table 5. Types of intersectoral relationships in the city-region system.
Source: prepared by the author.

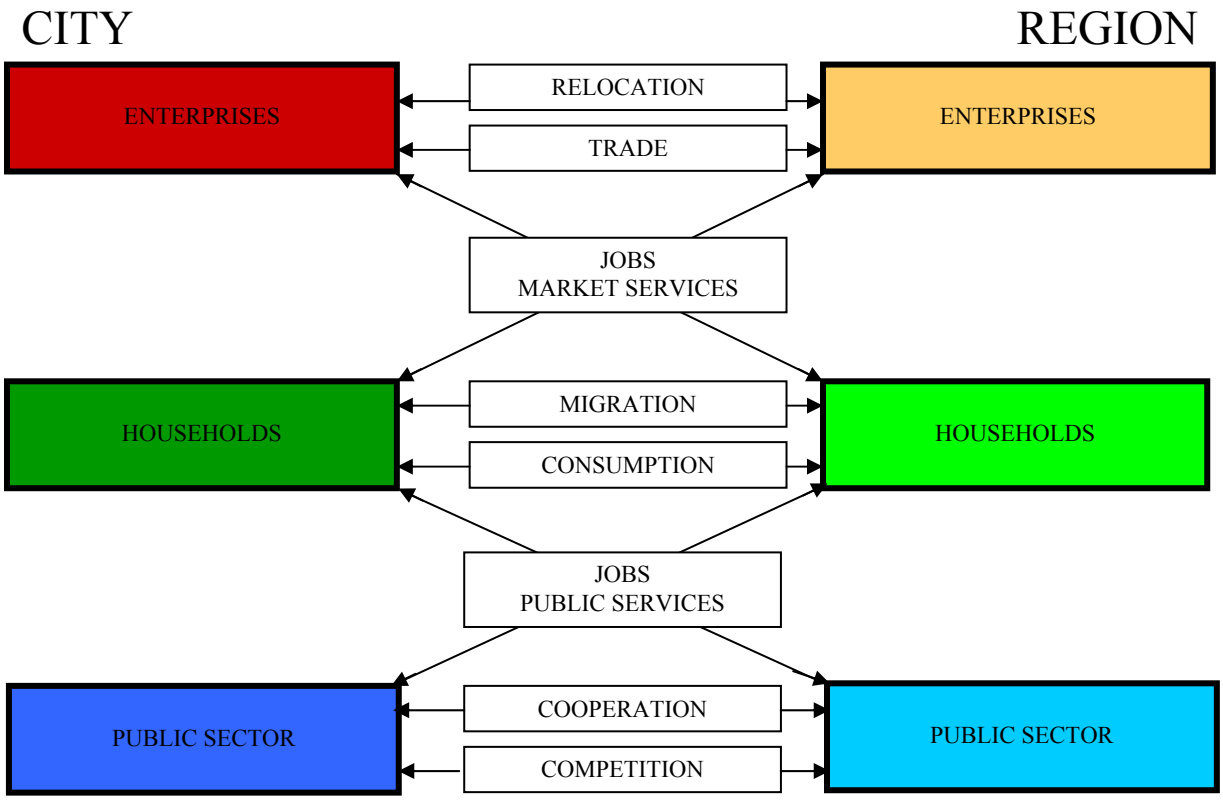


Figure 2. Key types of intersectoral linkages in the city-region system
Source: prepared by the author.

Enterprise-enterprise relationships

In recent years, there has been an observable tendency for a regional deconcentration of business activity (particularly industry-related). Studies conducted in the United Kingdom

by **D. Keeble and P. Tyler (1995)** showed that employment in production enterprises located in rural areas grew faster than in cities. Among the reasons for deconcentration in industry, the authors named such factors as: attractive living and working conditions, new sales markets and lower operating costs in rural areas. In metropolitan areas of large cities (e.g. Copenhagen - **Winther, Hansen 2006**), this is mainly related to soft location criteria associated with quality environment and living conditions, whereas business operations in these areas mainly aim to provide services to the local residents and local enterprises. Shifts between urban and rural areas are taking place mainly due to changes which occur *in situ*, and only to a lesser extent are they connected with relocation of business activity and establishment of new enterprises **(Healey, Ilbery 1985)**. It should also be emphasised that relocation connected with the influx of inward capital, given all types of attendant multiplier effects, can have a significant impact on the development of local systems, which in many cases can be greater than stimulation of - frequently limited – local resources **(Smętkowski 2000)**.

Exchange of goods and services is undoubtedly among the major types of relationships existing between metropolitan and regional enterprises. Owing to differences in the economic structure and in the accessibility of various resources in the city-region system, there can occur mutual complementarities arising from differences in the supply and demand. As a rule, metropolitan enterprises produce goods with a higher added value component, which can then be sold to regional enterprises (e.g. **Gorzelak, Smętkowski 2008**). In many cases, metropolitan enterprises also act as intermediaries in the trade exchange between the metropolitan region and the external environment. In addition to that, certain types of services offered by enterprises operating from a metropolis, such as banking, insurance, consulting, advertising, public relations, etc., can be offered to regional enterprises. On the other hand, as distance from the city centre grows and real property prices fall (reduced land rent), the role of traditional labour-intensive sectors of business activity, which produce goods with lower added value, increases. Here, agriculture is an interesting example as one of the key activities pursued in rural areas situated in metropolitan regions, especially when we consider the area occupied for farming purposes. Modern, market-oriented farming can have multifaceted links with city centres. Firstly, rural areas can perform a feeding function vis-à-vis the metropolis by providing foodstuffs for its residents. Nonetheless, as huge shopping centres operating as part of global retail networks appeared, the role of local farming was significantly curbed. The traditional model of land use proposed by J. H. Thűnen has been replaced by a more sophisticated model of mutual dependencies. Although rural areas remain food suppliers, the interdependency expressed by the distance between the place of production and the place of sale has been largely constrained. Moreover, areas under intensive agriculture are losing their rural character and turn into zones of quasi-

industrial farming production, with all the negative consequences of the process, mainly environmental pollution **(e.g. Tacoli 1998, p. 159)**. Another type of linkages is the supply of minerals (needed in power and construction sectors) to metropolitan enterprises, which may be mined in rural areas, also those situated in a metropolitan region.

Enterprise-household relationships

This type of linkages is considered to be the cardinal component of all relationships between the city and its surroundings, and can be quite varied in character. Firstly, city residents who have moved out of the city to a place within the boundaries of the metropolitan area or even beyond, still work in the city. This largely depends on the spatial and housing policy addressing rural areas around the city. Secondly, residents of the surrounding region account for a considerable part of the city's labour market. As regards movement in the opposite direction, such linkages are few and far between, as a rule being associated with the deconcentration of economic activity (which is usually contained within the boundaries of the metropolitan region) and commuting of highly qualified specialists to regional enterprises. Both the strength and the scale of such linkages depends on the spatial accessibility of areas surrounding the city: the higher the accessibility the stronger and wider the linkages. Such relationships largely determine the boundaries of the functional urban region (metropolitan area), although they can also reach beyond it. At the same time, the metropolitan area acquires an increasingly polycentric character, demonstrated in multi-directional flows between individual centres **(Aguilera 2005; Hall, Pain 2008)**.

Certain types of services undoubtedly have a natural tendency for concentration in places which are referred to as central – as claimed by the central place theory. Cities which supply the surrounding areas with services can be regarded as such central places. Such centrally-provided services can include finances (banks, insurance companies), education (higher education institutions and – to a lesser extent – secondary schools, training centres), R&D (research institutes, universities, laboratories), healthcare (hospitals, outpatient centres), retail trade (shopping centres) and culture (cinemas, theatres, libraries, culture centres), etc. Owing to a lesser value of the lower threshold (minimum supply), some of these services can be located in smaller city centres (lower-order central places), rural areas or – due to good accessibility of a given location and lower operating costs – outside the metropolitan centre. According to the central place theory, the system of central places tends to increase the level of hierarchisation. Many types of services require a heavy demand and a high turnover. For this reason, when certain areas (rural areas and smaller cities) become depopulated, they become less attractive for the providers of such services.

The development potential of small and medium-sized cities in the vicinity of big metropolises is a serious problem. Naturally, some of them use the proximity of a large city to their advantage, for example due to an inflow of both residents and capital. This is especially the case when such cities can offer easily accessible, cheap land for investments, a situation most frequently encountered in development corridors connecting metropolises. In consequence, some of these cities become incorporated by the polycentric metropolitan area. Conversely, further located small and medium sized cities have a lesser potential for growth. Instead, they can compete by offering better living conditions, and attracting the location of residential estates and certain types of business activity. For instance, surveys of medium-sized cities (with 20,000-100,000 population) lying in the vicinity of large urban centres in Germany **(Adam 2006)** indicated that they tend to preserve their functions and serve as commuting centres, although they depopulate at a faster rate than larger cities.

On the other hand, rural areas surrounding the city play an important role in satisfying those needs of the residents which are connected with recreation and leisure. Some of rural areas situated near big metropolises are being transformed into aggressively developed recreational areas (golf courses, amusement parks, etc.). In areas lying still further away, collective and individual recreation amenities are being developed, such as hotels, pensions and so-called 'second homes'. This process can lead to the transformation of rural areas into areas of intensive consumption. On the other hand, spatial policies pursued by the authorities often aim to counteract negative aspects of suburbanisation and attempts to preserve open, undeveloped areas. In such territories, there are restrictions concerning permissible development and less intensive recreation and leisure functions are encouraged.

Household-household relationships

Relationships between households in the metropolis and those in the region are mainly associated with permanent migrations. Very frequently, the metropolis is viewed as an attractive place for working and living by the region's inhabitants. This results in an outflow of such people, mainly those who are best educated, to the regional centre **(Gorzelak, Smętkowski 2008)**. On the other hand, examples of some inverse processes could be found, such as an efflux of residents from the metropolitan centre, usually confined within the boundaries of the metropolitan area in the case of working age population, and also beyond it – in the case of post-working age residents who frequently use their 'second homes' for this purpose.

The relationships between the metropolis and its region associated with consumption in the household sector are contemporarily of a minor significance. On the one hand, they can include travels of the region's inhabitants to the metropolis, for example with a view

to selling their agricultural produce in marketplaces. On the other hand, this can be connected with agri-tourism stays of metropolitan residents in locations within the metropolitan region.

Public sector – enterprise relationships

When providing services and delivering investment projects, public authorities may opt to use the enterprise sector. Nonetheless, it is difficult to narrow down the extent of the flow of services offered by enterprises to public authorities by metropolitan and regional enterprises. Undoubtedly, in most cases orders in their majority are delivered by local companies which often act as subcontractors of the executed investment projects (cf. e.g. Smętkowski, 2004). For this reason, the attendant public expenditure is not regarded as a significant component of linkages between the metropolis and the region.

Public authorities can also provide various services to enterprises, mainly through an indirect development of business environment institutions. In most cases, such activity is aimed to support local enterprises and does not play any important part in the relationships between the metropolis and the region.

Public sector – households relationships

Relationships associated with commuting to work in the public sector are similar to those which occur in the enterprise sector. However, their role is smaller, also because of the diminishing role of public ownership in the economy.

Furthermore we can mention services for the residents of the metropolis and the region which are provided by the public sector in the same way as they are offered by the enterprise sector. Examples include public higher education, high culture or specialised health care institutions, which are normally located in the metropolis, offering such services for the inhabitants of the metropolitan region. As regards the opposite direction, we can indicate tourist information centres, museums, etc., which operate in the metropolitan region and service tourist traffic largely composed of metropolitan residents. The typical linkages are similar to those discussed on the occasion of the enterprises-households relationships in the category of consumption.

Public sector – public sector relationships

Both the scope and extent of cooperation between local authorities can vary, starting from the development of transport infrastructure and public communication, through environmental protection to spatial development. Structurally speaking, various facilities belonging to transport, telecommunication and power infrastructure are located in areas surrounding the city, which connect the metropolis via a network with other metropolitan centres. This leads to the development of infrastructure corridors and in turn can trigger fragmentation of rural areas. As people need to commute to work, public authorities

must ensure accessibility of public means of transport having a sufficient quality. Thirdly, dumping sites for various types of waste are located in rural areas, ranging from relatively non-noxious municipal waste to highly noxious industrial waste. In addition to that, air and water pollutants can migrate easily, which necessitates cooperation in the sphere of environmental protection between different administrative units. Moreover, aforementioned processes related to changes in the distribution of population and enterprises call for joint spatial policy actions. As the example of such projects as Randstad Holland show us, such actions can be highly effective (Geurs, van Wee 2006). We can also observe processes to consolidate power structures in areas surrounding the city, as a result of which various organisations are set up to manage and administer those areas (regions, metropolitan areas, metropolitan unions); they are able to launch effective activities aimed to embrace the opportunities and counteract threats posed by globalisation (e.g. Scott, Agnew, Soja, Storper 2000, Stephens, Wikstrom 2000).

In addition to collaboration, local systems are engaged in competition in basic two aspects. The first of them refers to competing for investments. Public authorities can use a whole array of direct and indirect instruments in order to persuade potential investors to locate their investment in their area. Secondly, they can compete for inflow of residents. To be effective, they need to ensure attractive living conditions, inter alia by improving the quality of public services on offer. Thanks to incoming investments and new residents, their revenues grow, which as a rule will generate many positive feedbacks.

3. Metropolitan macroregions and their constituent parts

3.1. The regional hinterland – a tentative definition

As a matter of course, a city, especially a large one, cannot be viewed as an isolated point in geographical space. With the help of spatial, morphological or functional analysis, we can distinguish different zones relating to how the city influences its surroundings. It should be emphasised that there exist many, sometimes strikingly dissimilar, concepts for delimiting the city region, which is largely due to different definitions of the concept in hand, and to the existence of different impact zones of the city. As a result, the criterion for assessing the correctness and objectivity of a given method for delineating metropolitan area is largely a consequence of the adopted theoretical approach. There can be little doubt, however, that the range of the city's impact depends on the size and function of the city in question. Depending on the adopted measures, we can come up with a number of city impact zones which will differ in both object and range. On the basis of a review of relevant terminology, we can distinguish two main zones of city impact: zone of direct impacts in which the relationships are both fixed and strong (*Umland* in German) and zone in which the relationships are less vigorous or exceptional (*Hinterland* in German) **(Schöller 1953; Boudeville 1966)**.

The former includes the suburban zone, that is the area adjoining to the central city's build-up areas, which is normally identified using the morphological criterion. In addition to open areas, the zone is made up of villages, towns and hamlets; it is a territory with different types of development, unstable in physiognomic, functional and demographic terms, where both the forms and the substance typical of the city and rural areas tend to intermingle. This is a multifunctional space, with the number and nature of its functions being dependent on the development stage and functional structure of the city. The following can be regarded as suburban zone functions: agricultural, recreational, residential, municipal, communication, industrial, spa and academic. From the perspective of regional and national settlement systems, the suburban zone forms a part of the urban agglomeration, which also comprises the city's central and external districts. This zone is most seriously exposed to urban sprawl, a phenomenon which is commonly observed across the world, Europe not excluded (Schneider, Woodcock, 2008). It can also be noticed in EU's new member states, until recently socialist countries (e.g. Jauhiainen 2006), as well as areas undergoing a demographic downturn (e.g. Couch et al. 2005). The reasons underlying this process are universal, and relate to a greater interest of potential investors in new investment areas, recultivation of brown fields,

location of huge shopping malls outside city centres, and housing aspirations of inhabitants who wish to own a house in the suburbs.

It should also be observed that the suburban zone, with its close ties with the city, has a more narrow range than the city's impact zone, the boundaries of which are delimited by the spatial extent of various functions performed by the city. Based on the functional criterion, two zones of city impact can be distinguished: one where the ties are strong and durable, that is the entire metropolitan zone, and one which has much weaker ties with the city while remaining within its impacts - that is the metropolitan region.

A metropolitan area can be defined using the spatial distribution of mutually interdependent production, consumption, exchange-related and administrative activities (Castells 1982). Metropolitan functions are performed by the entire metropolitan region (and not only by its constituent city) and can be located in various places. As a result, the metropolitan area is not entirely homogeneous and consists of a mosaic of spaces, each with a different function, but at the same time is characterised by a robust internal integrity. According to J.B. Parr (2007) four dimensions of such metropolitan area might be distinguished: built city, consumption city, employment city and workforce city constituted by commuting to work. Its terminological equivalent is a functional urban region or functional urban area (ESPON 1.1.1 2004), that is an area having functional ties with the city. In the functional urban region, daily commuting which has replaced regular movements of the population represents the main category of linkages. In addition to that, other linkages associated with the flow of goods, capital and information can be observed in the region, whereas the diffusion model of social, economic and technological phenomena is not hierarchical in nature. The functional urban region defined in this way largely corresponds to the city-region in the economic base theory, the local system in the settlement system theory, and the urban fields in spatial-interaction theories.

On the other hand, the notion of the metropolitan region was introduced by R. McKenzie (1933), who combined the city and its hinterland in a functional whole delimited by the range of the dominant impact of the metropolis. The central city with its institutions and services that extended to the entire region and tied it with other regions, was the centre of functional linkages. Among such services, the major ones were: press, communications, finances, management, as well as specialised trade functions and professional services. Just as in the case of the urban functional region, in certain aspects its terminological counterpart is the functional macroregion, the extent of which can be identified using such tools as for example impact analysis of competitive cities. For instance, studies examining the range of such impacts which were conducted in France

also looked at different types of impact (economic, cultural) and, consequently, their different ranges of extent (cf. Maik 1997).

Here, we would like to quote the definition of a polarised region, formulated by J.R. Boudeville (and cited after: Grzeszczak 1999, pp.18-20), whereby such a region is a "hierarchical entity made up of the metropolis, its satellites and rural areas dominated by them. It is a heterogeneous space, the different parts of which are mutually complementary and maintain a more intensive exchange between them, and particularly with the dominant pole, than they do with the poles of the same order from the neighbouring regions. As such, it is a place for exchange of goods, services and information, whose internal intensity at any given point is higher than external intensity. A polarised region is an integrated entity, and its not an autarky – it is a system." The author contrasts polarised regions with urban regions, "which represent a generally uniform space, marked by a high population density, high employment in industry and services, varied forms of non-discrete urbanisation, interspersed with farming enclaves. Hierarchical structures are dystrophic, giving way to strongly integrated structures characterised by functional interdependencies." Although J.R. Boudeville set his definitions in a historical context, they could also well be transposed to a spatial context. As regards the terms mentioned above, the first definition should be ascribed to the metropolitan region (nodal region), while the second – to the metropolitan area (region which is largely homogeneous).

To sum up, in light of the spatial extent of the city discussed above, the notion of the metropolis should be viewed as equivalent to a system composed of a centre and a metropolitan area. Among others, this is associated with the blurring of centrality as part of a metropolitan system. In many metropolises, the economic centre is no longer clear-cut, as a result of the process whereby satellite centres are created, interconnected by a network of strong functional ties with the main metropolitan centre **(e.g. Sassen 2000, Hall, Pain 2007)**. In this way, a polycentric metropolitan area emerges, which comprises the metropolitan centre (central city) and the adjoining, densely populated areas, and has strong ties within the network. On the other hand, a metropolitan macroregion is Boudevillean 'polarised region' – a region influenced by the city, the boundaries of which are limited by the range of impact of other metropolises. In this approach, a metropolitan area constitutes the internal hinterland zone for the city, and the metropolitan macroregion – the external hinterland zone.

3.2. Selection of metropolitan and urban regions for the purpose of city-region analysis

This part of the paper presents a methodology for the selection of metropolitan and urban macroregions for the purpose of city-region analysis. The final outcome, based on

NUTS3 regions for the ESPON space, is a "technical typology" of regions enabling a selection of metropolitan areas and their regional hinterlands for further analysis. Using NUTS3 units allows to avoid data availability constraints at city and larger urban zone levels. Furthermore, this enables us to analyse the situation in regional hinterlands of large cities.

The following types of spatial units have been adapted to city-region relationship analysis:

- metropolitan/urban area, in which ties between the city and its surroundings are strong and permanent, and which has been approximated by a Larger Urban Zone as defined by the Urban Audit,
- metropolitan/urban macroregion that covers territories under the prevailing influence of the city, limited by the impact of other cities at a similar hierarchical level.

Approximations based on NUTS3 units, especially those concerning the delineation of metropolitan macroregions, are obviously a large simplification. Among the weaknesses of this approach, the following might be indicated: significant differences between adjusted metropolitan macroregions depending on statistical divisions in individual countries, neglecting of functional ties between territories, necessity of raw estimations in case of densely populated areas with a polycentric settlement pattern. However, other possible solutions based on smaller units are affected by insufficient availability of socio-economic data. Furthermore, in order to obtain long-term data series, NUTS 3 delimitation from 2003 instead of the new NUTS 2006 has been used.

The following general assumptions, underlying the identification of metropolitan and urban regions, have been applied:

- The importance of the city grows to some extent with the city size in terms of population,
- The influence of the city is decreasing with the distance from the city centre,
- The administrative borders of upper-tier administrative units (NUTS0, NUTS2) to some extent affect delimitation of metropolitan macroregions.

These assumptions are based on gravity potential models that, at least to some extent, relatively well illustrate relationships between the city and its region. However, these assumptions will be under investigation in the second part of this analysis, based on selected case studies. On the other hand, application of upper-tier administrative units as one of the criteria to separate different hinterlands reflects an attempt to adjust this division to socio-economic reality. For instance, among the advantages of NUTS2 units one may indicate that these regions reflect (depending on the country): real ties between territories as a result of an analysis conducted for their delineation; historical provinces that still constitute different types of relationships; geographical barriers (like mountains,

rivers, etc.) that affect these relationships. Furthermore, there are self-government authorities responsible for socio-economic development at this level in some countries. Regarding national borders, despite transborder integration processes, one should have in mind that these are still important elements not only of the legal and administrative context of regional development, but also of socio-economic ties between territories as well. This analysis would not combine city-regions relationships with transborder interactions, because this would require a different methodology.

Other established operational rules and criteria reflect to some extent the principles applied in previous studies, such as the following:

- Identifying European metropolitan and urban regions based on the Urban Audit's Larger Urban Zones (DG Regio, 2008),
- ESPON 1.4.3. Study on Urban Functions (2007),
- ESPON 3.4.3. The Modifiable Areas Unit Problem (2006).

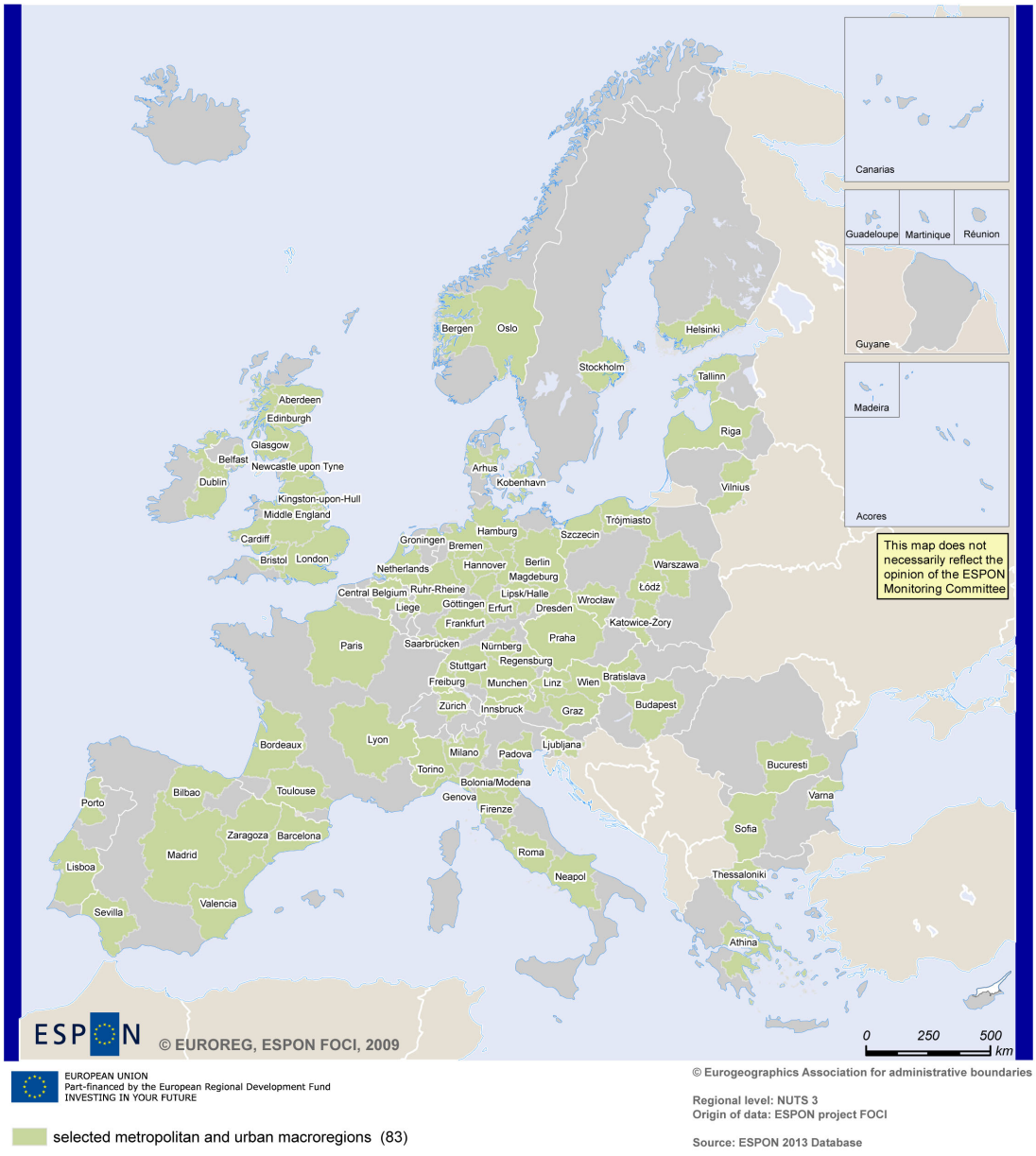


Figure 3. Metropolitan and urban macroregions selected as a sample for city-region analysis
Source: prepared by the author.

Based on these assumptions and remarks, the first step of this research has been to define metropolitan and urban areas (MA) based on the comparison of Urban Audit Larger Urban Zones (LUZ) and EUROSTAT population data for NUTS3 regions. The following basic rules have been applied: minimal size of LUZ (over 250,000 inhabitants),

correspondence between LUZ and NUTS3 (threshold of 70% share of population) and combination of neighbouring metropolitan areas into polynuclear metropolitan areas (maximum distance 60 km). In the next stage the regional hinterlands (RH) for such metropolitan and urban areas (MA) have been delineated using surrounding NUTS 3 combination approximations. Another set of rules has been applied here: neighbouring regions (direct neighbours and maximum distance), predominance of larger metropolitan area regions (ratio 3:1) and separate hinterlands. (**Annex 1)**
Using these rules, we distinguished 83 metropolitan/urban macroregions **(Figure 3)**. Owing to the specific characteristics of the respective administrative divisions, both the number and the surface area of these macroregions varied depending on a country.

In effect, it should be noted that the analyses were carried out on a sample of macroregions whose selection was largely dependent on the specific natures of the national settlement systems, delimitation of LUZs in the Urban Audit, and the NUTS3 administrative division. It should be acknowledged, however, that despite leaving out some large urban centres, such a sample should be sufficient to show the diverse relationships between the metropolis and the surrounding region.

All the identified macroregions were accepted for further analyses. However, we should emphasise considerable differences between them, which can have a bearing on the results obtained (**Annex 2**).

	Macro-regions	Metropolitan areas (MA)	%	Regional hinterlands (RH)	%
Area [sq km]	2 105 077	473 612	22.5	1 631 466	77.5
Population 1995	330 127	177 768	53.8	152 359	46.2
Population 2004	338 132	182 744	54.0	155 388	46.0
Population density (inh/sq2)	161	386	-	95	-
Population change 95-05 (1995=100)	102,4	102,8	-	102,0	-
GDP 95 [EUR]	5 531 133	3 330 141	60.2	2 200 992	39.8
GDP 04 (constant prices 1995) [EUR]	6 915 492	4351797	62.9	2 563 695	37.1
GDP change 95-04 (1995=100)	125.0	130.7	-	116.5	-

Table 6. Basic information about macroregions and their constituent parts
Source: prepared by the author.

The analysed macroregions are inhabited by nearly 340 million population and altogether occupy an area in excess of 2 million km^2, of which about 1/5 were metropolitan areas, and the rest formed their regional hinterlands. The demographic situation was different,

with over a half of the population living in the core areas, and the dynamics of growth in the researched period (1995-2004) visibly led to a strengthening of this trend. At the same time, metropolitan areas generated over 60% of the macroregional GDP, and its rate of growth was much higher than in the case of the regional hinterland. It should be borne in mind, however, that the GDP in question is expressed in EUR, which means that the overall picture can be affected by the disparities in the development rates between individual countries, as will be discussed in detail below.

As already indicated above, the analysed units are considerably varied **(Table 7).** An average macroregion occupies an area of 25 000 km^2 and is inhabited by 4 million population, which corresponds to the average population density of 182 inhabitants per km^2. Nevertheless, whilst the number of the population in an average macroregion was stable over a 10-year period, its GDP expressed in EUR increased on average by over 30%. Significant differences could be observed between the analysed macroregions, expressed by the coefficient of variation (CV): the widest in the case of GDP (ranging from 573 billion to 1.5 billion EUR), but also considerable in the case of the population (oscillating from 21 million to 0.5 million inhabitants). The dynamics of economic development was also strongly diversified, with real GDP changes ranging from a 1.3% decrease (Bergen) and a 201.4% increase (Vilnius). The demographic development was more stable, with a 6.7% fall (Leipzig/Halle) or a 14.7% increase in the population (Valencia) in the extreme cases.

Indicator	Area [sq km]	Population density (inh/sq2)	Population 1995 [`000]	Population 2004 [`000]	Population change 95-05 (1995= 100)	GDP 95 [mln EUR]	GDP 04 (constant prices 1995) [mln EUR]	GDP change 95-04 (1995= 100)
Metropolita/Urban macroregions								
Average	25362	182	3977	4074	101,8	66640	83319	134,8
Max	105954	555	20315	21004	114,7	457761	573105	300,1
Min	3658	16	486	503	93,3	1044	1479	98,7
SD	18850	119	3929	4050	4,4	85290	107980	32,7
CV	74	65	99	99	4,3	128	130	24,2
Metropolitan areas								
Average	5706	443	2142	2202	102,3	40122	52431	143,9
Max	17612	1951	12182	12800	115,0	339308	413934	355,3
Min	797	29	270	274	92,7	580	999	95,2
SD	3941	356	2441	2511	4,7	57823	76005	43,1
CV	69	80	114	114	4,6	144	145	29,9
Regional hinterlands								
Average	19656	121	1836	1872	101,2	26518	30888	119,6
Max	97926	350	8443	8705	119,3	130142	159171	170,0
Min	1079	6	108	107	90,8	464	479	93,4
SD	17005	84	1659	1720	4,8	30642	35788	14,3
CV	87	69	90	92	4,7	116	116	12,0

Table 7. Differences between macroregions and their constituent parts
Source: prepared by the author.

The constituent parts of the macroregions were as strongly diversified, slightly more so in the core areas. An average core area occupied an area of 5 000 km^2 and was inhabited by over 2 million people, with the population density of 440 inhabitants per km^2. In the period in question, the population of such areas increased by 2.3%, and the GDP grew by 43.9% - a considerably better result than in their regional hinterlands, where the number of the population increased on average by 1.2%, and GDP was 19.6% higher (in constant prices). A typical regional hinterland occupied nearly 20 000 km^2 and had a population of 1.8 million, which meant a density of 121 inhabitants per km^2, that is still more than the average population density in EUR27+CH+NO.

3.3. Conclusions

The macroregions' sample selected for analysis was strongly varied in terms of area, population and GDP values. This was true for macroregions as a whole and for their constituent parts, i.e. metropolitan regions and regional hinterlands. It means that the results are strongly dependent on the regional context, which implies the need to carry out the analyses in the form of case studies which would complement the statistical surveys of the macroregions undertaken at the European level.

The demographic situation of the regions in hand was relatively stable when set against marked differences in the pace of economic growth. In effect, this generated wide differences between metropolitan regions and their hinterlands, but accompanied by visible differences between individual cases. Therefore, in the subsequent section of the report we will try to identify those macroregions which are developing most rapidly (including their constituent parts), and offer a typology of the macroregions under analysis in terms of the disparities in the level and pace of economic development.

4. Convergence processes in metropolitan macroregions

In its part of the report, the empirical study of 83 metropolitan/urban macroregions situated in the EU27, Norway and Switzerland was aimed to:

a) Discuss the developmental dynamics of the core areas in these macroregions in the context of the remaining LUZs regions,

b) Compare the degree and dynamics of the internal disparities in the macroregions measured by GDP per capita,

c) Compare the dynamics of economic growth in the macroregions' constituent parts, i.e. metropolitan regions and regional hinterlands.

4.1. Dynamics of macroregions core areas vs. other LUZs regions

The first part of the study focused on the developmental dynamics of all NUTS3 regions corresponding to the LUZs as defined in the Urban Audit[17], taking into account the degree of their correspondence to NUTS3, size of LUZs, and their location vis-à-vis one another. The analyses were conducted for the GDP dynamics in nominal terms, and for the GDP values relativised to the national average.

The development dynamics of NUTS3 regions corresponding to LUZs in 1995-2004 was quite similar (with real GDP growth of ca. 27-28%), regardless of the size and degree of correspondence to the NUTS3 region **(Table 8).** The exceptions were polynuclear metropolitan macroregions (15.6% increase) and regions situated in a close proximity to larger urban centres (20.6% increase). Although statistically significant, those differences largely stemmed from the condition of the economies in the individual countries because the overall picture significantly changed once the data were relativised to the average pace of growth in a given country. Firstly, we could observe a significantly lower pace of growth (in comparison to the regions' national average) of those LUZs which were situated close to larger urban centres (lower by 2.3pp), and those with a population under 250 000 (lower by 0.6pp). On the other hand, the highest values could be observed in monocentric systems regardless of the LUZ - NUTS3 correspondence (increase by 2.5 - 3.0pp above the national average). The pace of development of polynuclear metropolitan macroregions was also higher than the national average (1.2pp).

The poorer results of urban centres situated in the vicinity of large metropolises support the hypothesis on the "shadow of the metropolis", which means the backwashing of functions and developmental resources from smaller urban centres into the core area. Characteristically, only some regions from this group recorded a pace of growth which was distinctly higher than the national average (Cambridge and Portsmounth in the metropolitan region of London, Brescia in the metropolitan region of Milano and Płock in the metropolitan region of Warszawa – higher than the national average; altogether, 22 regions were developing faster, while 31 regions -slower). On the other hand, the poorer results in smaller urban centres corroborate the thesis that small cities have lesser opportunities to participate in metropolisation processes. Given that, we should bear in mind that these results may arise from the weak correspondence of LUZs to the NUTS3 administrative division, due to the inclusion of rural areas into these regions. At the same time, some regions of smaller cities provided more examples of speedy development (10pp higher than the national average), which was usually associated with the

[17] The study also included Marseilles, Nice-Grasse and Lille. Owing to the approximation of LUZ with a NUTS3 region for which GDP data was available, some LUZs were treated jointly, i.e. Białystok-Suwałki, Arnhem-Nijmegen, Rouen-Le Havre and Oviedo-Gijon.

development of modern industries or tourism (Cork (IE), Györ (HU), Ancona, Sassari (IT), Coimbra, Funchal, Ponta Delgada, Faro (P), Irakleio, Ioannina (GR), Ajaccio (FR) and Oulu (F).

Name	**N**	**GDP growth 1995-2004 [%]**	**SD**	**GDP growth 1995-2004 [each country=100]**	**SD**
Metropolitan areas' regions (strong correspondence between LUZ and NUTS3)	78	127.0	24.3	102.7	8.8
Metropolitan areas' regions (weak correspondence between LUZ and NUTS3)	61	128.4	17.0	103.0	9.2
Polynuclear metropolitan areas	47	115.6	8.4	101.2	6.6
Metropolitan areas subordinated within metropolitan macroregions	50	120.6	15.4	97.7	8.5
Other urban areas regions (LUZ<250 000)	49	128.5	20.2	99.4	12.2
Total	285	124.5	19.1	101.1	9.4

* unavailable data was replaced by the following estimates assuming that regional GDP growth was the same across the country for Bulgaria (1995), Romania (1995-1997), Norway (2004), Switzerland (2004) and Athina (GR) (1995-2000).

Table 8. GDP dynamics in 1995-2004 in different types of LUZs regions*
Source: prepared by the author.

The weaker pace of growth in smaller urban centres is also confirmed in a different research dimension which only included LUZs located outside the zone of impact of larger urban centres **(Table 9)**. When this set is divided into three classes, i.e. LUZs with over 1 million; those between 0.5 and 1 million; and those under 0.5 million population, we will see that while the first two groups were developing at an average rate ca. 3.5pp higher than the national average, the smaller LUZs merely matched the national level (0.6pp *in plus*); however, the statistical significance of this difference was not high (t-test, p=0.15).

Groups	N	GDP growth 1995-2004 [each country=100]	SD
Population			
> 1 mn	60	103.7	8.6
0.5 - 1 mn	55	103.4	8.4
< 0.5 mn	70	100.6	8.1
Capital city status			
Capital city-regions**	27	107.0	9.2
Other metropolitan areas regions	159	101.6	8.0

* LUZs with less than 0.25 million population and LUZs situated within the metropolitan macroregions of a larger urban centre were excluded
** capital cities of Cyprus and Malta were excluded

Table 9. GDP change in 1995-2004 [%] in metropolitan areas' regions 1995-2004* Source: prepared by the author.

The differences can also be explained by the fact that different urban centres perform different functions. For example, this can be seen in capital city regions, which in the period 1995-2004 reached a pace of growth 7pp higher than the national average, while in the remaining cases the LUZs were, on average, developing at a modest rate which was only 1.6pp higher than that in other areas in a given country.

Based on the analyses made, we can propose the following conclusions:

- the national context is of considerable importance in investigating the growth dynamics of LUZs regions,
- the pace of development in the regions of cities located within the macroregion of large metropolis is normally much lower than the average dynamics observable in a given country, although some exceptions to this rule could also be found;
- the regions of smaller urban centres (LUZ under 0.5 million) are as a rule developing more slowly; certain exceptions can occur when such cities perform specific functions (such as: national capital, tourist industry, modern industrial complex).

4.2. Internal differences in metropolitan macroregions

This part of the report discusses the scale and dynamics of the internal disparities within macroregions. Its aim was to conduct a verification of the hypothesis that metropolisation processes tend to increase disparities in the development level between metropolitan areas and their regional hinterlands.

The degree of internal disparities within the macroregions can be measured by comparing the development level of the core areas and their surroundings, expressed in the form of GDP per capita. To this end, the following index was used:

W_{ZR} = (GDP per capita (MA) / GDP per capita (RH)) - 1

where: MA – metropolitan area, RH – regional hinterland.

The indicator in question has positive values when the development level of the metropolitan area is higher than that of the regional surroundings, and negative – in the opposite situation.

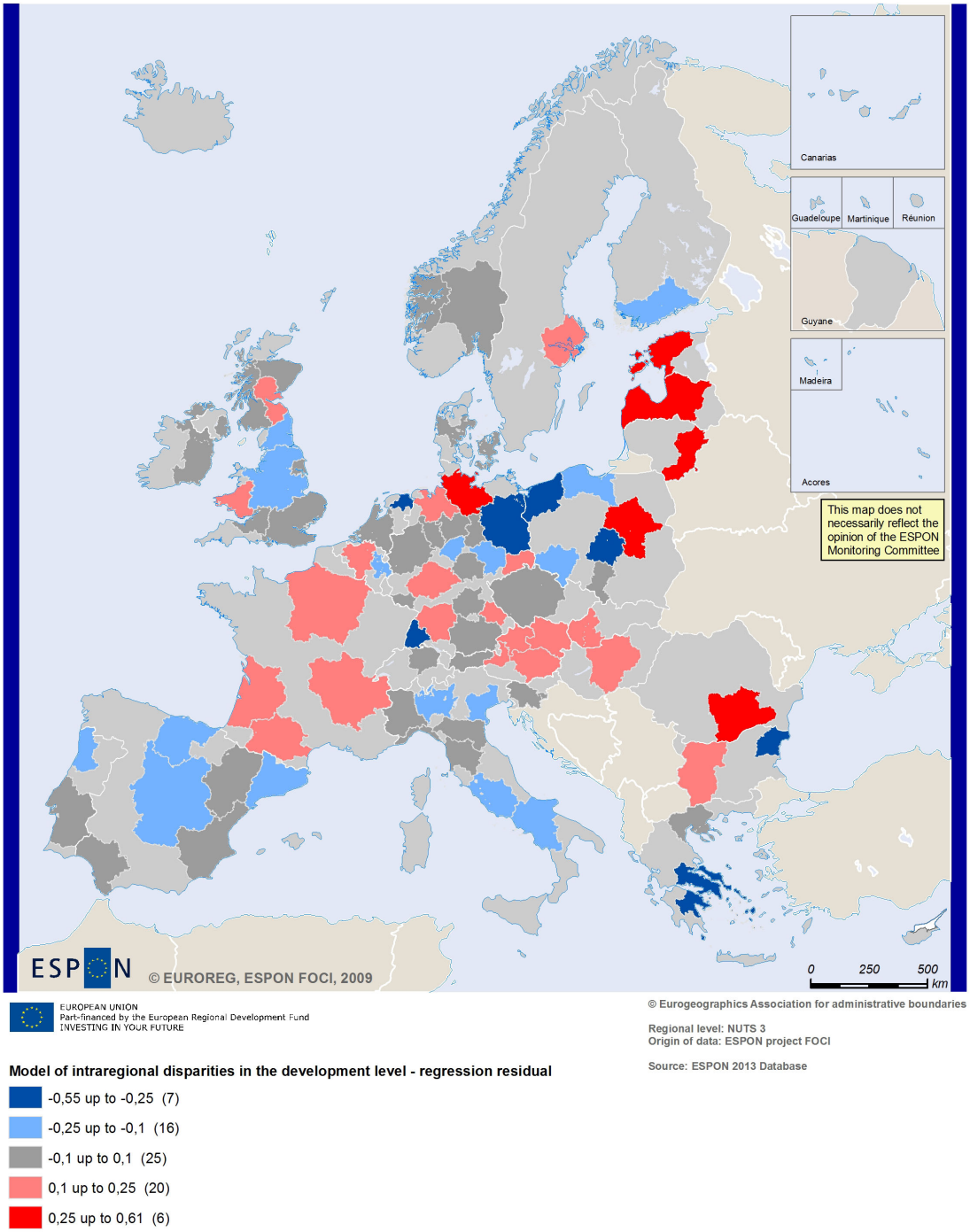


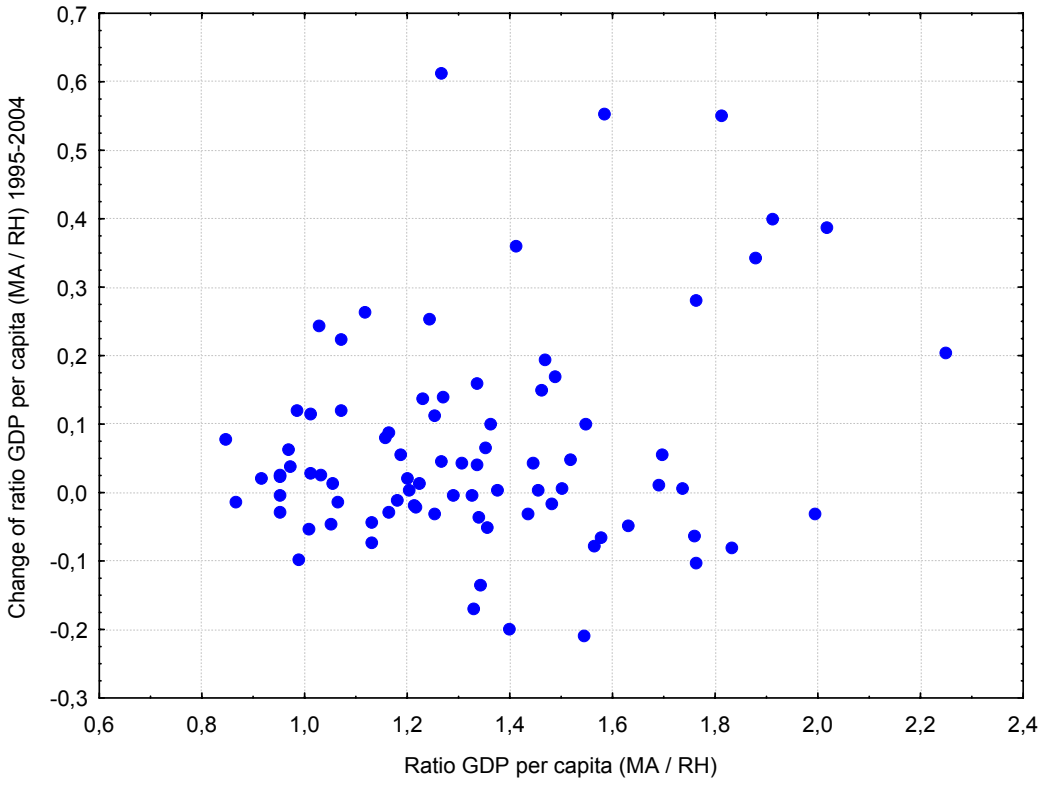
Figure 4. Disparities in the development level between the metropolis and its region in 1995-2004
Source: prepared by the author.

In 1995, its average value was +0.33, and increased in 2004 to +0.40, i.e. by 0.07 units. In 1995, the widest intraregional differences in the development level could be observed in Central and Eastern European countries, particularly in the capital city macroregions, e.g. Bratislava (1.25), Warszawa (1.02), Bucuresti (0.91), Wien (0.76) **(Figure4)**. The differences were considerable also in the Nordic countries (particularly Oslo and Stockholm), so as in the polynuclear region of Central Belgium and in the Groningen region in northern Holland (these cases could to some extent be affected by commuting to work). On the other hand, minor differences could be observed in Spain (excluding Madrid) and Greece, as well as in Italy (except Roma and Milano) and the United Kingdom (with the exception Glasgow and Edinburgh). In Germany, the widest intraregional disparities could be observed in Frankfurt and Hamburg (in the latter case, the part of the former GDR were comprised to the metropolitan sphere of influence). On the other hand, the differences in the case of smaller urban centres in Germany were insignificant, and in the case of Magdeburg and Gottingen, the regional hinterland manifested a higher level of development than metropolitan area.

In the subsequent years, (1995-2004) this situation quite rapidly changed. In particular, the increasing intraregional differences in Central and Eastern European countries should be emphasised (with the exception of smaller urban centres which were not national capitals, which could be attributed to delayed industrial restructuring processes). Most remarkably, the increased disparities could be seen in the capital city regions of the Baltic states. Another distinct countries where the differences markedly increased were the United Kingdom (with a relatively weaker increase in the London region and the polynuclear Central England region), the Nordic countries (primarily the regions of Stockholm and Kobenhavn) and Greece. The existing disparities decreased in Austria and Germany – especially in the former GDR (except Dresden and the macroregions situated in the southern *Länder*). The intraregional differences also clearly diminished in Portugal (which could be caused by the small size of the Lisboa and Porto respective LUZs, which could lead in interpreting some of their functional urban areas as the regional hinterland). On the other hand, the situation in France and Spain was relatively stable. Altogether, 55 macroregions recorded a growth of the disparities in the development level, as compared to 28 where a decrease could be observed. When we exclude the 19 relatively stable regions (+/- 0.0025) from the picture, 42 recorded an increase (on average by 0.171), and 22 – a decrease (on average by 0.076).

Placing the scale of intraregional disparities in the context of their dynamics made it possible to develop a simplified regional typology, aimed to identify extreme cases in terms of both the conditions and the dynamics of such disparities **(Figure 5)**. Generally speaking, there was no clear correlation between the scale of internal disparities and its dynamics. However, it could be interesting to examine the situation of macroregions in

two cross-sections: firstly, geographical along the east-west axis and secondly, related to the threshold of LUZs with 1 million population. As it turned out, the extreme situations in terms of the level and dynamics of the disparities could be observed in the capital city macroregions situated in Central and Eastern European countries regardless of the size of the LUZ. On the other hand, the macroregions of smaller LUZs did not differ considerably when compared to the remaining macroregions of Western Europe. At the same time, the macroregions in the EU15, Norway and Switzerland were more similar both in terms of internal disparities and the dynamics of change. Interestingly, although the macroregions of smaller cities were more varied in terms of developmental differences, the changes in them were relatively insignificant but more prone to decrease. The situation in the macroregions of metropolitan areas with over 1 million population was different as they more frequently recorded higher disparities in the level of development. Interestingly enough, this increase was as a rule higher in those macroregions which were characterised by a smaller scale of internal disparities.



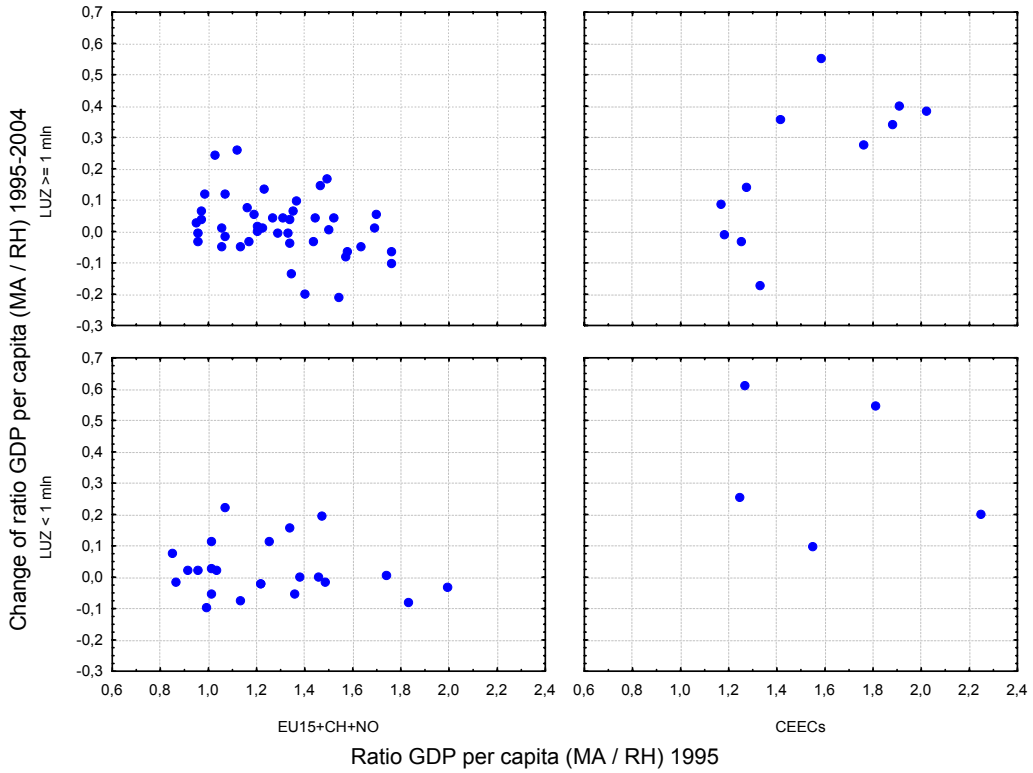


Figure 5. GDP per capita and its change in 1995-2004 (MA/RH ratio)
Source: prepared by the author.

The typologies of macroregions in terms of the level and dynamics of disparities in the GDP level were developed using the average value (1.33) for the level of disparities, after introducing an additional interval at a distance of ¼ of the standard deviation (+/- 0.07). At the same time, an additional, 'stability' interval was introduced for changes in the disparities, in the +/- 0.025 range for 0. The results were rendered on the map **(Figure 6)** in which the regions with a speedy increase in the level of disparities were marked in red; regions with a rapid decrease – in green, and stable macroregions in grey. The intensity of the colour indicates the scale of divergences – the more intensive the saturation the wider the internal differences were in 1995. The macroregions with the highest level and pace of disparities in the development level included regions situated in Central and Eastern Europe, as well as Paris, Madrid, Edinburgh and Hamburg. On the other hand, in the macroregions in Portugal, Austria, Dublin, Toulouse, Frankfurt, Central Belgium and Groningen in the Netherlands, the scale of disparities was decreasing despite their being quite wide. At the other extreme, there were regions with a similar level of development in the core and in the periphery, where the disparities were increasing, e.g. the majority of British and Greek macroregions, as well as Zaragoza and Bilbao-Santander in Spain, Firenze and Padova-Venezia in Italy, Zurich in Switzerland, Liege in Belgium and Wrocław in Poland. On the other hand, particularly in smaller German macroregions such as: Gottingen, Bielefeld, Freiburg, and in Barcelona, Sevilla,

Emilia-Romagna and Innsbruck, although they were insignificant, the disparities in the level of development were falling even further.

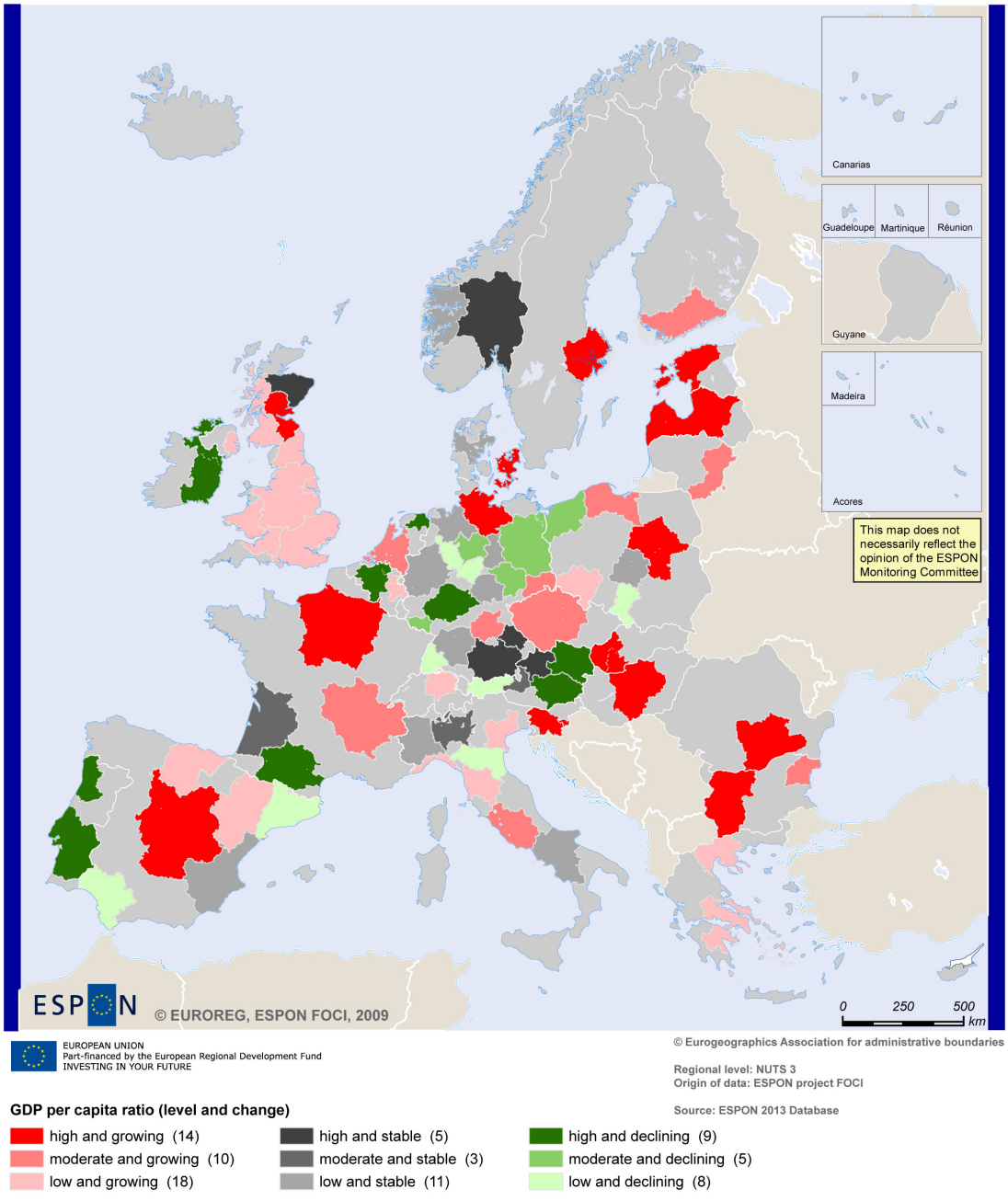
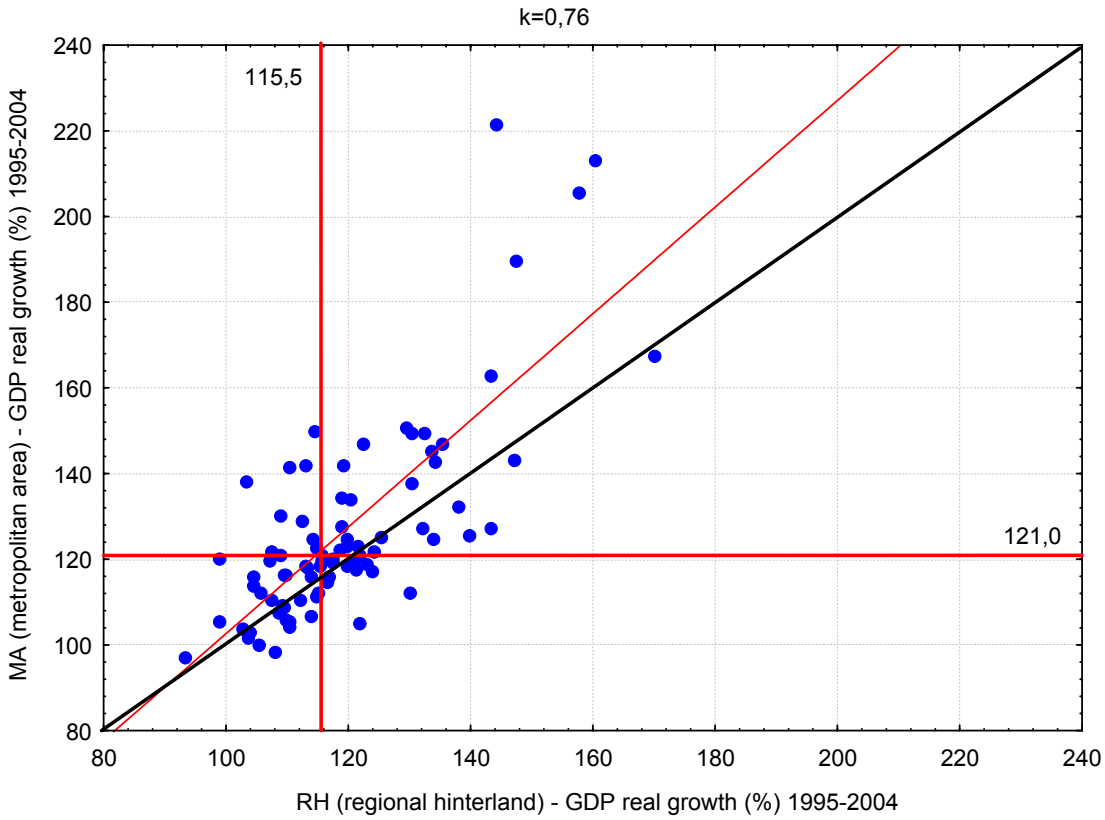


Figure 6. Typology of macroregions based on GDP per capita ratio level and change
Source: prepared by the author.

4.3. Convergence process in metropolitan macroregions

This part of the report strives to answer the question on the consequences of a rapid development of the metropolitan region for its regional hinterland. To this end, the correlations between the GDP for the metropolitan area and its surroundings were examined both for nominal values and when relativised to the national average. In addition to that, a typology was developed for the median values. On this basis, the core areas and the regional hinterlands which were developing faster or slower than the median values were separately defined **(Figure 7)**. As a result, we were able to distinguish four types of macroregions, viz.: a) rapidly developing metropolis and the regional hinterland, b) rapidly developing metropolis and slowly developing regional hinterland, c) slowly developing metropolis and rapidly developing the regional hinterland, and d) slowly developing metropolis and the regional hinterland.

a) real growth %



b) each country's growth = 100

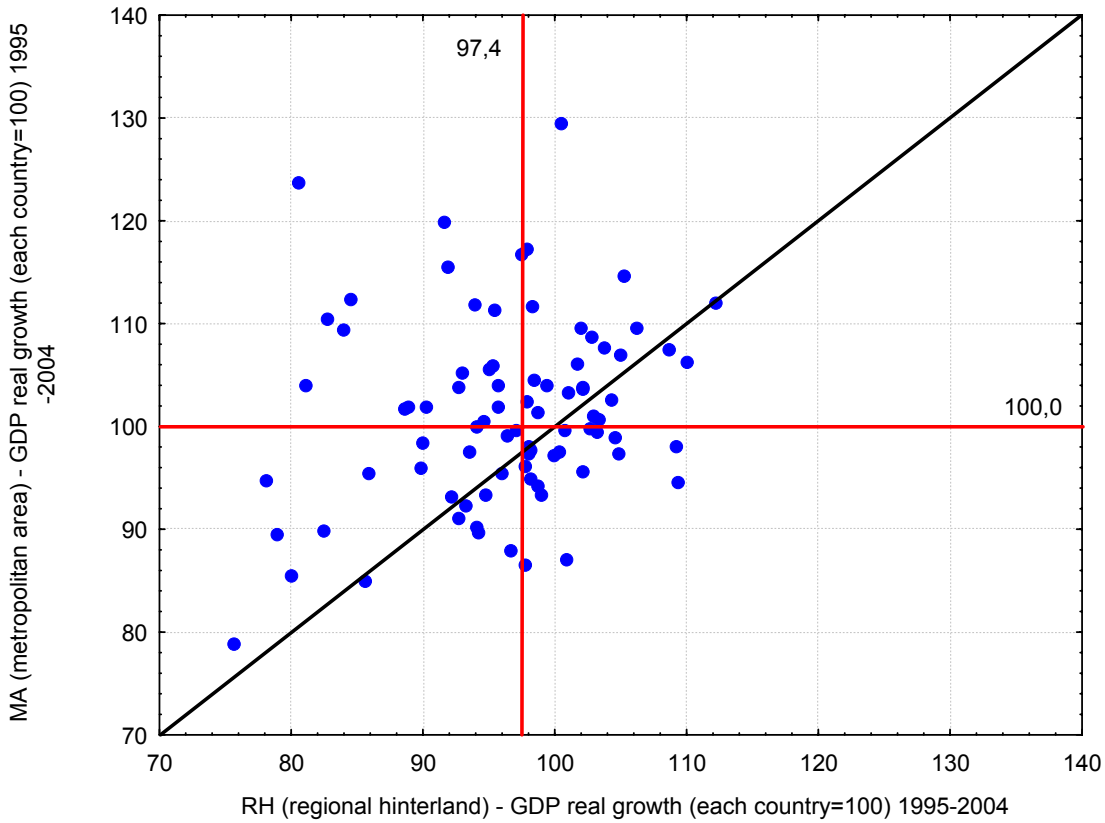


Figure 7. GDP growth in constituent parts of macroregions 1995-2004
Source: prepared by the author.

When we compared the pace of growth in the macroregions' constituent parts, we found out that there was a strong positive correlation between the rate of growth in the central area and its surroundings, of k=0.76 (k=0.60 after excluding outliners) **(Figure 7a)**. Furthermore, the majority of cases showed a faster increase of the central area than that of its surroundings (54:29). An average GDP increase in the core areas was 28.4%, as compared to 19.6% in their hinterland. In general terms, no real GDP decrease could be observed in the researched period (save for one exception - Gottingen in Germany). The distribution of these types (**Figure 9a**) illustrates the European-wide differences between the centrally located countries (Germany, Italy, Austria and Belgium), which recorded a low level of economic development in the period in question, and the external countries which were developing at a faster rate: Central and Eastern Europe, Nordic countries, United Kingdom, Ireland, Spain, Portugal and Greece. The above is also confirmed by the analysis of the real rate of growth of these countries **(Figure 8)**. As regards the central area, the exceptions to the above regularity were the metropolitan regions of München, Regensburg and Dresden (although in the latter case the metropolis' surrounding area was developing more slowly than the average), and in the peripheral areas – the British macroregions: Glasgow, Aberdeen and Kingston upon Hull.

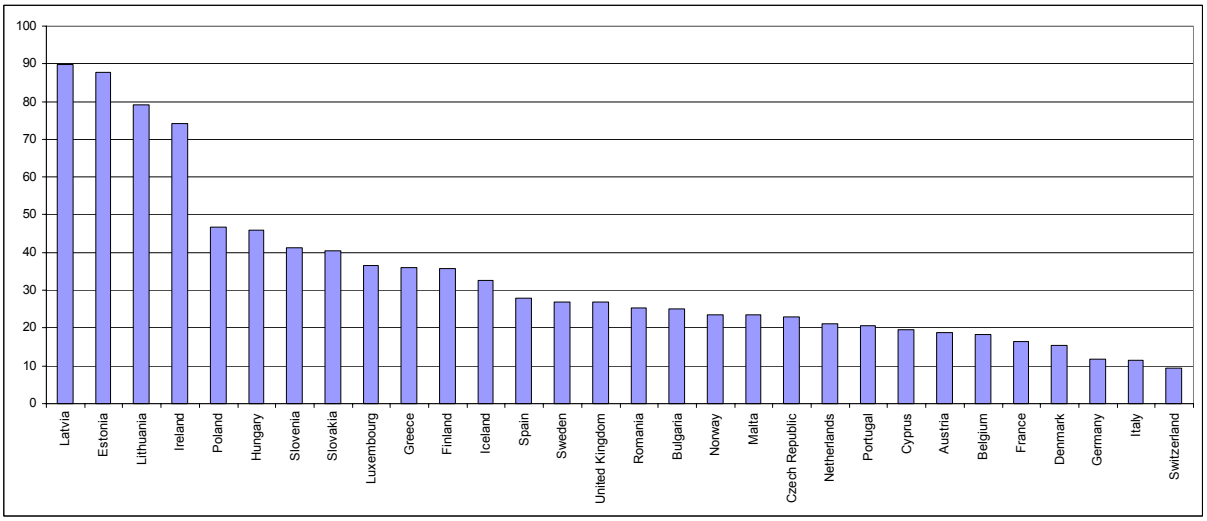
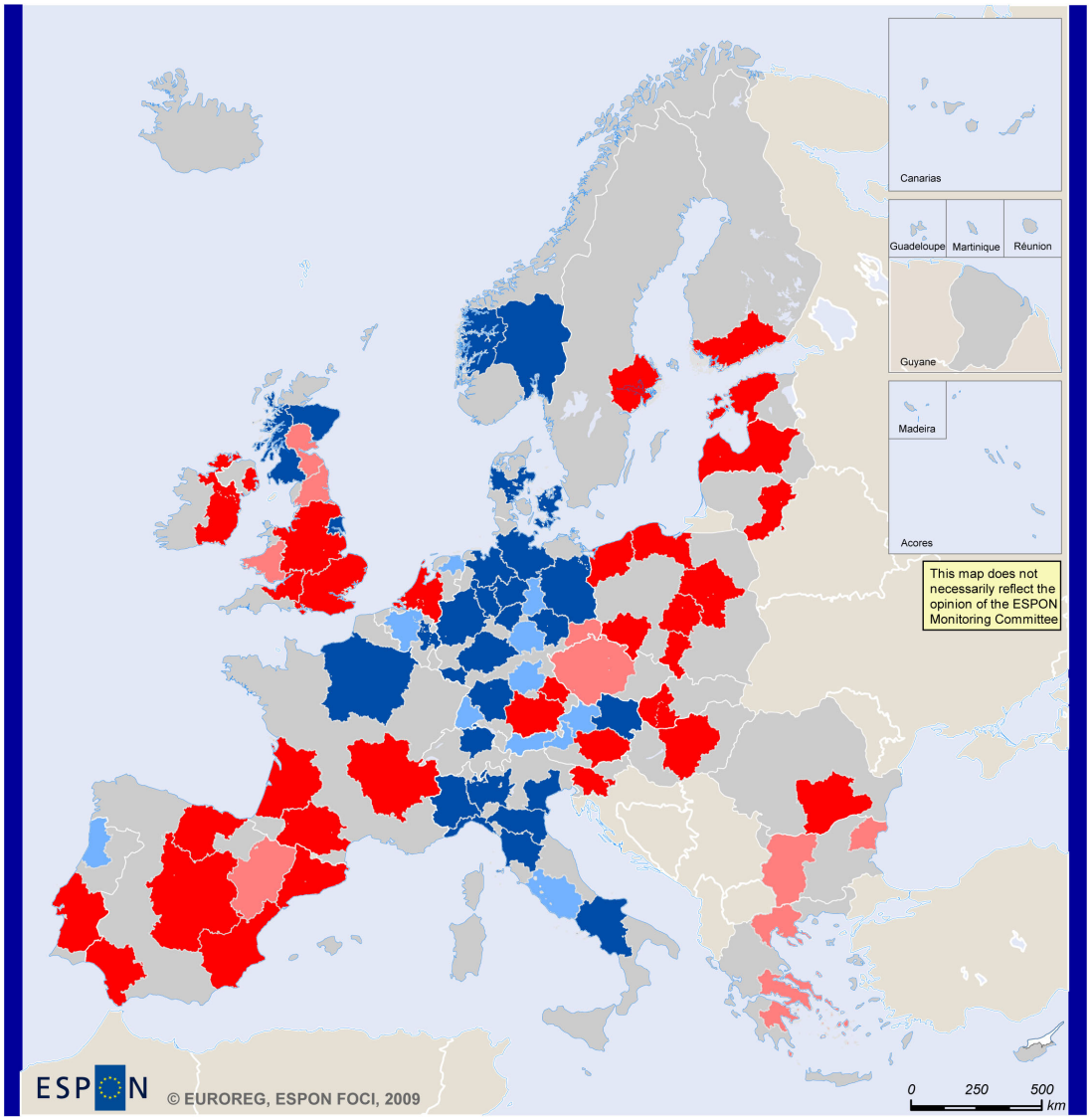


Figure 8. GDP growth (%) in constant prices in ESPON countries 1995-2004
Source: prepared by the author based on UNECE data.

More interesting results can be obtained when the observations are made independently of the rate of economic growth in individual countries **(Figure 7b)**. In this case, no correlation between the growth rate of the metropolis and its regional surroundings could be observed.[18] As before, the number of macroregions whose core areas were developing faster than their hinterland was distinctly higher (51:32). In most cases, the rate of growth of the core areas was 1.6pp higher than the national average, whilst their surrounding area was developing 3.9pp more slowly. As compared to the respective national economies, the metropolitan area of Warszawa was growing the fastest (by 29.5pp), while the Bergen metropolitan area was at the other extreme (- 21.1pp). The growth rate 'leaders' other than the remaining Central and Eastern European metropolises included: Bristol, München, Stockholm, Helsinki and Toulouse. On the other hand, most acute problems were experienced by regions with a considerable share of industry in their economies, e.g.: in Poland (Katowice, Łódź and Szczecin), Portugal (Porto), United Kingdom (Aberdeen), Italy (Torino) and Germany (Saarbrucken). The regional hinterland developing at the fastest rate was that of München, and of the East German cities: Magdeburg and Erfurt, and – probably due to the development of the tourist functions – the hinterlands of Valencia (Spain) and Innsbruck (Austria). A faster development of the macroregions' two constituent parts was easily visible in the southern part of Germany (also in Magdeburg and Erfurt), southern England (London, Bristol), French macroregions (save for the Paris macroregion where the surrounding area was developing more slowly than the median value), certain capital city macroregions in Central and Eastern European countries (Warszawa, Budapest, Bucuresti), as well as in the region of Lisboa, some cities in central and northern Italy (Roma, Milano, Padova-Venezia, Firenze), Graz (Austria) and Aarhus (Denmark).

[18] A very weak correlation (k=0.31) could be observed once the extreme situations were removed.

a) real growth %



b) each country's growth = 100

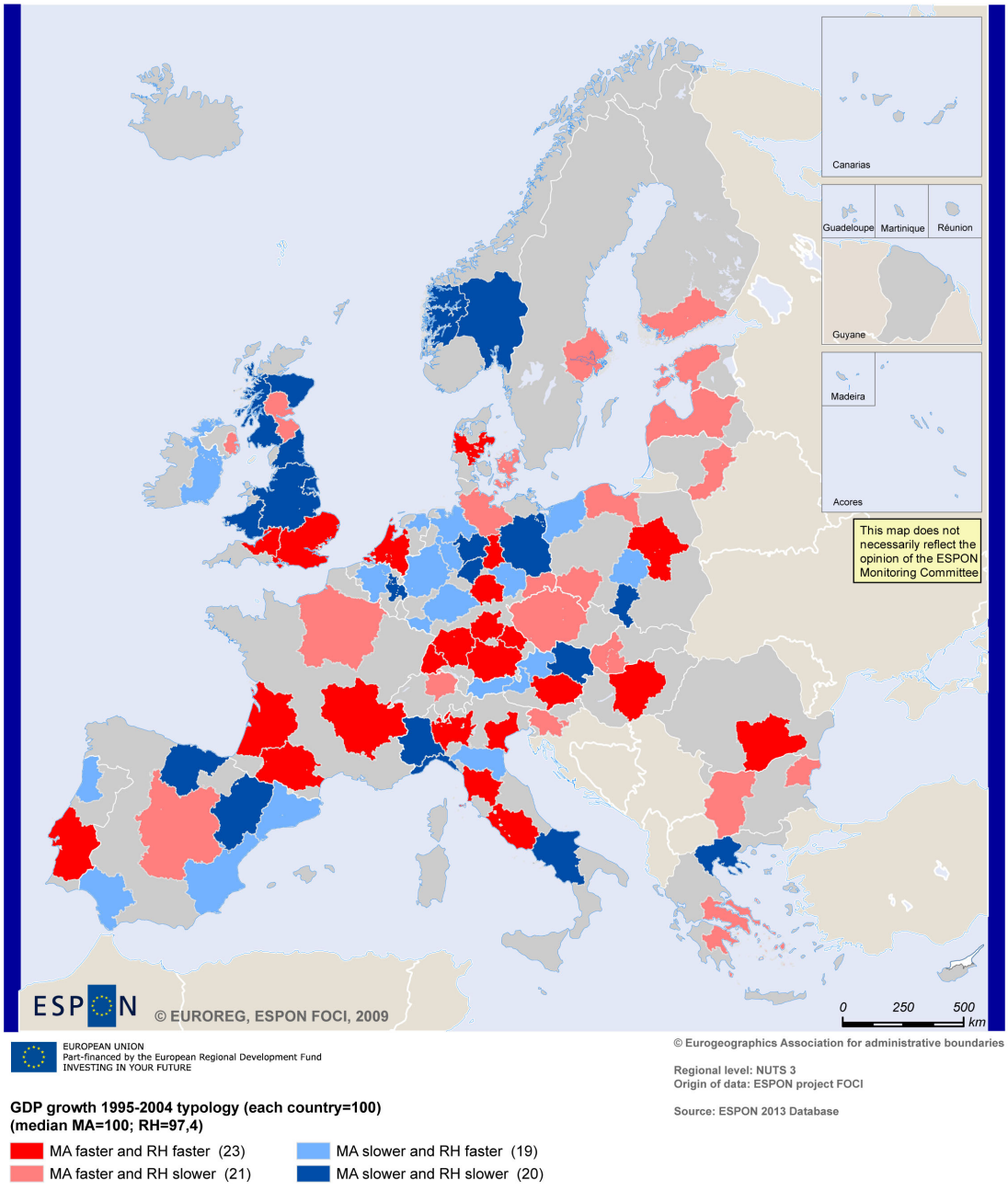


Figure 9. Typology of macroregions based on GDP growth 1995-2004
Source: prepared by the author.

4.4. Conclusions

The macroregions covered by the study were characterised by a prevailing tendency for increasing the disparities in the development level between metropolitan areas and areas surrounding them. This was particularly well visible in the capital city regions (notably

Nordic as well as Central and Eastern European countries), but such processes could also be observed in some of other large cities. The declining scales of internal disparities were less frequent, with their greatest scale encountered in eastern and northern Germany (except Hamburg), Portugal, Austria and Ireland. It should be noted that as a rule this was the case in those regions where the scale of internal disparities had earlier been very high. On the other hand, in the period in question these countries – with the exception of Ireland – were characterised by a relatively low pace of economic development. These observations can mean that metropolisation processes spurred a faster development of large urban centres, which at the same time resulted in an increase in the development disparities in the metropolis-region system. The implications of this process for the regional hinterland in terms of the development dynamics are discussed in the chapter below, which offers a comparison of the development rate in the metropolis and in its hinterland. However, any fuller or more thorough analysis of these processes and corroboration of the interpretation of the results obtained will only be possible after an analysis of development factors at the European level, and on the basis of case studies' analysis.

The development dynamics in the macroregions was rather distinctly correlated with the nationwide rate of growth (in some countries, this was related to a significant share of one macroregion in the national economy). On the other hand, there were relatively few macroregions which deviated from this rule: they were the rapidly developing regions in countries with a lower growth rate, and the slowly developing regions in countries with a high rate of growth. Moreover, a faster or slower nationwide rate of growth as a rule affected both the metropolitan areas and their regional hinterlands. In this case, however, the number of exceptions was higher, which resulted in either a fast increase in the disparities related to developmental level, or in their visible decline. Putting the rate of growth in the context of the national average made it possible to clearly show the differences between the regions within a given country. In effect, we were not able to identify the interrelationships between the development rate of the metropolis and its regional surroundings, while the occurrence of the individual types of macroregions was similar. Consequently, we indicated macroregions where a fast development of the metropolitan area was accompanied by a speedy development of its surroundings. This could be viewed as a proof of the lack of barriers to the diffusion of developmental processes. On the other hand, an inverse situation could point to structural differences or low accessibility which hampered the diffusion processes or, alternately, to the backwashing of developmental resources from the periphery into the regional centre. In a situation of a slower development of the centre, its surroundings as a rule coped slightly better than the mean value. This could either indicate relatively weak intraregional linkages or point to a competent use of endogenous resources by the

regional hinterland (e.g. related to the development of tourism or modern industries). Nevertheless, there also existed macroregions where both the metropolis and the remaining part of the macroregion were developing tangibly more slowly than the national average; this could be seen as a proof either of their strong intraregional ties or of their structural affinities.

5. Internal disparities and typology of metropolitan macroregions

5.1. Internal disparities within metropolitan macroregions

This part of the report provides a comparison of selected European metropolitan macroregions and their component parts (i.e. metropolitan areas and the regional hinterlands) in terms of:

- The demographic situation – which regions and their component parts experience population growth and which become depopulated; what is the role of migration and of natural increase in these processes; does this affect the shape of the settlement system (size of cities in the regional hinterland, degree of polycentrism of the metropolitan area);
- The economic structure – what is the degree of similarity between the metropolis and the surrounding region, particularly with regard to the role of the market services sector, and what are the relationships between the development of "specialised" and "simple" services;
- The labour market situation – what is the situation in the macroregional labour market in terms of the activity rate and unemployment rate; is the dynamics of change similar across the macroregion; are there any marked differences in labour productivity in individual sectors.

Unfortunately, due to the lack of relevant NUTS3 data for most of the Member States, a comparative analysis of metropolitan macroregions did not cover aspects relating to the quality of the human capital, degree of innovativeness and the macroregions' attractiveness for tourism **(Annex 3)**.

The analyses based on the available data were multi-dimensional in character as they took account of both the status and the dynamics of processes occurring in metropolitan macroregions (broken down by metropolitan areas and their regional hinterlands) and the interrelationships between the metropolis and the region (**Table 10**).

Research area	**Metropolitan Area** (MA)		**Regional Hinterland** (RH)		MA / RH **Ratio**	
	State	Dynamics	State	Dynamics	State	Dynamics
Demographic situation incl. settlement system						
Economic structure incl. specialised services						
Labour market incl. labour productivity						

Table 10. Dimensions of the intraregional disparities analyses
Source: prepared by the author.

Demographic situation

In 2000-2005, the majority of macroregions (55) recorded a population increase, with a population decrease noted only in 25 regions[19]. The average increase reached 3.1% (and was the fastest in Valencia macroregion - by 12.8%), whereas the average decrease was -1.7% (with the deepest reduction in the Leipzig and Halle region - by -4.7%). The migration balance played a greater role in the population dynamics, unlike the natural increase. As a rule, the migration balance was positive (with negative balance recorded in 20 macroregions), and amounted to ca. 6.1‰ annually. In contrast, the natural increase was usually neutral, reaching ca. -0.2‰ annually (there were more deaths than births in 37 macroregions). These processes likely result from a high migration attractiveness of metropolitan areas (their good labour market situation) and population ageing (first and foremost in the regional hinterland of metropolises), coupled with the falling women's fertility rate.

In both component parts of the macroregion, the population dynamics was mostly shaped by migration processes, and to a much lesser degree – by the natural increase *in situ* **(Table 11)**.

Constituent part	Population change in 2000-2005 in %	Average natural increase in ‰	Average migration balance in ‰
Metropolitan area	2.1	0.3	3.6
Regional hinterland	1.2	-0.8	2.6

Table 11. Basic demographic indicators in metropolitan macroregions
Source: prepared by the author.

[19] The demographic situation of metropolitan macroregions is shown using the data compiled for the DEMIFER project for the years 2000-2005. This was done for 80 of 83 macroregions selected for analysis (excluding Norway and Switzerland).

However, while the migration balance was positive both in metropolitan areas and in their regional hinterlands (56 regions), and the scale of migration was rather similar (in 27 cases, the relative immigrants inflow to the metropolitan area was higher than to its regional hinterland, and in 29 a reverse situation could be observed), metropolitan areas as a rule had a positive natural increase (42 cases), whereas regional hinterlands lost population due to an excess of deaths over births (51 cases). **(Table 12)**. The situations when the centre had a positive migration balance and the regional hinterland a negative one – which could point to migration flows from the periphery to the centre of the macroregion – were relatively rare (12 cases, most of them in Central and Eastern Europe); the outflow from metropolises to their regional hinterlands was even smaller, which in turn could be seen as a proof of deurbanisation processes (3 relatively small macroregions: Belfast, Saarbrűcken, Bratislava) **(Figure 10c)**.

As a rule, demographic processes had a similar direction in both component parts of a given metropolitan macroregion **(Table 12)**. Only in 19 cases opposing processes could be observed: in 14 macroregions the number of the population was increasing in the metropolitan area and decreasing in the regional hinterland, whereas in 5 macroregions we could observe an opposite process. The former situation characterised mostly Central and Eastern European macroregions, ranging from Sofia and Bucharest through Prague and Warsaw to Berlin and Vienna, as well as Athens and Naples (**Figure 10a**). The greatest polarisation between these processes could be observed in the macroregions of smaller cities such as Varna (MA: +4.0%; RH: - 7.8%), Graz (MA: +5.6%, RH: -1.2%) and Bergen (MA: +3.0; RH: -0.6%). On the other hand, the depopulation of metropolitan areas coupled with a simultaneous population increase in their regional hinterlands was a process that could primarily be observed in the UK macroregions of Belfast, Cardiff and the polycentric region of Central England, as well as the German Rhine-Ruhr and Genoa in Italy.

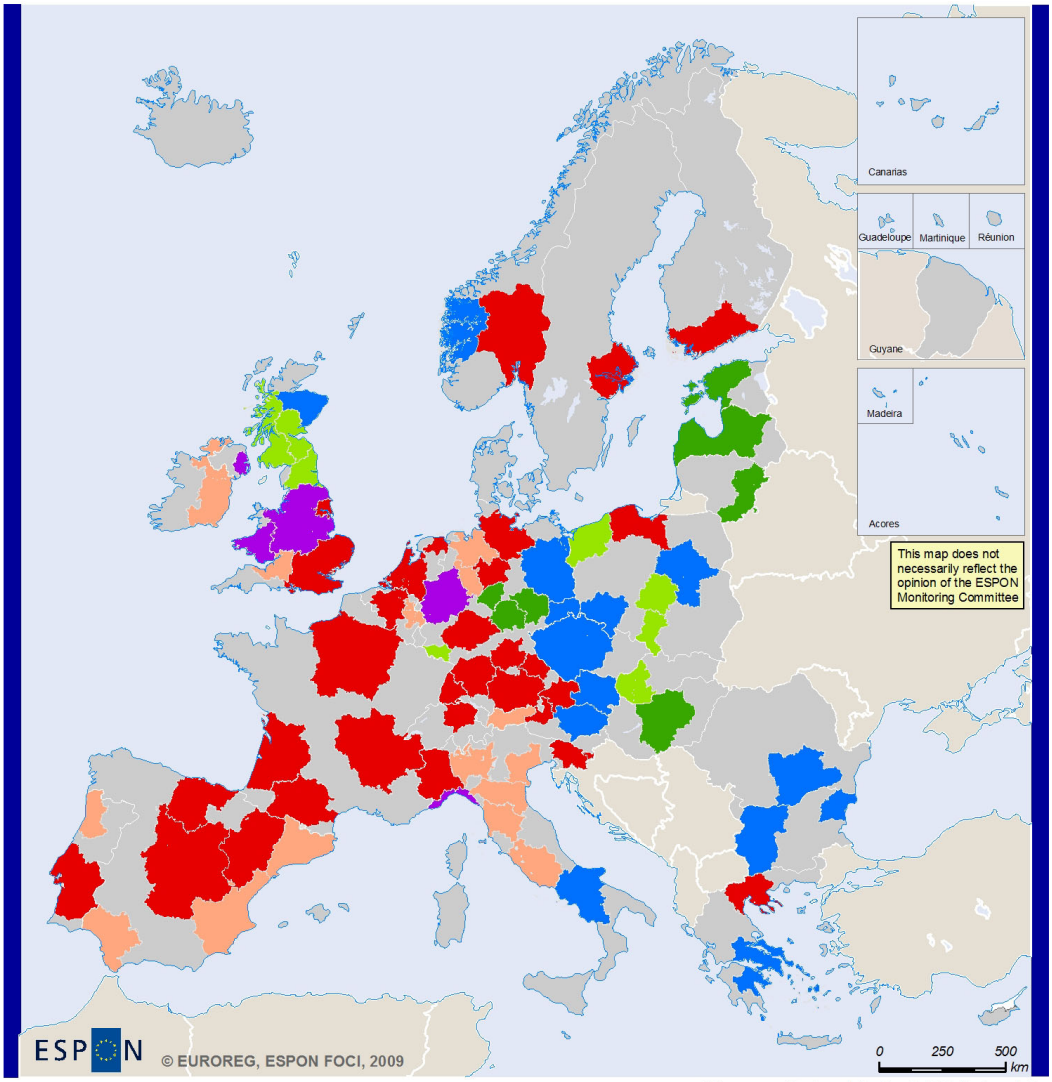
The population increase in the macroregions with a growing population was as a rule higher in metropolises than in their regional hinterlands (31 of 46 macroregions). Nevertheless, this correlation could not be observed in the case of population decrease: in 8 macroregions, it more strongly affected the metropolitan areas, and in 7 cases – the regional hinterlands of metropolises.

Type of macroregion	Population change	Natural increase	Migration balance
Increase MA > Increase RH (11)	31	16	27
Increase MA < Increase RH (12)	15	10	29
Increase MA i Decrease RH (21)	14	16	12
Decrease MA < Decrease RH	7	23	5

(32)			
Decrease CEC > Decrease RH (31)	8	12	4
Decrease MA i Increase RH (42)	5	3	3

Table 12. Demographic trends in metropolitan areas and their regional hinterlands [2000-2005]
Source: prepared by the author.

A relatively small number of macroregions (London, Paris, Milan, Lyon, Stuttgart) recorded a positive natural increase both in the metropolis and in its hinterland **(Figure 10b)**. In other macroregions, particularly in Western Europe, the positive natural increase model prevailed in metropolitan areas, with a simultaneous population decrease in the regional hinterland. On the other hand – with few exceptions – CEE countries and northern Germany noted more deaths than births in both constituent parts of metropolitan macroregions.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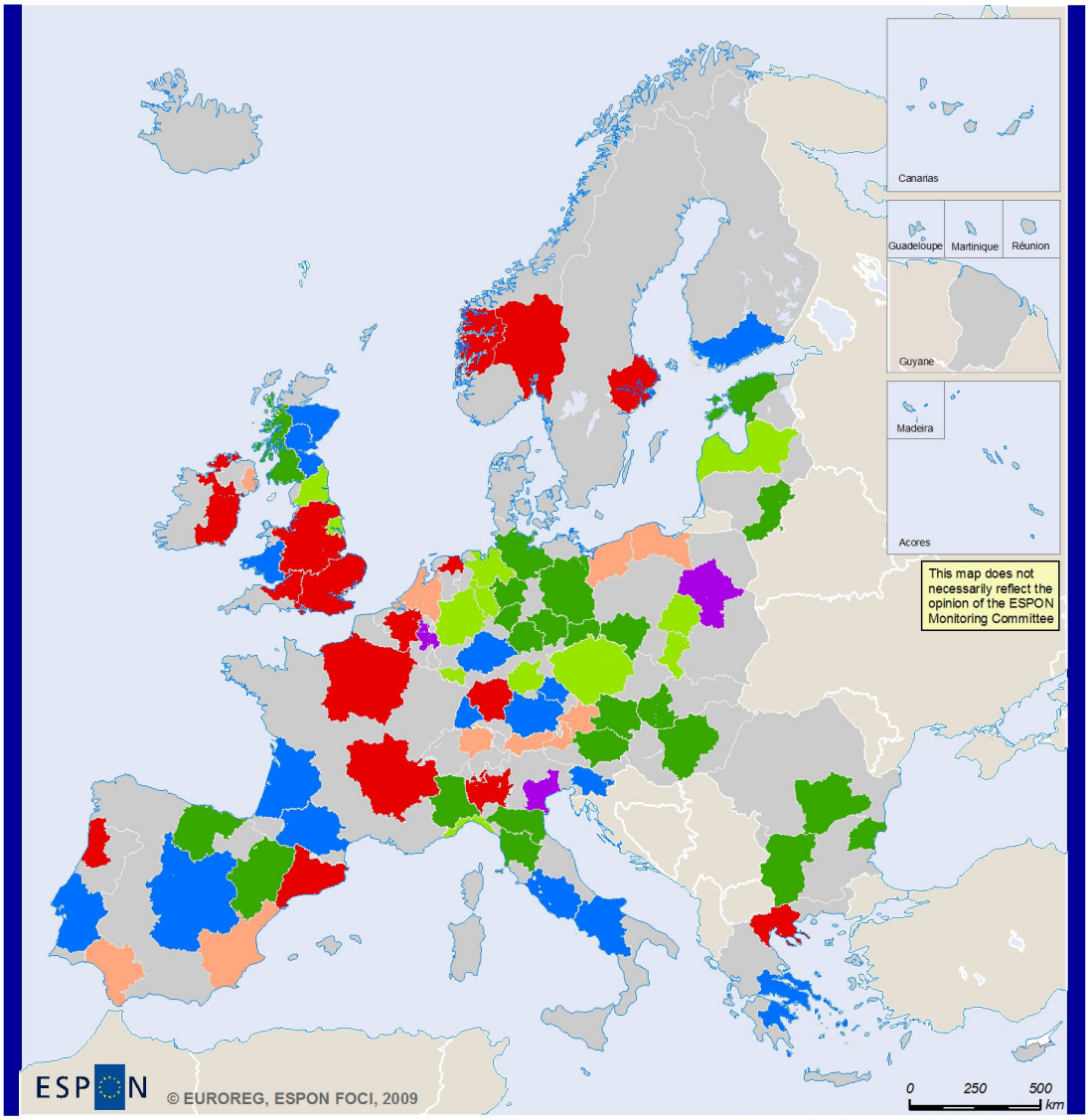
Origin of data: ESPON project FOCI
Source: ESPON 2013 Database
Typology of macroregions - population change [2000-2005]
Increase MA > Increase RH (31)
Increase MA < Increase RH (15)
Increase MA & Decrease RH (14)
Decrease MA < Decrease RH (7)
Decrease MA > Decrease RH (8)
Decrease MA & Increase RH (5)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Origin of data: ESPON project FOCI
Source: ESPON 2013 Database
Typology of macroregions - natural increase [2000-2005]
Increase MA > Increase RH (16)
Increase MA < Increase RH (10)
Increase MA & Decrease RH (16)
Decrease MA < Decrease RH (23)
Decrease MA > Decrease RH (12)
Decrease MA & Increase RH (3)

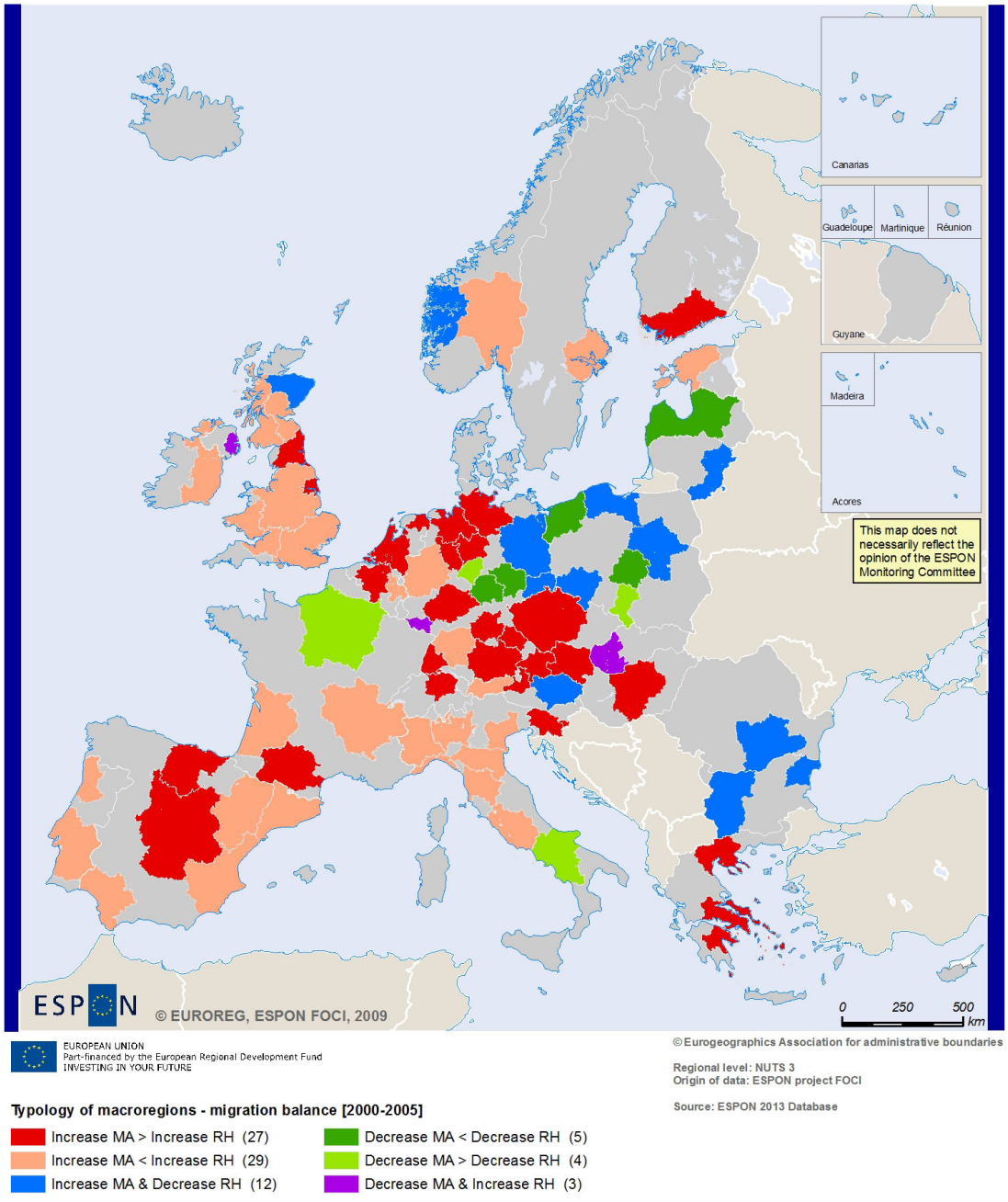


Figure 10. Demographic situation in metropolis-region context [2000-2005]
Source: prepared by the author.

The changes taking part in the component parts of the surveyed macroregions were quite distinctly correlated **(Table 13)**. In particular, this was true for the natural increase

(k=0.76). In contrast, migration processes were not as strongly interlinked (k=0.52), which in some macroregions could point to movements of people between the metropolis and its hinterland, directed to metropolitan areas. At the same time, the relativisation of the population dynamics in metropolitan macroregions vis-à-vis the situation in individual countries revealed a negative correlation: a population increase in the metropolitan area faster than the average national increase denoted a smaller than average increase of the population in the regional hinterland. This was mainly due to the differences in the migration balances. We can conclude therefore that the compatibility of demographic trends observable in macroregions largely resulted from the differences between individual countries, whereas the dominant trend observable in individual countries was the concentration of the population in metropolitan areas.

a) nominal values

Regional hinterland Metropolitan area	Population change	Natural increase	Migration balance
Population change	0.64**	0.38*	0.60**
Natural increase	0.52**	0.76**	0.37*
Migration balance	0.45**	*0.01*	0.52**

b) values relativised using the national average

Regional hinterland Metropolitan area	Population change	Natural increase	Migration balance
Population change	-0.56**	-0.28*	-0.51**
Natural increase	*-0.21*	-0.43**	*-0.05*
Migration balance	-0.60**	*-0.14*	-0.63**

Table 13. Correlation between changes in metropolises and their regional hinterlands [2000-2005]
Source: prepared by the author.

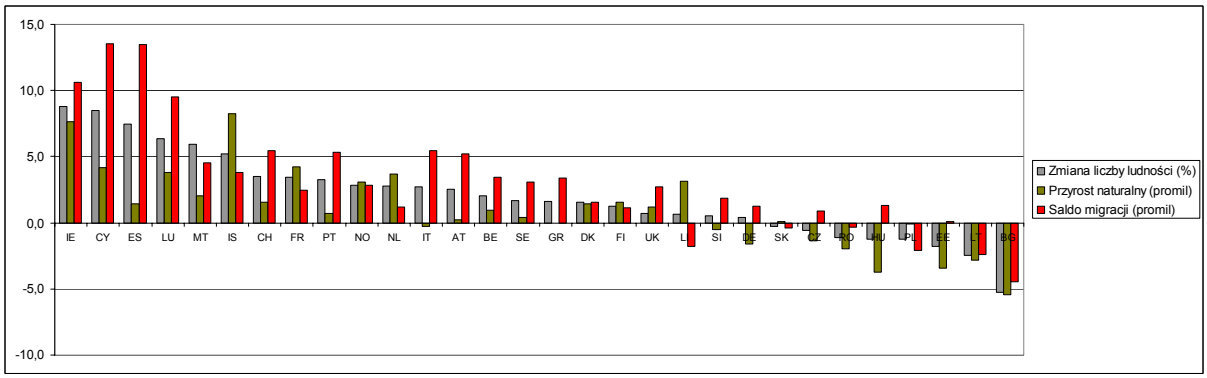


Figure 11. Demographic situation by ESPON country in 2005.
Source: prepared by the author.

The analysis of extreme cases produces interesting information which helps interpret the phenomena described above as it placed them more specifically in their regional context

(Table 14). In the group of five metropolitan areas with the greatest demographic dynamics, there were three Spanish cities: Madrid, Valencia and Barcelona, Toulouse (France) and Dublin (Ireland). Interestingly, in as many as three of these cases (Valencia, Dublin and Barcelona), the rate of the population increase in the regional hinterland was faster than in the metropolitan area, which proved a high migration attractiveness of these macroregions (probably caused by the natural environment assets).

On the other hand, among the five metropolitan areas where the population decrease was the fastest were old industrial districts such as: Łódź (Poland), Leipzig/Halle (Germany), Glasgow (Scotland), as well as two capital city regions of new Member States, i.e. Riga and Bratislava. And, while the regional hinterlands of Glasgow and Bratislava had a positive migration balance – which could point to suburbanisation processes going beyond the metropolitan areas' boundaries - in the remaining cases the reduction of the population clearly affected these two component parts of macroregions.

Metropolitan macroregion	Metropolitan area			Regional hinterland		
	Population change (%)	Natural increase (‰)	Migration balance (‰)	Population change (%)	Natural increase (‰)	Migration balance (‰)
Metropolitan areas with highest population increase						
Madrid	12.2	4.2	18.8	5.5	-0.9	11.7
Toulouse	8.9	5.0	12.1	5.4	-1.3	11.8
Valencia	8.7	1.1	15.7	15.7	3.0	26.1
Dublin	7.7	9.5	5.2	11.4	6.6	14.9
Barcelona	7.5	2.0	12.4	14.4	1.0	26.0
Metropolitan areas with highest population decrease						
Łódź	-2.3	-4.3	-0.2	-1.1	-1.3	-1.1
Riga	-2.3	-4.7	-0.1	-3.2	-4.4	-2.1
Leipzig/Halle	-2.3	-3.1	-0.4	-6.6	-5.5	-7.1
Bratislava	-2.6	-1.2	-4.0	-0.7	-1.8	0.5
Glasgow	-2.7	-0.6	0.2	-1.3	-1.9	1.6

Table 14. Extreme cases in terms of population change in the metropolitan area
Source: prepared by the author.

In the analysis of the impact of the settlement system on demographic processes, we used a few simple indicators[20] such as:

- The number of the population and population density in the metropolitan area and its regional hinterland;
- The share of the largest city (within its administrative boundaries) in the population of the metropolitan area and in the population of the regional hinterland;

[20] Data derived from the most recent Urban Audit (2003-2006).

- The ratio between the population of the largest cities (within their administrative boundaries) of the metropolitan area and the regional hinterland.

It turned out that the structure of the settlement system shown in this manner was not distinctly correlated with demographic processes. The only significant if weak correlations could be observed between the following indicators (in brackets, values of the *k* coefficient with the significance level of 0.05):

- The number of the population of the metropolitan area and the natural increase in the metropolitan area (0.27);
- The share of the city in the population in the metropolitan area and migration inflow into the city (0.26) and the natural increase in the regional hinterland (-0,36);
- The number of the population of the regional hinterland and the natural increase both in the metropolis (0.25) and in the regional hinterland (0.23);
- The migration inflow to the metropolitan area and the population density in the regional hinterland (-0.24);
- The size of the largest city of the regional hinterland and the natural increase in the regional hinterland (0.28);
- The ratio of the population density in the centre and that in the regional hinterland and the population increase in the metropolitan area (0.27).

The majority of these correlations were most likely merely superficial, due to the impact of extreme cases, which can be distinctly seen in the scatter diagrams. In addition to that, in some cases the correlations were indirect, related to other factors such as the differences in the age structure of the population of the macroregions' component parts, as well as the differences in the immigrants' areas of origin.

Summary – demographic situation

Based on our analyses, we can propose the following conclusions relating to the demographic development of metropolitan macroregions in the years 2000-2005:

- The population increase observable in most metropolitan macroregions helped strengthen their role in the analysed countries;
- The population increase in metropolitan macroregions was mainly caused by migration inflows (positive migration balance both in the metropolitan areas and in the regional hinterland of the metropolis), which was probably connected with the segmentation of migration – young people in working age would immigrate to metropolitan areas to seek employment or to study, whereas middle-aged or

retired people would move to areas situated further from the centre, seeking a higher quality of life and better living conditions;

- The natural increase played a smaller role in the population dynamics, and as a rule was positive in metropolitan areas and negative in their regional hinterlands, which in all probability was caused by the differences in the age structure of the population: metropolises were to a larger extent inhabited by people in reproduction age, whereas people in older age groups accounted for a larger share of the population in the regional hinterlands;
- In light of the research, the structure of the settlement system, measured using simple indicators (population density, degree of polycentricity), did not have any substantial bearing on those processes.

The economic structure

There were marked differences between the surveyed macroregions in terms of economic structure[21]. The smallest differences could be observed in the agricultural sector as its share in the gross added value (GVA) in 2005 was on average 2.1%, exceeding 5.0% only in few macroregions. The role of industry was more varied, with differences ranging from 15.4% to 41.5% - and its share in GVA reached on average 28.2%. Similarly, the services sector had a nearly 70% share in GVA, oscillating from 56.2% to 83.5%.

In the years 1998-2005, the share of the agricultural sector in the value of products and services was systematically falling in all macroregions **(Table 15)**. The reduced share of agriculture was more strongly visible in non-metropolitan areas (-1.9pp) as this sector had already played a lesser role in the economies of metropolitan areas (on average, 1.1% of GVA). At the same time, deindustrialisation processes affected metropolitan areas more strongly (-2.5pp), while in their regional hinterlands, industry was still a significant player despite a 1.5pp decrease (32.5%). As a result of these processes the share of the services sector increased as it grew by 3.1pp in metropolises, mostly at the expense of industry, and by 3.2pp in the regional hinterland – which is a reflection of the waning of the traditional agriculture- and industry-based economy.

Component part	Agriculture	Industry and construction	Services

[21] The economic structure of metropolitan macroregions (N=79) was analysed on the basis of 2003 EUROSTAT data on gross value added (GVA) for three main sectors: agriculture, industry and construction, and services for NUTS3 entities. In addition, for some macroregions (N=77), the internal structure was analysed taking into account three aspects: "simple" services (sections: G: trade and repairs, H: hotels and restaurants, I: transport, storage and communication), "advanced" services (J: financial intermediation; K: real estate, renting and business activities), and "public" services (L: public administration, M: education, N: health and social work, O: community services). These data were derived from the IGEAT database created for the needs of the project based on the NUTS3 system for 2006.

	% GVA in 2005	Change in pp in 1998-2005	% GVA in 2005	Change in pp in 1998-2005	% GVA in 2005	Change in pp in 1998-2005
Metropolitan area	1.1	-0.7	25.5	-2.5	73.4	3.1
Regional hinterland	4.2	-1.9	32.5	-1.5	62.4	3.2

Table 15. Basic economic structure indicators in metropolitan macroregions
Source: prepared by the author.

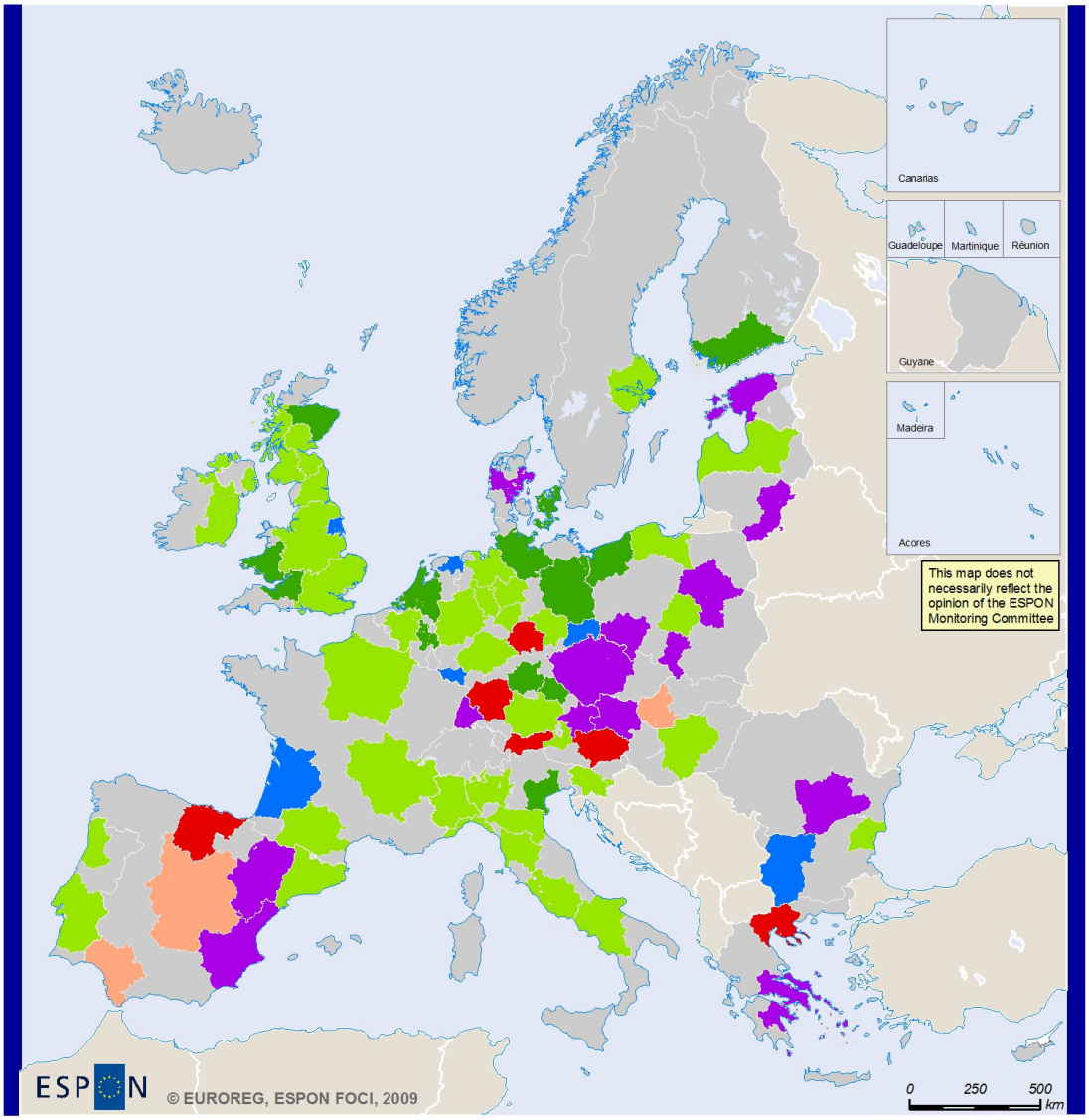
While in the case of agriculture, the directions of changes in both component parts of the majority of macroregions were convergent, the situation in industry and services was much more complex **(Table 16).** In about 20 macroregions, opposing tendencies relating to the role of these sectors in the metropolis and in the region could be observed.

Type of macroregion	Share of agriculture	Share of industry	Share of services
Increase MA > Increase RH	0	6	24
Increase MA < Increase RH	0	3	35
Increase MA i Decrease RH	1	6	7
Decrease MA < Decrease RH	27	13	1
Decrease MA > Decrease RH	51	37	0
Decrease MA i Increase RH	0	14	12

Table 16. Structural trends in the metropolitan areas and their regional hinterlands [1998-2005]Source: prepared by the author.
In the vast majority of macroregions, deindustrialisation was the dominant process; it was progressing at a particularly fast rate in the regional surroundings of large cities in the United Kingdom, Italy, France, Benelux countries and Germany (with the exception of Stuttgart and Erfurt) **(Figure 12a)**. In some macroregions, these processes of relative deindustrialisation of metropolitan areas were accompanied by an increased role of industry in the regional hinterland. Here, examples include the capital city macroregions of CEE countries (including Austria) as well as some regions of Spain (Valencia, Saragossa). In contrast, the role of industry grew only in a very small number of macroregions, both due to its faster development in metropolitan areas, e.g.: Bilbao, Stuttgart, Thessaloniki, Graz, Innsbruck or Erfurt, and in their regional hinterlands, e.g. Madrid, Seville or Bratislava. As a matter of course, increasing industrialisation was followed by a relative diminishing of the significance of the service sector in the economy.

The role of the services sector grew relatively faster in non-metropolitan locations. Nevertheless, in some places of Europe (northern England and Scotland, northern Italy,

the regions of some cities in Central and Eastern Europe and in northern Germany), this sector was developing relatively faster in metropolises than in their hinterlands **(Figure 12b)**. Moreover, opposing tendencies concerning the development of this sector could be frequently observed in the metropolis-the region context. As a rule, this led to a relative increase of the concentration of the services sector, particularly in the capital city regions of CEE countries. On the other hand, a relative deconcentration of services could be seen particularly distinctly in Spanish macroregions (Madrid, Bilbao), some regions of Germany (Stuttgart, Erfurt) and Austria (Innsbruck, Graz) and, to a lesser extent, in some of CEE countries (Budapest, Sofia, Bucharest).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Source: ESPON 2013 Database
Typology of macroregions - GVA in industry change in pp [1998-2005]
Increase MA > Increase RH (6)
Increase MA < Increase RH (3)
Increase MA & Decrease RH (6)
Decrease MA < Decrease RH (13)
Decrease MA > Decrease RH (37)
Decrease MA & Increase RH (14)

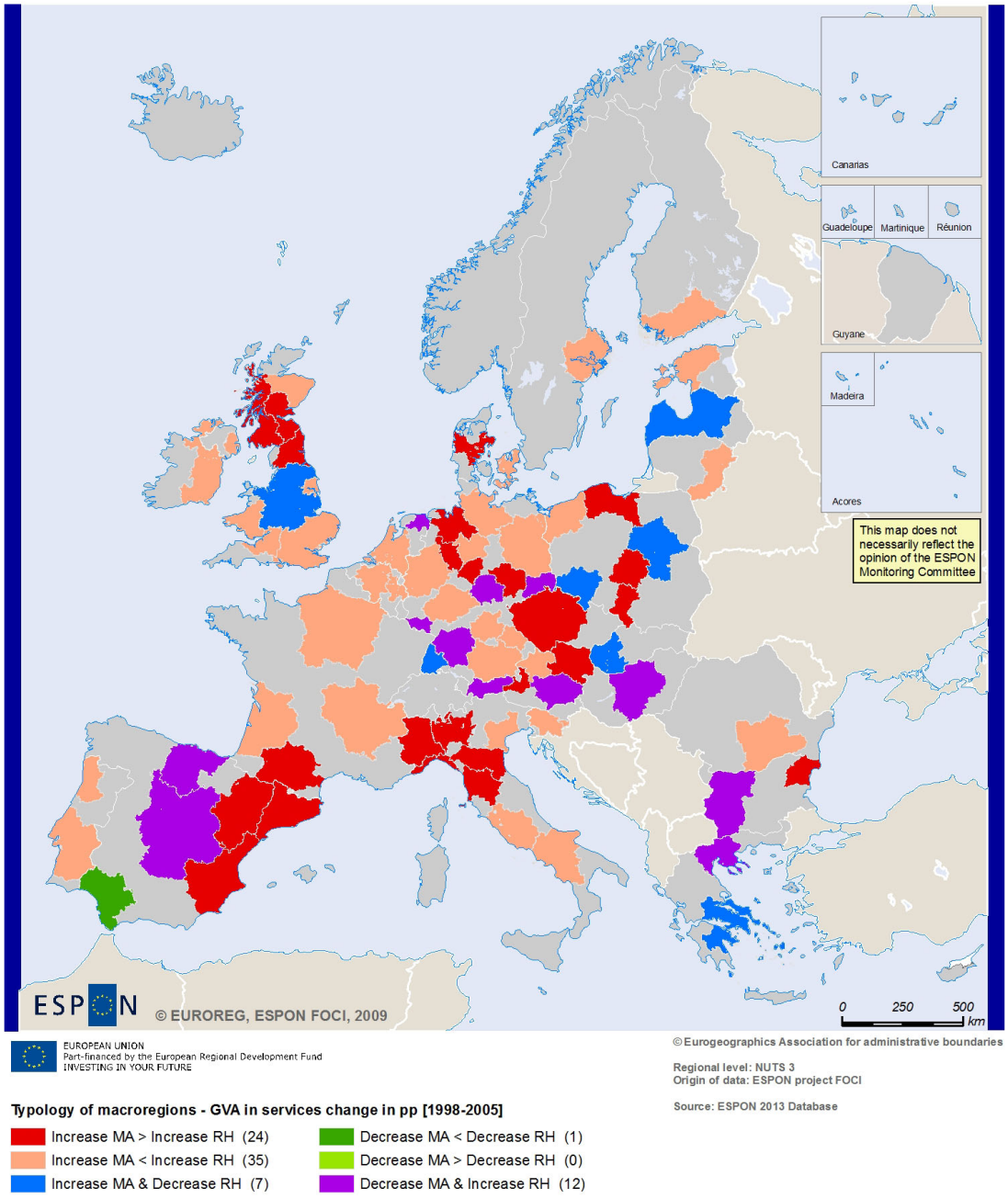


Figure 12. Change in the economic structure in metropolis-region context [1998-2005]
Source: prepared by the author.

A synthetic view of the structural differences between the metropolis and the region for the three principal sectors can be shown using the dissimilarity index, expressed by the following formula:

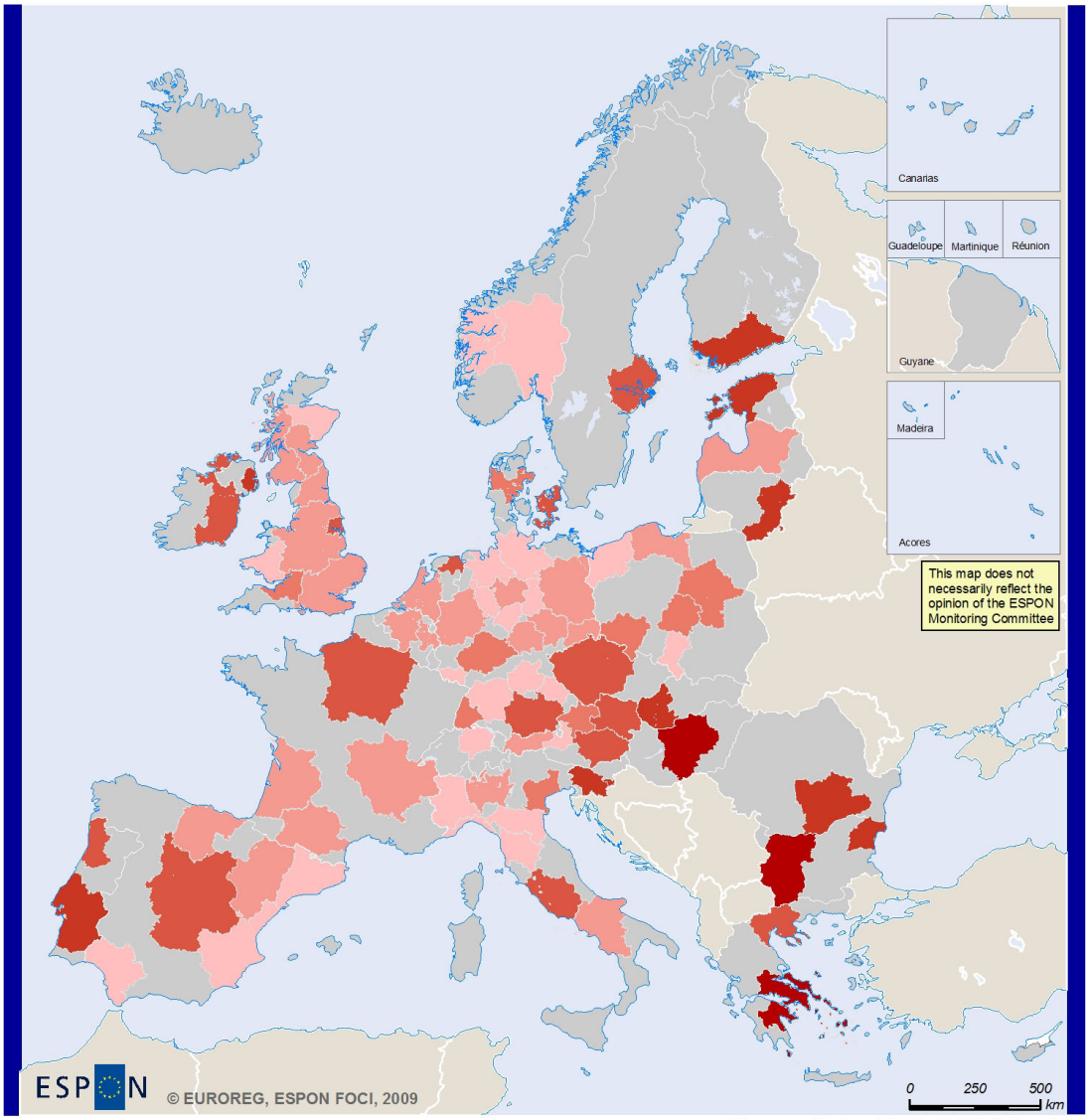
$\Sigma_{i \to N} | a_i/A - b_i/B | / 2$

where: i – sector of the economy, a/A – GVA of the metropolitan area, b/B – GVA of the regional hinterland.

This index can be expressed in the percentage form and can assume values from 0 – total similarity, to 100 – denoting the total dissimilarity of the economic structure.

In 1998-2005, the average structural similarity rate within metropolitan macroregions was very high (ca. 11%) as well as stable (change only by 0.2%). Nevertheless, significant differences were observable between macroregions, with the figures ranging from 0% to 40%. At the same time, the pace of changes in the economic structure was similar in the metropolis-the region context, and reached 3.7pp in metropolitan areas and 4.1pp in their regional hinterlands.

Structural disparities were particularly high in the capital city macroregions of CEE countries (Warsaw, Budapest, Sofia, Bucharest, Vilnius, Ljubljana, Bratislava, Prague), including Greece (Athens) **(Figure 13)**. At the same time, some macroregions were internally homogenous in terms of economic structure, e.g. the Spanish regions of Barcelona, Valencia, Seville, Emilia-Romagna in Italy or selected regions of northern (e.g. Hamburg and Bremen), as well as southern Germany (e.g. Stuttgart, Nuremberg). On the other hand, changes in the dissimilarity index values were rather "patched" spatially. The differences in this respect as a rule increased in CEE countries, northern England and Scotland, and in selected regions of Germany (Hamburg, Munich, Rhine-Ruhr), Italy (Turin, Milan, Florence), Spain (Valencia, Seville) and Greece (Athens). In contrast, in some of the major Western European macroregions (including London and Paris), the economic structures of the metropolis and the regional hinterland were becoming increasingly similar.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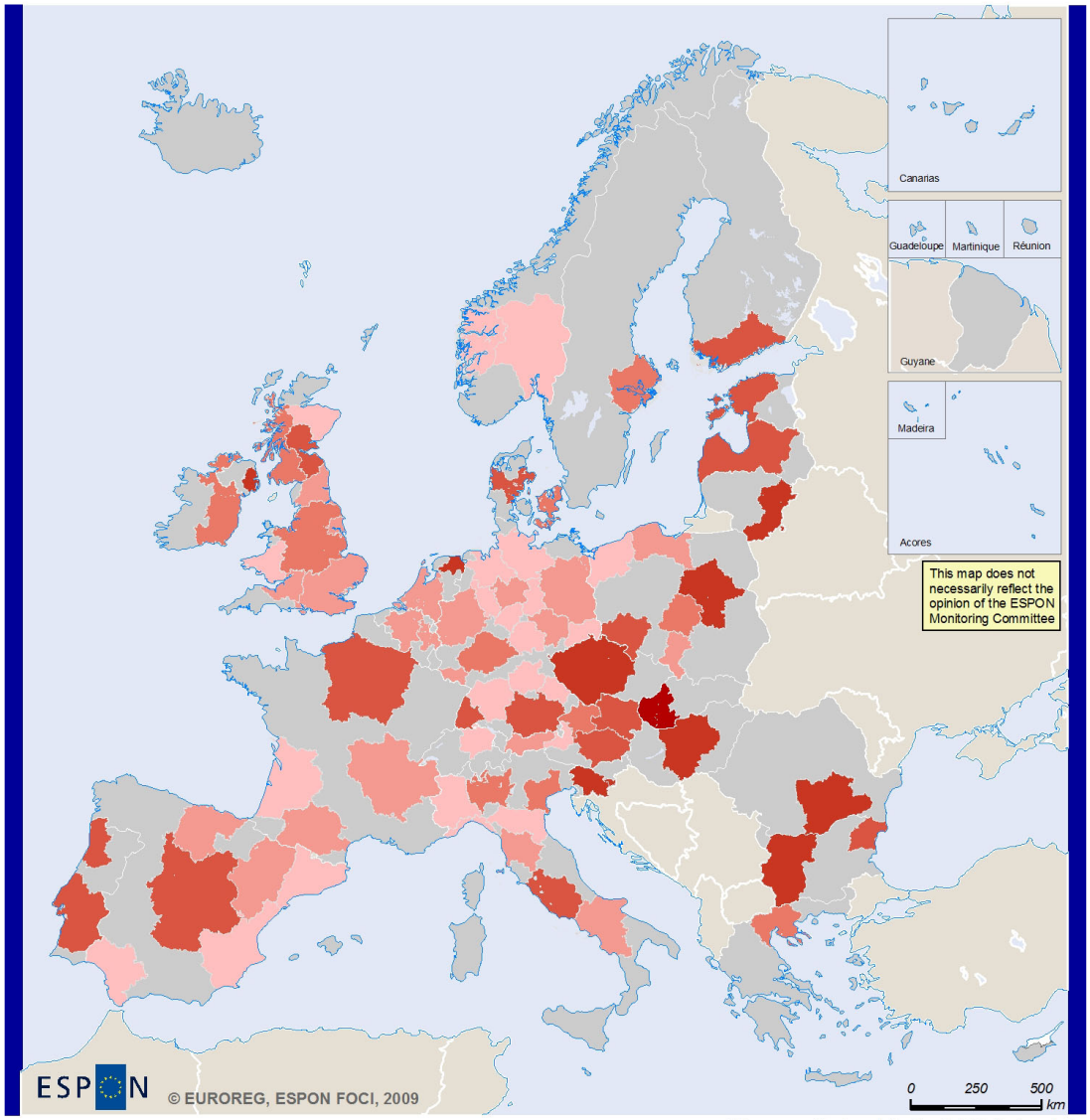
Dissimilarity index 1998 [%]
0,8 up to 5 (3)
5 up to 10 (9)
10 up to 15 (14)
15 up to 20 (10)
20 up to 25 (23)
25 up to 31,4 (20)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Regional level: NUTS 3
Origin of data: ESPON project FOCI
Source: ESPON 2013 Database
Dissimilarity index 2005 [%]
0,8 up to 5 (2)
5 up to 10 (9)
10 up to 15 (16)
15 up to 20 (11)
20 up to 25 (21)
25 up to 39,8 (20)

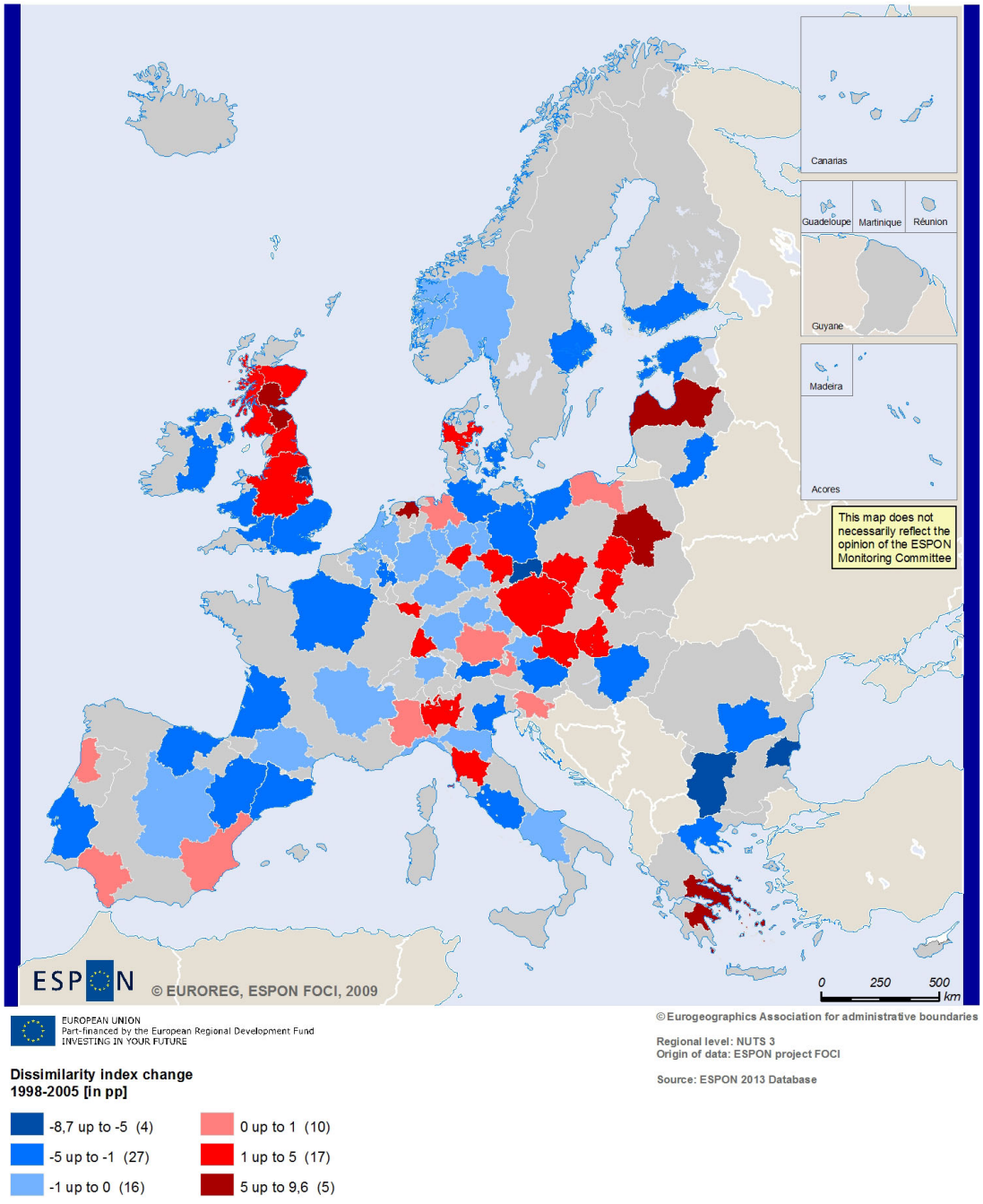


Figure 13. Structural similarity and its changes in metropolis-region context
Source: prepared by the author.

The structural changes in the metropolis and in the region did not show any significant correlation. This means that, for instance, the increased significance of the services sector in the metropolis did not imply specific structural changes in the regional hinterland. In effect, there existed wide disparities in this regard between macroregions, which could be seen as a proof of the *differentia specifica* of the each metropolis-region system.

This is also corroborated by the analysis of five extreme cases in terms of decreased similarity of the economic structure. In some of them (e.g. Warsaw and Athens), the deindustrialisation process progressed rapidly in metropolises, which was accompanied by a simultaneous development of the production sector in their regional hinterlands **(Table 17)**. However, in other macroregions (e.g. Edinburgh) the speedy development of the metropolitan service sector was accompanied by a deindustrialisation process in the regional surroundings. On the other hand, the unique character of the region of Groningen, a city in northern Holland, was expressed by the fact that the significance of industry in the economy increased – quite a typical situation in smaller urban centres which did not perform significant service functions vis-à-vis external part of the regional hinterland.

Macroregion	GVA in agriculture		GVA in industry and construction		GVA in services	
	% in 2005	Change in pp in 1998-2005	% w 2005	Change in pp in 1998-2005	% in 2005	Change in pp in 1998-2005
Metropolitan area						
Warsaw	1.1	-0.5	18.5	-8.2	80.4	8.7
Athens	0.4	-0.2	15.0	-3.8	84.6	4.0
Riga	1.3	0.0	19.6	-8.5	79.0	8.6
Groningen	1.3	-0.7	51.2	2.5	47.5	-4.8
Edinburgh	0.4	-0.2	16.8	-9.5	82.8	9.7
Regional hinterland						
Warsaw	13.2	-2.6	30.9	3.5	55.9	-0.9
Athens	7.3	-4.2	47.8	9.5	44.9	-5.3
Riga	10.4	1.1	27.1	-0.9	62.4	-0.2
Groningen	3.9	-2.0	28.4	-3.2	67.8	2.2
Edinburgh	2.1	-1.0	30.2	-3.5	67.7	4.4

Table 17. Extreme cases in terms of the dissimilarity of economic structures
Source: prepared by the author based on EUROSTAT data.

In contemporary information economy, the increasing role of specialised B2B services is extremely important as compared to other types of services. The analysis investigating the share of specialised services in two NACE sections (J – financial intermediation and K – real estate, renting and business activities to simple services such as: trade and repair,

(G), transporting, storage and communication (H) as well as hotels and restaurants - I) shows that the higher was the share of services in the economy of a given macroregion the higher the share of specialised services **(Table 18).**

	Metropolitan area (MA) - share of services in GVA	Regional hinterland (RH) - share of services in GVA	Ratio of services' share in GVA [MA/RH]
Share of specialised services in GVA			
- metropolitan area	0.61**	0.42**	*0.01*
- regional hinterland	*0.19*	0.59**	-0.44**
Share of simple services GVA			
- metropolitan area	*0.06*	-0.41**	0.46**
- regional hinterland	*0.00*	0.24*	-0.25*

** at the significance level of 0.01
* at the significance level of 0.05

Table 18. Correlation between the share of specialised services in GVA and the role of the service sector [2002]
Source: prepared by the author.

This correlation was equally visible in the metropolises and in their regional hinterlands. Furthermore, the metropolis' "advancement" in services, understood as a high share of specialised services in Gross Value Added had a positive though smaller impact on the services sector in the regional hinterland. In contrast, the role of simple services was different: their high share in the metropolitan economy would as a rule imply a small share of services in the regional hinterland's GVA, and thereby broader differences in the role of services between the metropolis and the region.

This correlation can hypothetically indicate situations when the provision of simple services to the regional hinterland by the metropolitan centre obstructs the development of such services in the regional hinterland and leads to the so-called "shadow effect" of the metropolis. However, the comparative analysis of the service sector structure shows that there exists a positive correlation between the role of the simple services sector in the metropolis and in the regional hinterland **(Table 19)**. Moreover – and very interestingly – a higher share of simple services in the metropolitan economy implies a smaller role of the specialised services sector and (albeit to a lesser extent) public services in the regional hinterland's economy. This interrelationship is difficult to explain, and it should be borne in mind that it could be coincidental, caused by an interplay of other factors not included in this part of the study.

Regional hinterland Metropolitan area	Share of simple services	Share of specialised services	Share of public services
share of simple services	0.46**	-0.57**	-0.44**

share of specialised services	-0.28*	0.59**	0.26*
share of public services	*-0.17*	*0.13*	0.67**

** at the significance level of 0.01
* at the significance level of 0.05

Table 19. Correlation between the shares of different types of services in GVA in the metropolis and in the region [2002]
Source: prepared by the author.

Summary

Based on our analyses, we can draw the following conclusions concerning the changes in the economic structure which took place in metropolitan macroregions in the years 1998-2005:

- The structural differences between the metropolis and the region are primarily due to the different roles of industry in the economy, whereas the differentiating significance of the agricultural sector, expressed as its share in gross added value, is only marginal.
- It is difficult to identify linkages between structural changes occurring in metropolises and in their regional hinterlands. In some regions, similar processes take place (e.g. an increasing role of services), whereas opposing trends can be observed in other macroregions (e.g. increasing share of services in the metropolitan area's economy, accompanied by a simultaneous industrialisation of the metropolitan regional hinterland).
- The role of services in metropolitan services results from a growing role of specialised services, whereas the service "advancement" of the metropolis is usually accompanied by an increased role of services in the regional hinterland.
- A greater role of simple services in the metropolis is correlated with a smaller role of specialised and public services. However, suggesting the direct reason for this is difficult.

Labour market situation

On the basis of analyses depicting the labour market situation[22], we can say that there were few disparities in this regard between the metropolis and the region as compared to the demographic and structural aspects. In 2005, per 1000 inhabitants of the metropolitan region, on average ca. 448 were employees. In effect, the activity rate was

[22] Data on the situation in macroregional labour markets used in the present study were derived from two EUROSTAT sources: ESA95 (European System of Accounts) – showing data on the number of employees by place of work, and LFS (Labour Force Survey) – providing data on the number of economically active population and unemployment rate by place of residence. The data from the former source referred to the NUTS3 level in 2003, and from the latter – to the NUTS3 system in 2006.

47.7% with the rate of unemployment reaching 9.5%. In addition, despite favourable economic performance, there was no marked improvement of the situation in macroregional labour markets in the years 2002-2005. As an example, the average unemployment rate remained at a similar level even though the activity level improved, albeit slightly.

The surveyed component parts of macroregions, i.e. metropolitan regions and their regional hinterlands, differed mostly in terms of the number of employees per 1000 population **(Table 20)**, which was visibly higher in metropolises. This can be due to a higher percentage of the non-working age population and to commuting to work from locations beyond the boundaries of metropolitan areas. At the same time, the situation in macroregional labour markets in terms of activity rate and unemployment rate was quite similar, with a slight prevalence (by about 2pp) of metropolitan areas over their regional hinterlands.

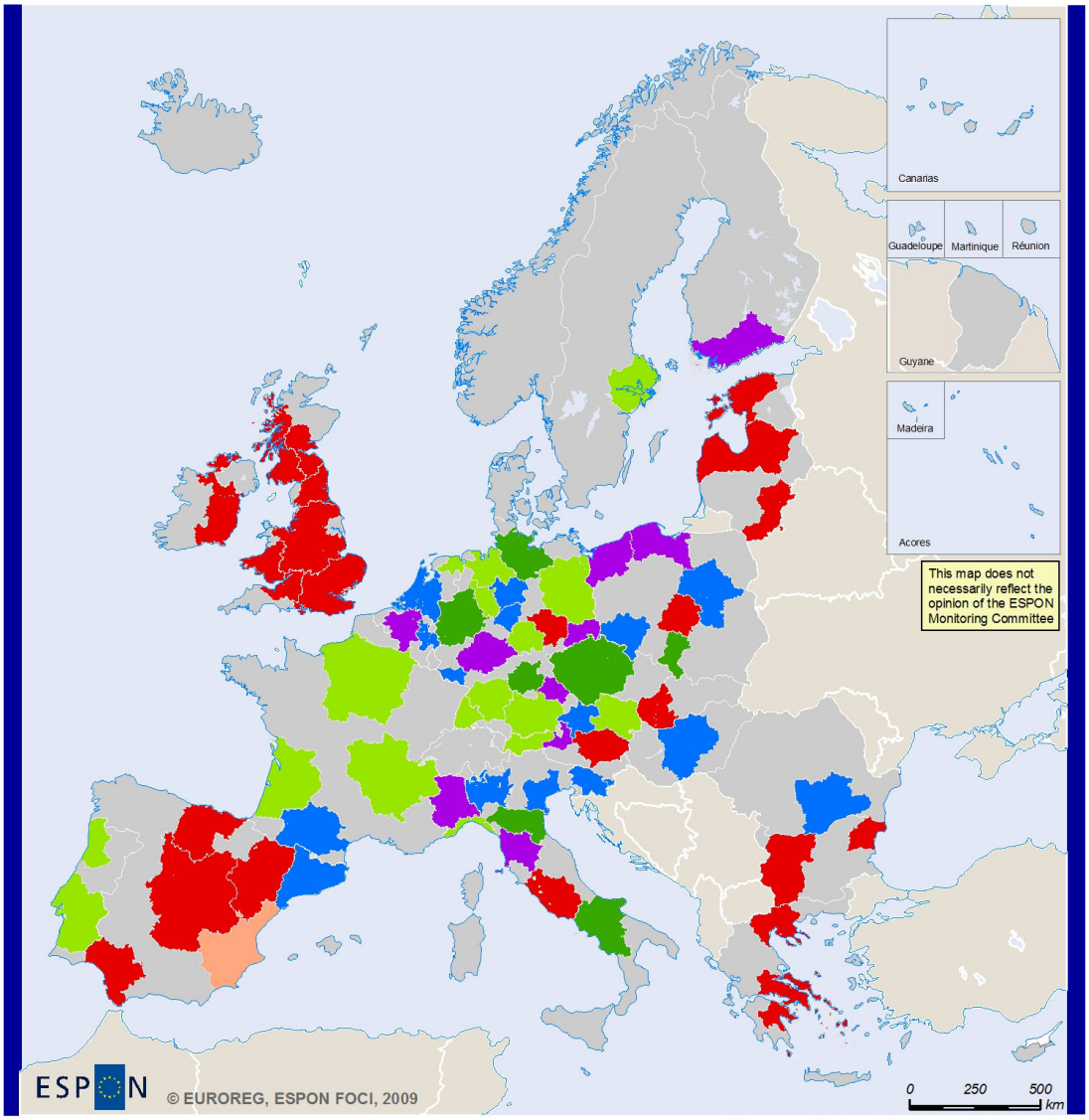
	Employees per 100 population		Activity rate		Unemployment rate	
	% in 2005	Change in pp in 2000-2005	% in 2005	Change in pp in 2002-2005	% in 2005	Change in pp in 2002-2005
Metropolitan area	48.8	0.9	48.9	1.3	8.4	-0.1
Regional hinterland	41.0	0.2	46.6	0.9	10.5	0.1

Table 20. Basic labour market indicators in metropolitan macroregions [2005]
Source: prepared by the author.

In addition to that, the labour market dynamics was rather similar in the surveyed metropolises vs. the regions **(Table 21)**. Generally, the labour market situation was improving, as a rule to a greater extent in metropolitan areas, which could be observed particularly well in British, Spanish and CEE macroregions. In contrast, in many of German, French, Italian and Austrian macroregions the labour market situation was deteriorating in both component parts of metropolitan macroregions. In the remaining countries, the situation varied from country to country, whereas the distribution of individual types of macroregions was rather patchy, which was particularly well visible in Italy and Poland **(Figure 14)**.

Types of macroregions	Employees per 100 population	Activity rate [%]	Unemployment rate [%] (reversed scale)
Increase MA > Increase RH	24	24	11
Increase MA < Increase RH	15	13	7
Increase MA i Decrease RH	7	2	16
Decrease MA < Decrease RH	1	21	15
Decrease MA > Decrease RH	17	5	20
Decrease MA and Increase RH	10	9	5

Table 21. Labour market trends in metropolises and its regional hinterlands
Source: prepared by the author.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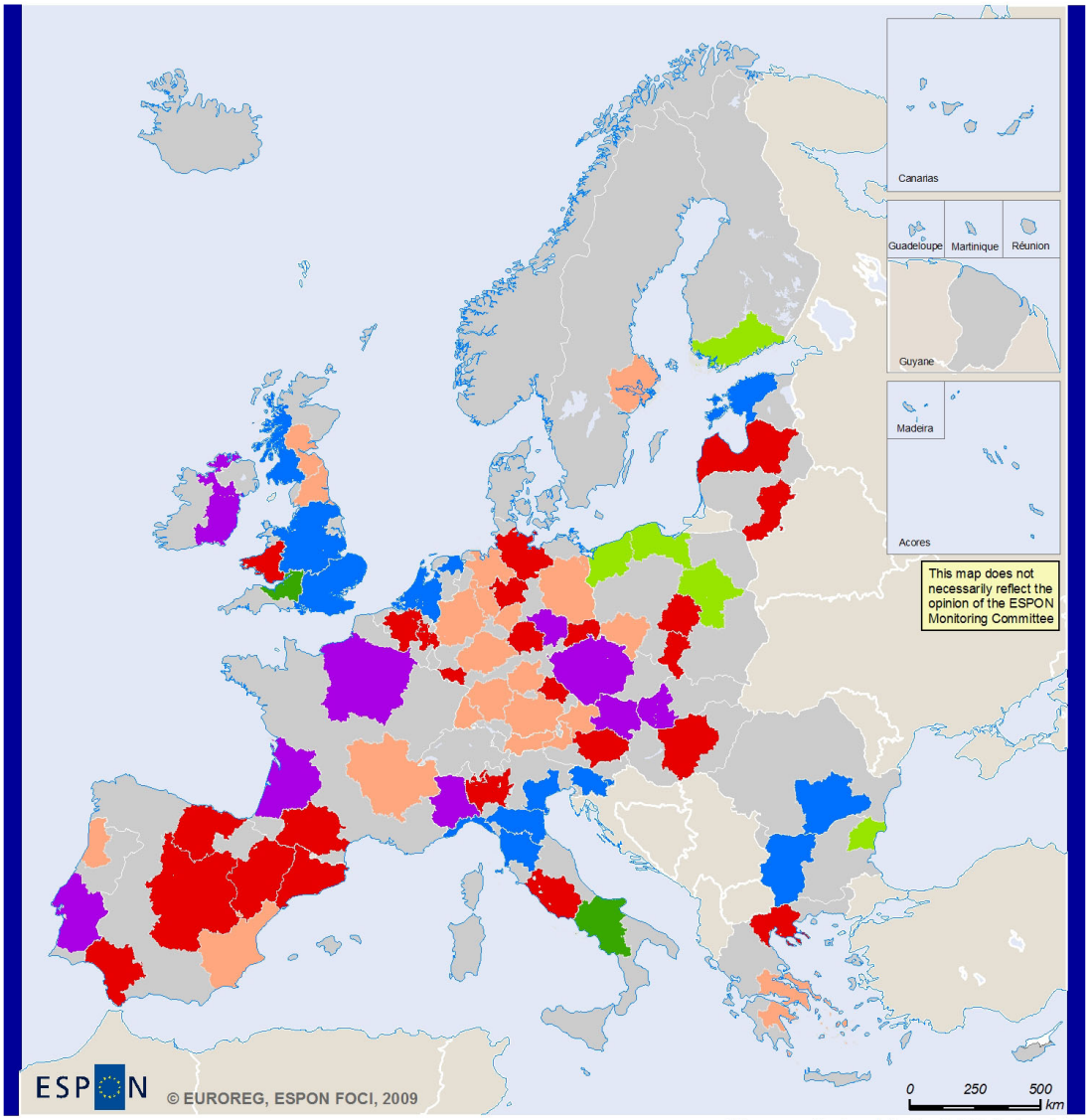
Regional level: NUTS 3
Origin of data: ESPON project FOCI
Source: ESPON 2013 Database
Change in employees per 100 population in percentage points [2002-2005]
Increase MA > Increase RH (24)
Increase MA < Increase RH (1)
Increase MA & Decrease RH (15)
Decrease MA < Decrease RH (7)
Decrease MA > Decrease RH (17)
Decrease MA & Increase RH (10)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Source: ESPON 2013 Database
Change of activity rate in percentage points [2002-2005]
Increase MA > Increase RH (24)
Increase MA < Increase RH (21)
Increase MA & Decrease RH (13)
Decrease MA < Decrease RH (2)
Decrease MA > Decrease RH (5)
Decrease MA & Increase RH (9)

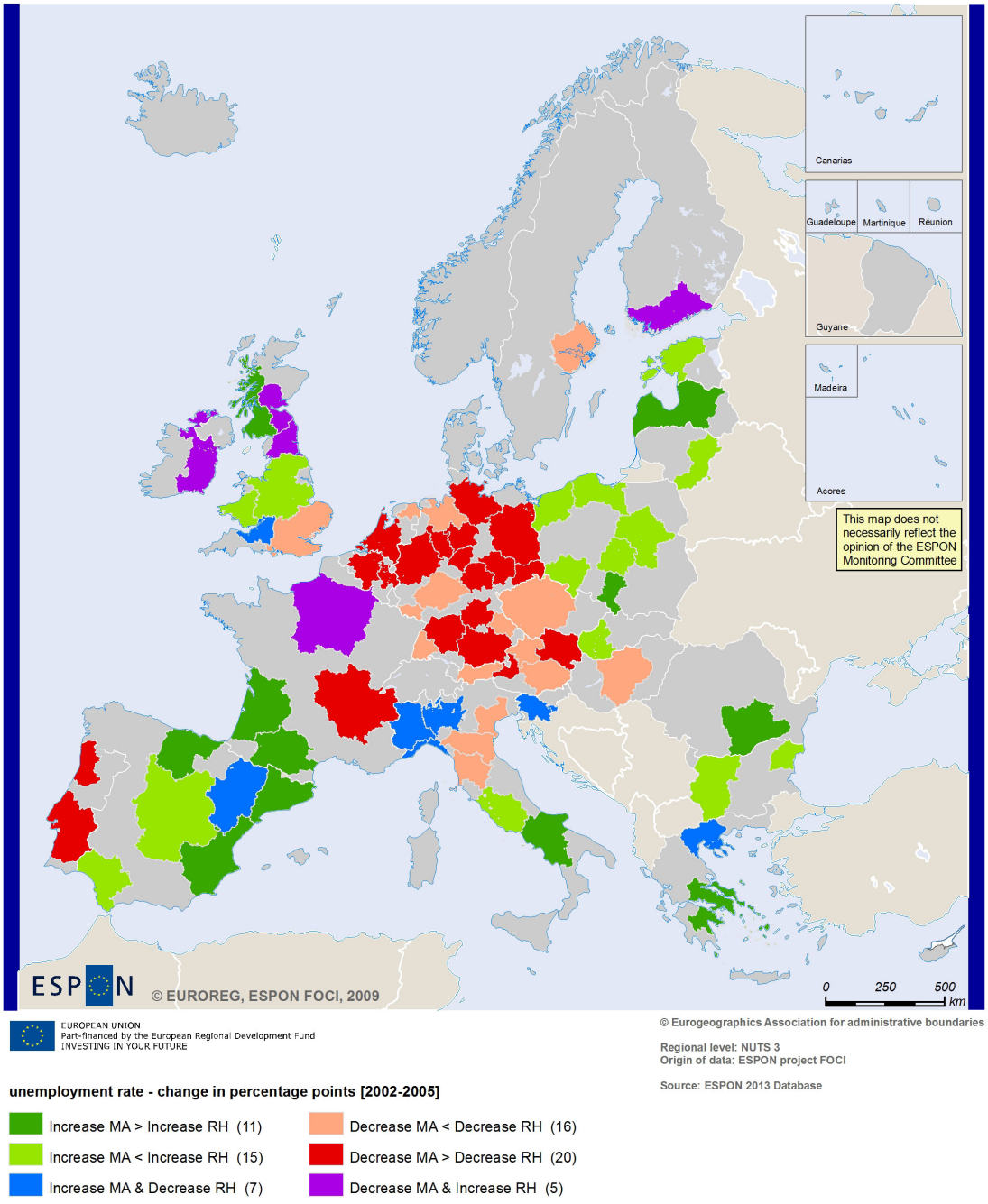


Figure 14. Changes in labour market situation in metropolis-region context in 2002-2005
Source: prepared by the author.

The situation and changes in the labour market situation were quite similar in the analysed metropolises and regions. In particular, an improved situation in the metropolitan labour market would as a rule imply an improvement in the regional hinterland's labour market, mostly with regard to the unemployment rate (k=0.68) and the number of employees per 100 population (*k*=0.72). In contrast, the intraregional correlation in terms of activity rate changes was weaker (k=0.54). Also, in 2005 the correlation between the values of three analysed indicators (i.e. employees, activity rate and unemployment rate) in the metropolis and in the region remained at a similar level. Furthermore, in 2005 a high unemployment in metropolises was strongly correlated statistically with a small percentage of employees per 100 population in the regional hinterland, which is difficult to interpret. It could well be that this was caused by a negative impact of the metropolis' problems on cooperation linkages between the metropolis and the region.

a) status [2005]

Region Metropolis	Employees per 100 population	Activity rate	Unemployment rate
Employees per 100 population	0.58**	0.30*	-0.33*
Activity rate	*0.15*	0.52**	*-0.07*
Unemployment rate	-0.77**	-0.24*	0.58**

b) change [2002-2005]

Region Metropolis	Employees per 100 population	Activity rate	Unemployment rate
Employees per 100 population	0.72**	*-0.02*	-0.59**
Activity rate	*0.06*	0.54**	0.22*
Unemployment rate	-0.53**	0.33*	0.68**

** at the significance level of 0.01
* at the significance level of 0.05

Table 22. Correlation between labour market situation and change in the metropolis and its regional hinterland]
Source: prepared by the author.

It should be pointed out that the labour market dynamics in the surveyed metropolises and regions was significantly shaped by the economic performance in the country at large. In the years 2002-2005, the situation in this respect varied from country to country. The highest fall in the unemployment rate was recorded in CEE countries (except Bulgaria), mostly the Baltic countries (Lithuania, Latvia, Estonia), as well as Poland, Slovakia and Romania. On the other hand, among the EU-15, the situation got better in Spain and Italy, and deteriorated – though not as strongly - in Germany, Portugal, Sweden and the Netherlands **(Figure 15)** .

To some extent, the tendencies described above are reflected in an analysis of extreme cases **(Table 23)**. For instance, the most significant unemployment rate decreases, measured in percentage points, could be observed in the metropolises of Southern Europe: in Naples (Italy) and Seville (Spain) as well as in Central and Eastern Europe: Vilnius (Lithuania), Varna and Sofia (Bulgaria). As unemployment fell, the number of employees per 100 population was increasing rapidly, which was particularly well visible in Bulgaria. In addition to that, the unemployment rate fell comparably also in the regional hinterlands of these metropolises (except Naples). As a result, the situation in regional labour markets became more uniform - except Seville and Varna, where unemployment was still felt more acutely in the metropolis' regional hinterland.

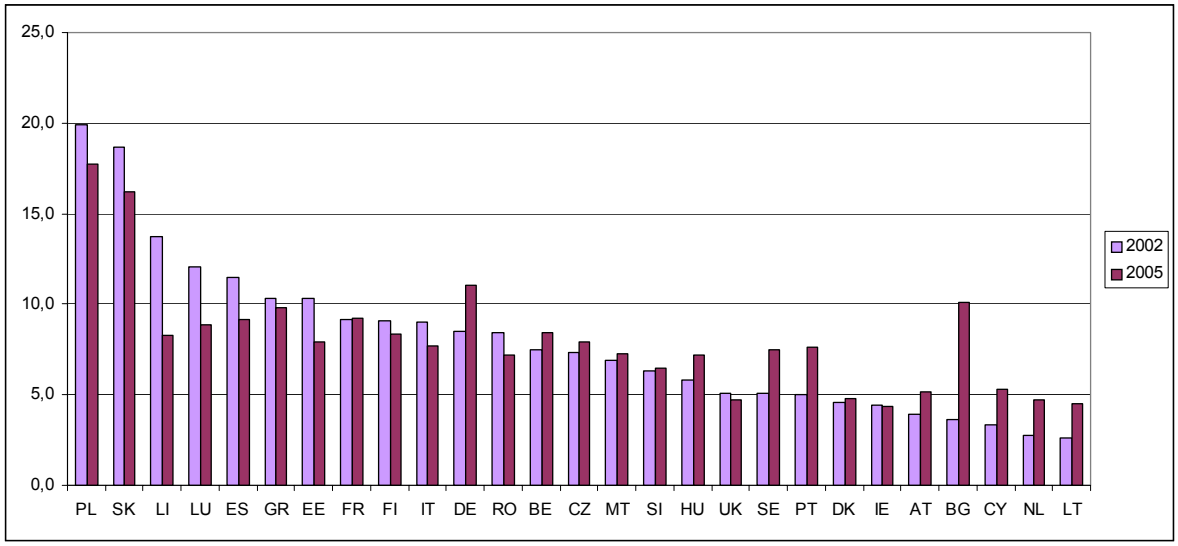


Figure 15. Changes in unemployment rate by ESPON country in 2002-2005.
Source: prepared by the author.

At the same time, the labour market situation deteriorated most alarmingly (with an increase in the unemployment rate by 3-5pp) in four German metropolises, and in Porto (Portugal). These processes affected the metropolises and their regional hinterlands equally strongly, as a result of which the unemployment rate was similar across the entire macroregion. Here, the differentiating factor (between the metropolis and the region) was the number of employees per 100 population, which oscillated between 45-

52 in the metropolitan area and between 39-48 in the regional hinterland of the metropolis.

Macroregion	Metropolitan area				Regional hinterland			
	Unemployment rate		Employed per 100 population		Unemployment rate		Employed per 100 population	
	% in 2005	Change in pp in 2002-2005	% in 2005	Change in pp in 2002-2005	% in 2005	Change in pp in 2002-2005	% in 2005	Change in pp in 2002-2005
Metropolitan areas with highest unemployment rate decrease								
Naples	15.2	-7.2	31.5	-0.2	14.1	-0.3	31.5	-1.3
Seville	13.9	-6.3	37.9	3.0	17.1	-8.6	34.9	2.6
Vilnius	8.6	-5.9	46.6	4.6	7.1	-8.1	40.5	3.6
Varna	9.5	-5.8	46.2	12.0	16.7	-10.8	41.0	6.5
Sofia	8.0	-4.7	53.5	9.7	10.3	-7.1	39.7	3.6
Metropolitan areas with highest unemployment rate increase								
Saarbrücken	11.4	3.3	50.8	0.8	10.2	3.5	39.3	-0.2
Hanover	11.0	3.3	51.1	0.0	10.8	2.8	41.4	-0.2
Ruhr-Rhine	11.3	3.6	47.2	-0.1	8.8	2.8	44.8	-0.3
Bremen	11.6	4.5	48.0	-1.0	11.7	4.6	43.5	-0.4
Porto	10.8	4.8	46.1	-2.3	7.4	3.5	48.5	-1.5

Table 23. Extreme cases in terms of unemployment rate changes in the metropolitan area
Source: prepared by the author.

The economic growth without fostering a distinct improvement in the labour market situation was possible mainly due to an increase in labour productivity. Productivity in the surveyed metropolitan macroregions differed from region to region. **(Table 24)**. A comparison of productivity in industry and in services (without taking internal differences between them into account) points to a higher productivity in the former sector (by 13% higher in the metropolis and 11% in the regional hinterland), characterised by an increasing tendency concerning these disparities (ca. 5-6pp in 2002-2005). On the other hand, productivity in industry was even 2.5 to 3 times higher than in agriculture both in the metropolis and in the regional hinterland, and this ratio increased tangibly during the three years.

Ratio	Metropolitan area		Regional hinterland	
	2002	2005	2002	2005
Industry / Services	1.07	1.13	1.07	1.11
Industry / Agriculture	2.66	3.14	2.44	2.70

Table 24. Differences in labour productivity between sectors and their changes
Source: prepared by the author.

A comparison of metropolitan areas and regional hinterlands in terms of labour productivity revealed that while productivity in agriculture was on the whole similar and becoming uniform even further in the period in question (1998-2005), the disparities in the two remaining sectors were significant and growing wider **(Table 25)**. Labour

productivity in the industrial sector in metropolises was by some 17% higher than in their regional hinterlands. The scale of disparities in labour productivity was similar in the service sector (14%). Nevertheless, owing to substantial internal differences in the sector, it can be expected that it was much higher in the case of specialised services, and lesser in the sector of simple and public services.

	Agriculture		Industry		Services	
	2005 ratio	Change in pp in 1998-2005	2005 ratio	Change in pp in 1998-2005	2005 ratio	Change in pp in 1998-2005
Labour productivity ratio MA/RH	1.03	-0.03	1.17	0.02	1.14	0.01

Table 25. Ratio of labour productivity between the metropolis and the region in metropolitan macroregions
Source: prepared by the author.

Summary

Based on our analyses, we can propose the following conclusions concerning the situation in the macroregional labour markets in 1998-2005:

- The pool of labour in metropolitan areas was higher and better utilised than in regional hinterlands;
- There were marked linkages between the labour market situation in metropolises and in their regional hinterlands, but this applied to the dynamics rather than the situation on the macroregional labour market – and was largely a consequence of changes in the nation-wide labour market;
- The situation in macroregional labour markets was rather stable despite a period of good economic performance, and economic growth was mostly produced by an increase in productivity;
- The disparities in productivity between the metropolis and the region were relatively wide, both in case of the industrial and services sectors.

Multidimensional coherence of metropolitan macroregions

Intraregional cohesion should be evaluated not only in terms of equalising the development level disparities between the metropolitan area and its further regional hinterland, but – more importantly – in terms of the correspondence between the directions of changes in both these territorial systems. In addition to the strictly economic dimension (GDP per capita), these transformations may relate to other aspects, e.g. demographic and structural aspects as well as the labour market situation. To evaluate the similarity of intraregional changes in metropolitan macroregions, nine of the following variables were selected:

- Demographics: population change, natural increase, migration balance;
- Economic structure: changes in the share of agriculture, industry and services;
- Labour market: changes in the number of employees per 100 population, changes in the economic activity and unemployment rates.

As the next step, these variables were assessed, and the following were regarded as positive: population increase, positive natural increase and migration balance; increased role of services in the economy and reduced role of agriculture; as well as an increase in the number of employees and the activity rate, as well as reduction of the unemployment rate. In the case of industry, owing to the significance of the sector's internal structure, we decided to forgo assessment at this level of aggregation.

In some of the surveyed metropolitan macroregions, we could see some discrepancy in the directions of change **(Table 26).** As a rule, this divergence could only be observed for one of the three examined aspects (2-3 analysed indicators in case of 35 macroregions). Slightly more frequently, this was related to a greater number of positive trends in the metropolitan area (20 cases) than in the regional hinterland (15 cases). At the same time, with a wider divergence concerning the directions of change (comprising 4 or more indicators) – which was observed in as few as 8 macroregions – the predominance of positive trends in the metropolitan region was clearly visible, which could be a consequence of the backwashing of development resources from the regional hinterland to the metropolis.

On the other hand, the directions of intraregional changes were similar in 31 metropolitan macroregions (ca. 40%). Moreover, as a rule this resulted in the relative strengthening of the role played by the regional hinterland (19 cases), which could point either to its endogenous growth potential or to the positive effects of the diffusion of development processes generated by the metropolitan centre.

<table>
<tr><td colspan="2">Similarity of directions of change (0 or 1 indicator)</td><td colspan="4">Dissimilarity of directions of change (2 or more indicators)</td></tr>
<tr><td colspan="2">N=31</td><td colspan="4">N=43</td></tr>
<tr><td>MA favourable*</td><td>RH favourable *</td><td colspan="2">High (4 or more indicators)</td><td colspan="2">Low (2 or 3 indicators)</td></tr>
<tr><td rowspan="3">N=12</td><td rowspan="3">N=19</td><td colspan="2">N=8</td><td colspan="2">N=35</td></tr>
<tr><td>MA favourable *</td><td>RH favourable *</td><td>MA favourable *</td><td>RH favourable *</td></tr>
<tr><td>N=8</td><td>N=0</td><td>N=20</td><td>N=15</td></tr>
</table>

- at least 5 indicators

Table 26. Compatibility in the directions of change in metropolitan macroregions
Source: prepared by the author.

The distribution of the individual types of metropolitan macroregions in the European space was quite patchy and did not easily yield to generalisation. The widest intraregional dissimilarity in the directions of change could be observed in macroregions situated in Central and Eastern Europe (6 of 8 cases). These were mostly the capital city macroregions of: Warsaw, Bucharest, Sofia, Ljubljana, in addition to Wrocław and Dresden. This group also included Athens and Saarbrűcken. Lesser dissimilarities (also with an excess of more favourable trends for the metropolitan area than for the regional hinterland), were also quite common in CEE countries, e.g. Austria, Czech Republic, Hungary and Lithuania, and in some Italian and Spanish macroregions. In addition, this group included e.g. polycentric metropolitan macroregions of central England and the Netherlands. A certain discrepancy concerning development trends in a more favourable situation in the regional hinterland was visible in the remaining capital city macroregions: Paris, Lisbon, Dublin, Berlin, Tallinn, Helsinki and Bratislava. This group also included some macroregions in the United Kingdom, France and Italy. On the other hand, German macroregions as well as some British and Spanish macroregions (with London and Barcelona) as well as certain macroregions in Sweden and Latvia were characterised by a full compatibility in the directions of changes.

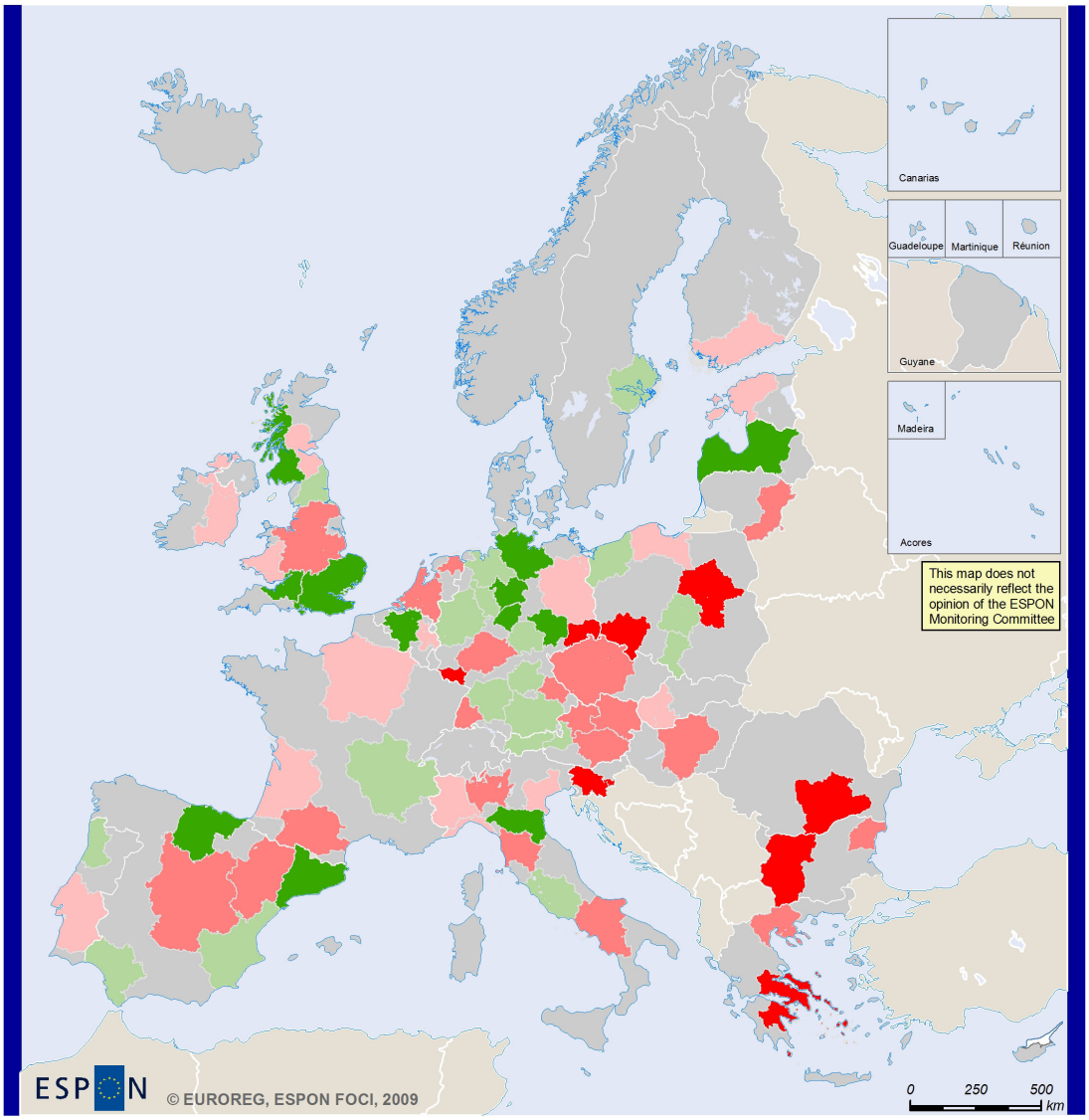


Figure 16. Types of macroregions based on trends compatibility
Source: prepared by the author.

5.2. Types of metropolitan macroregions

As shown in the above analyses, despite some common characteristics, metropolitan macroregions of Europe represent a rather motley set in such aspects as the dynamics of economic growth, demographic processes, structural changes and labour market situation. This is largely an effect of development which was underpinned by the dissimilar evolution of these territorial units in *longue durée* processes. For these reasons, the Report first identified the key dimensions of the disparities among metropolitan areas and separately among their regional hinterlands. These dimensions were then used to create separate classifications of metropolises and their regions, and ultimately a typology of metropolitan macroregions. This typology served to analyse the dynamics of interregional disparities in development level, which led to the formulation of certain generalisations concerning the development paths of individual types of macroregions.

Research methodology

In our analysis, we adopted a rather formalised procedure for identifying the key dimensions of disparities and typological classes of macroregions. To this end, multivariate analyses (principal component analysis and cluster analysis) were used, which to some extent allowed for an objectivisation of the results obtained. Below, the variables used in the study are summarised, along with short descriptions of the methods applied.

Regional socio-economic disparities may be analysed both on the basis of a purposeful selection of variables, or in an exploratory manner, using the broadest possible spectrum of indicators. In the present study, the latter method was applied. We should also bear in mind that the selection of features was largely dependent on the availability of comparable data on NUTS3 subregions in the analysed countries. Ultimately, the data used for analyses were the following:

- Level of economic growth: GDP per capita (EUR and the national average =100);
- Demographic potential and characteristics of the settlement system: number of the population, population density (pax/km^2), population of the metropolitan centre (actual number and % of the population of the metropolitan region);
- Economic structure: gross value added by basic sectors: agriculture, industry and services (%),gross value added by groups of services: simple, specialised and public (% of the total and % of the service sector);
- Labour productivity: productivity (EUR), productivity in basic economic sectors and groups of services (EUR and % of total productivity);

- Labour market: people in work (per 100 population), economic activity (%), unemployment rate (%).

Altogether, 25 variables were used in the analyses, some of which were complementary variables. Expanding this mix by indicators illustrating: human capital, level of innovation, social capital or the institutional environment would certainly serve to offer a fuller picture of the major dimensions of disparities. Unfortunately, such data could not be taken into account due to the lack of relevant statistics for NUTS3 subregions in many of the analysed countries. Nonetheless, analyses carried out in Central and Eastern European regions **(Smętkowski, Wójcik 2009)** indicate that such indicators are correlated with the variables used in the study, and we can therefore assume that the dimensions of disparities associated with them could at least partly be identified owing to the application of multivariate methods of data analysis.

Factor analysis using the principal component method was applied to identify the major dimensions of disparities between the constituents of metropolitan macroregions. This method, exploratory in character, involves the reduction of variables which are replaced by weakly correlated principal components, which in fact represent the meta-dimensions of disparities. As a result, it is possible to reduce the number of variables without losing key information. The significance of the selected principal components results from their share in total variance; in further analysis, those components were used which better explain the disparities than a single component – in this case, the screen test was used **(Catell 1966)**. As a next step, the number of variables was reduced using the correlation and factor method proposed by **G. Gorzelak (1979)**. This method involves elimination of insignificant variables characterised by: a low value of the variation coefficient (adopted value: 0.1), a high degree of correlation (adopted value: 0.8), also poorly correlated with the adopted principal components before rotation (adopted value: 0.4). Then, to facilitate interpretation of the disparities' dimensions, the principal components were transformed orthogonally using the Varimax method. In choosing the names of the components, we used the spatial distribution of the values of individual components and other background information.

At the next stage, all the above components of socio-economic disparities were used to offer a classification of the constituents of metropolitan macroregions. This classification was made using hierarchical cluster analysis and the Ward optimisation method. The advantage of this method lies in a considerable homogeneity of the typological classes, coupled with a tendency to identify many small clusters. On this basis, the classification tree was produced, which allowed for the identification of similar units. The similarity threshold was arbitrarily determined within the range of 20-30% of the maximum distance between the elements, and its actual height was dependent on the shape of the

classification tree. Typological classes were identified on the basis of: the average values of the analysed meta-traits; an analysis of their distribution as well as of other background information, and were given summary names.

Classification of metropolitan areas

Based on the principal components analysis, we can distinguish four major dimensions to differentiate metropolitan areas in demographic and economic terms **(Annex 4)**:

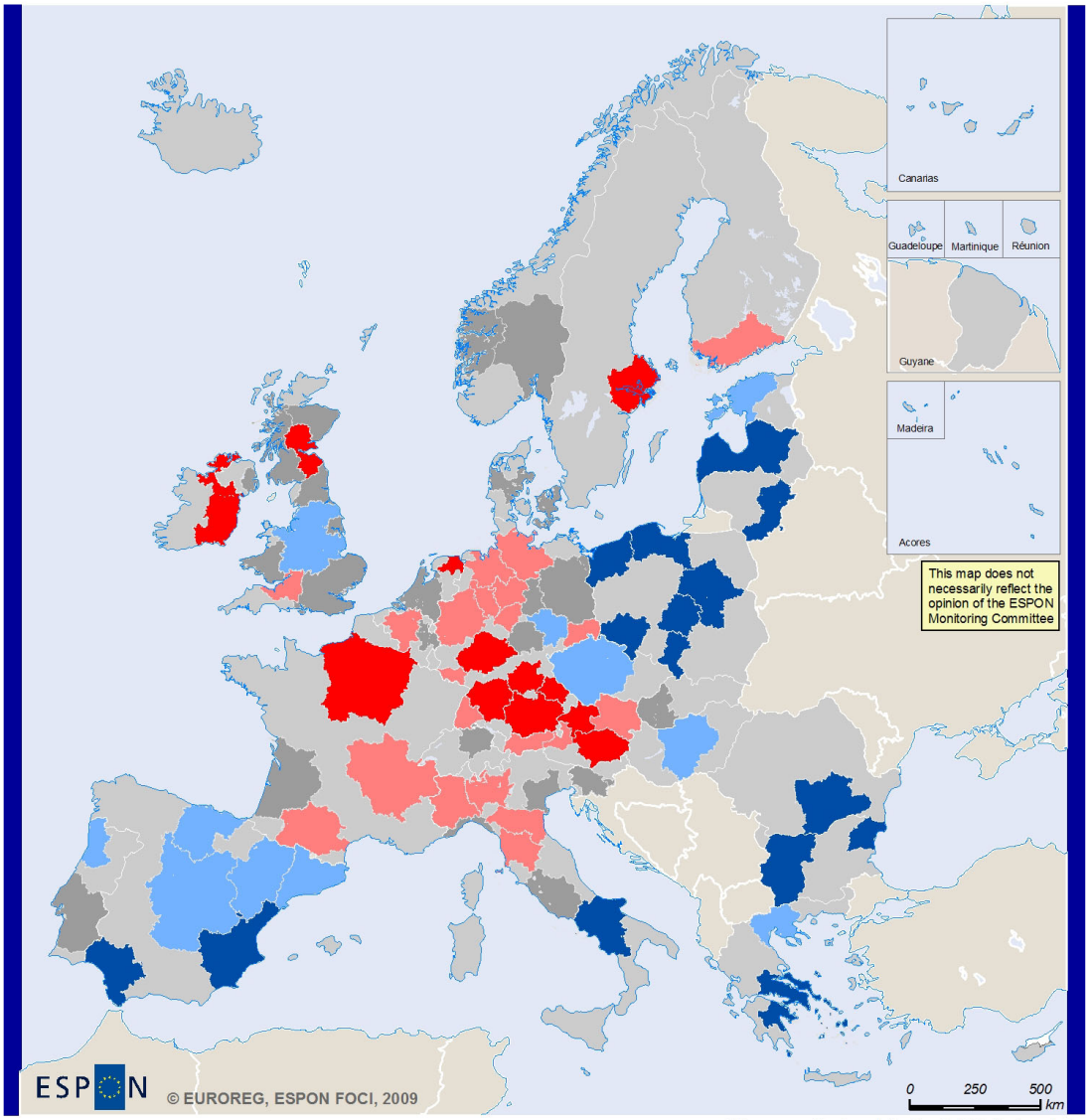
- Component 1 "modern economy" (25% of the total variance), which referred to highly-developed service centres characterised by high labour productivity in industry and a good labour market situation;
- Component 2 "population potential" (16% of the total variance), which referred to populous, densely populated and usually deindustrialised metropolitan areas with a significant role of the service sector (with specialised services in particular) in the economy;
- Component 3 "national growth poles" (12% of the total variance), which referred to highly-developed metropolitan areas in countries with a relatively large share of simple services in the economy and a small role of public services;
- Component 4 "weak suburban zone" (12% of the total variance), which referred to monocentric metropolitan areas with a low population density and low labour productivity in agriculture.

A better evaluation of the diagnostic value of the adopted components will be possible with an analysis of the spatial distribution of their actual values **(Figure 17).**

The high values of the first component were characteristic primarily for metropolitan areas situated in highly-developed countries such as Germany (Frankfurt am Main and the south Lander), Austria, France (especially Paris) and Italy (northern part), the Nordic countries and Ireland. At the other extreme, there were metropolises in CEE countries, Greece and the Iberian Peninsula. In effect – and to some extent (with the exception of the UK and the Netherlands) - this component indicated the classical economic dimension of European disparities, related to the modern character of the economy between the centre and the periphery.

The high values of the second component were mostly characteristic for largest metropolitan areas, as a rule including the capital city: London, Paris, and also: Rome, Madrid, Berlin and Warsaw, in addition to former polycentric industrial conurbations: Rhine-Ruhr and Central England. The remaining capital cities (save for the smallest states) also had relatively high values of this component. In addition, other large urban centres such as: Frankfurt am Main, Milan, Lyon, Toulouse and Naples were included in

this group. On the other hand, the smallest values typified the industrialised metropolitan areas of smaller cities such as: Bilbao, Saragossa, Varna, Regensburg or Groningen. As a result, this component indicated the demographic dimension of the disparities, showing the major areas with a concentration of the population and well-developed service functions catering to the national and supra-national economic areas.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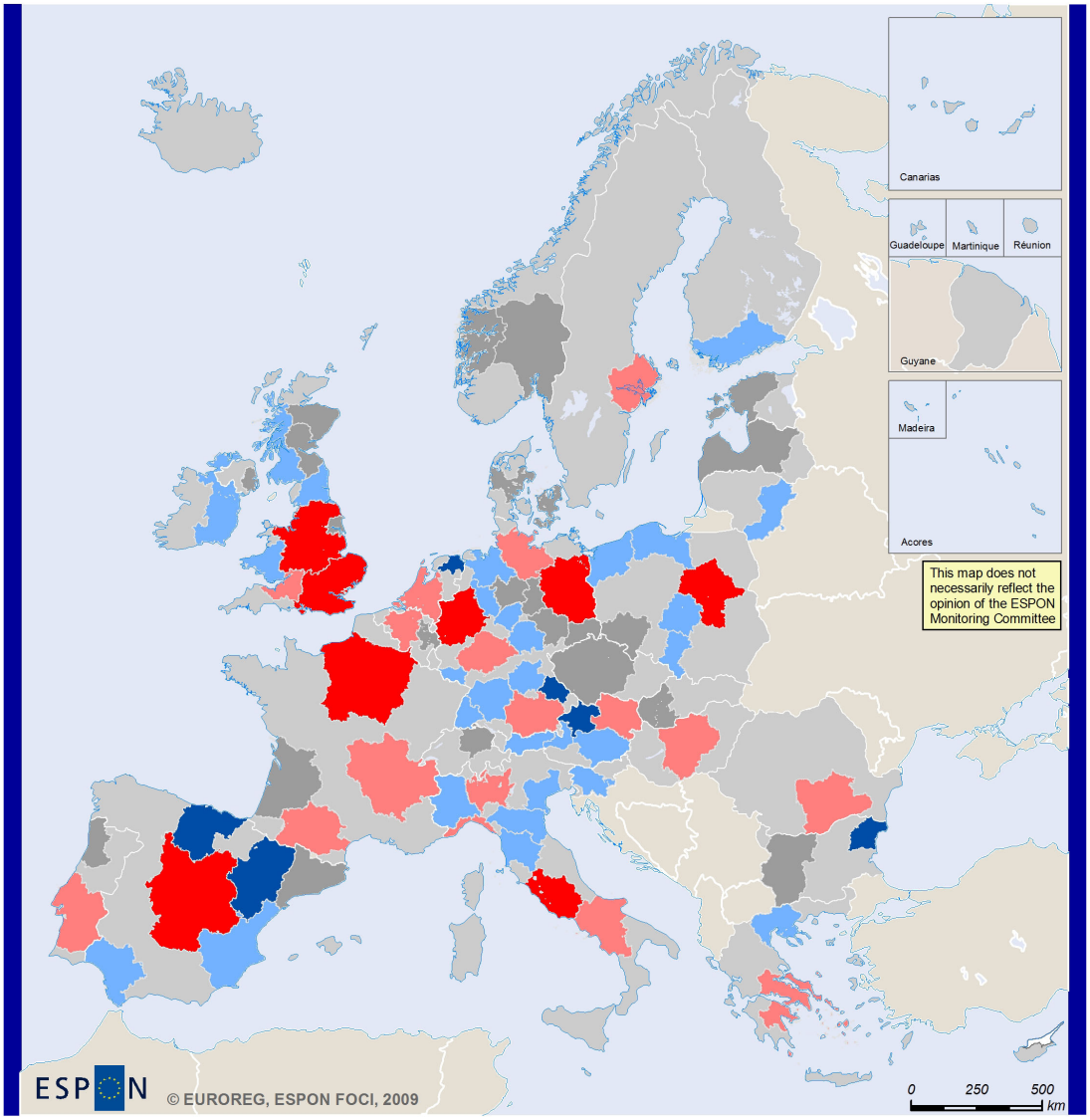
Component (1) - "modern economy"
-2,55 up to -1 (15)
-1 up to -0,25 (11)
-0,25 up to 0,25 (15)
0,25 up to 1 (21)
1 up to 1,77 (12)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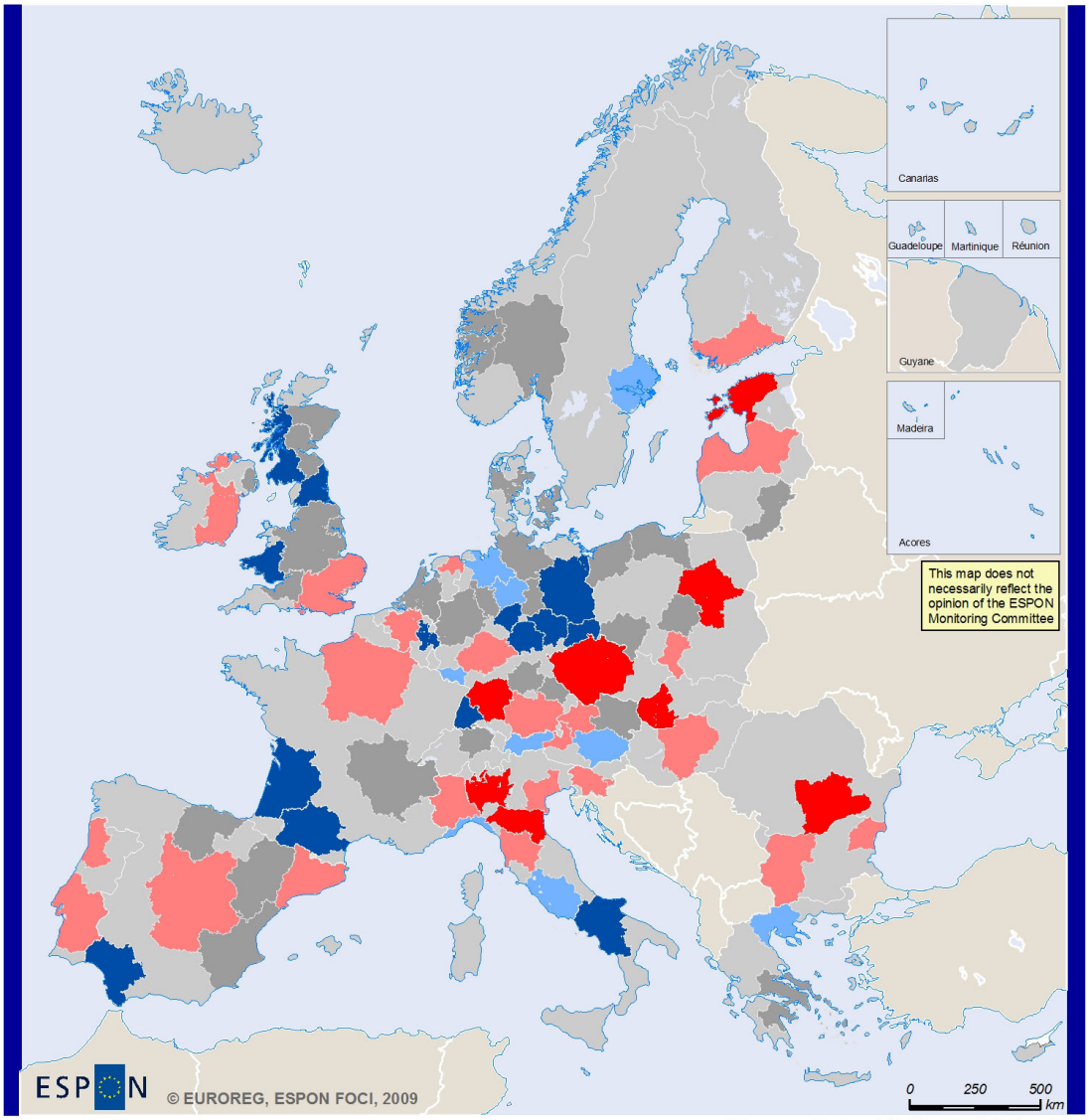
Component (2) - "population potential"
-2,7 up to -1 (6)
-1 up to -0,25 (29)
-0,25 up to 0,25 (14)
0,25 up to 1 (17)
1 up to 4,37 (8)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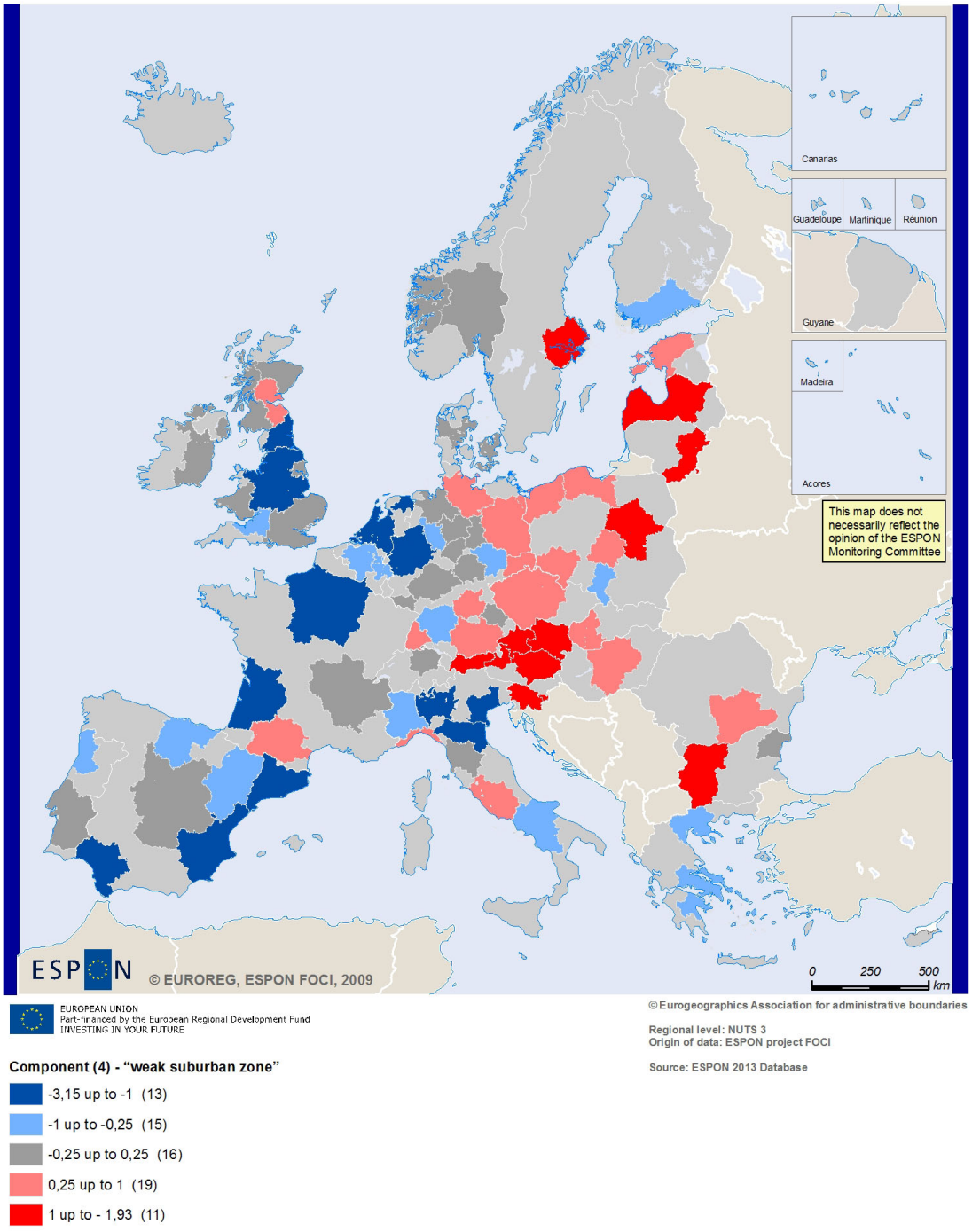
Source: ESPON 2013 Database
Component (3) - "national growth poles"
-2,26 up to -1 (14)
-1 up to -0,25 (9)
-0,25 up to 0,25 (20)
0,25 up to 1 (23)
1 up to 2,48 (8)



Note: the values for metropolitan areas were presented in graphic layer for metropolitan macroregions.

Figure 17. Spatial distribution of principal component values in metropolitan areas
Source: prepared by the author

The high values of the third component mostly indicated those metropolises which had a high development level as compared to their national economies; they were mainly capital cities, especially those situated in Central and Eastern Europe. Those metropolises were relatively frequently characterised by a considerable share of simple services in the form of well-developed trade, transport and tourist traffic functions. At the other end, there were cities with a relatively low level of wealth as compared to the average national level, located in France, the UK, eastern Germany (not excluding Berlin), as well as central (not excluding Rome) and southern Italy. It can be said therefore that this component shows the national dimension of disparities associated inter alia with services rendered by the major growth poles to their national economies.

The last principal component identifies metropolitan areas with a high degree of monocentrism, e.g. the demographic domination of the key urban centre, with a relatively high percentage of people employed in agriculture in the suburban zone (and the resultant low productivity of labour in this sector). This group mainly included CEE metropolises (with Austria), as well as some of the metropolitan areas situated in Western Europe, e.g.: Toulouse, Edinburgh, Rome as well as Munich, Nuremberg and Stockholm. The remaining metropolises of the former EU-15 had average or low values of this component. We can say therefore that this component best illustrates the agricultural dimension of disparities in the suburban zone of the metropolis along the European east-west axis.

It should be emphasised that the above principal components explained only some of the disparities between the analysed metropolitan areas (65.6% of the variance). This could suggest that there exist other dimensions of disparities, not incorporated into our analysis, and associated for example with human or social capital or institutional environment.

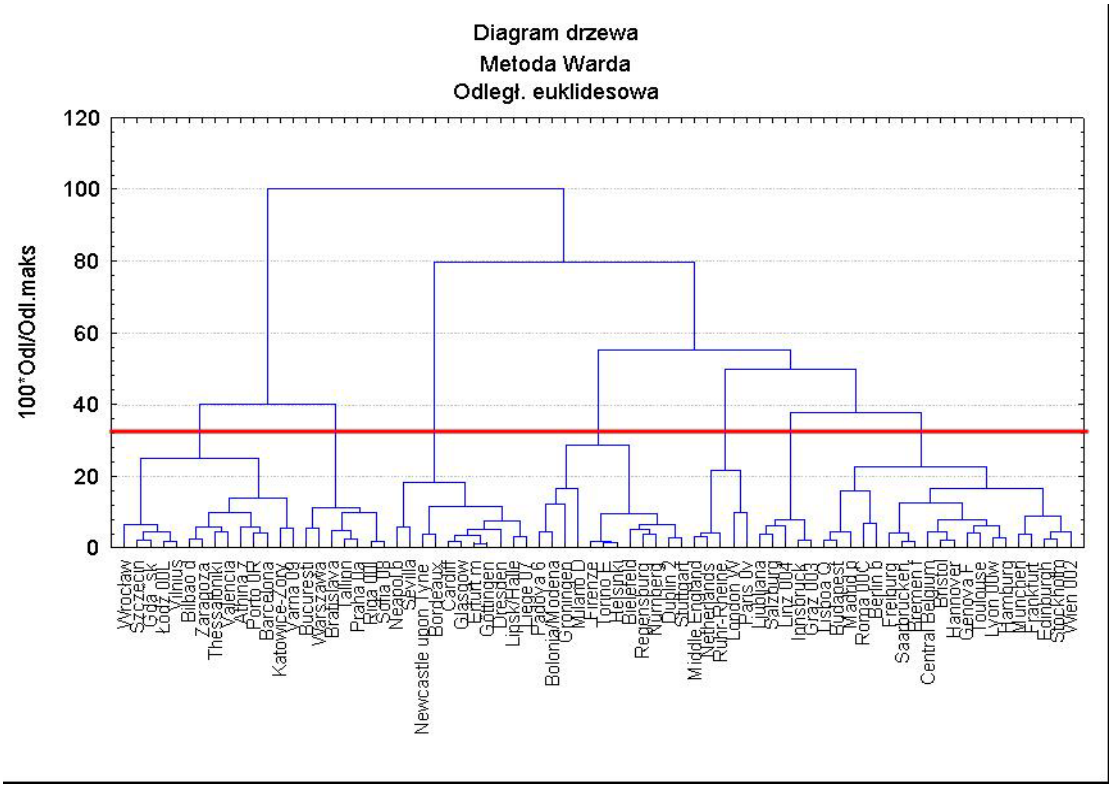


Figure 18. Classification of metropolitan areas - graph
Source: prepared by the author.

The values of these four principal components of the disparities were used in the classification of macroregions, the results of which are shown in the **Figure 18**.

In this case, identification of classes was not formalised; it was mostly based on the analysis of the dendrite structure together with the spatial distribution of the identified types. On the basis of their distribution, analysis of their average values and other background information, individual typological classes were given summary names reflecting their specific character.

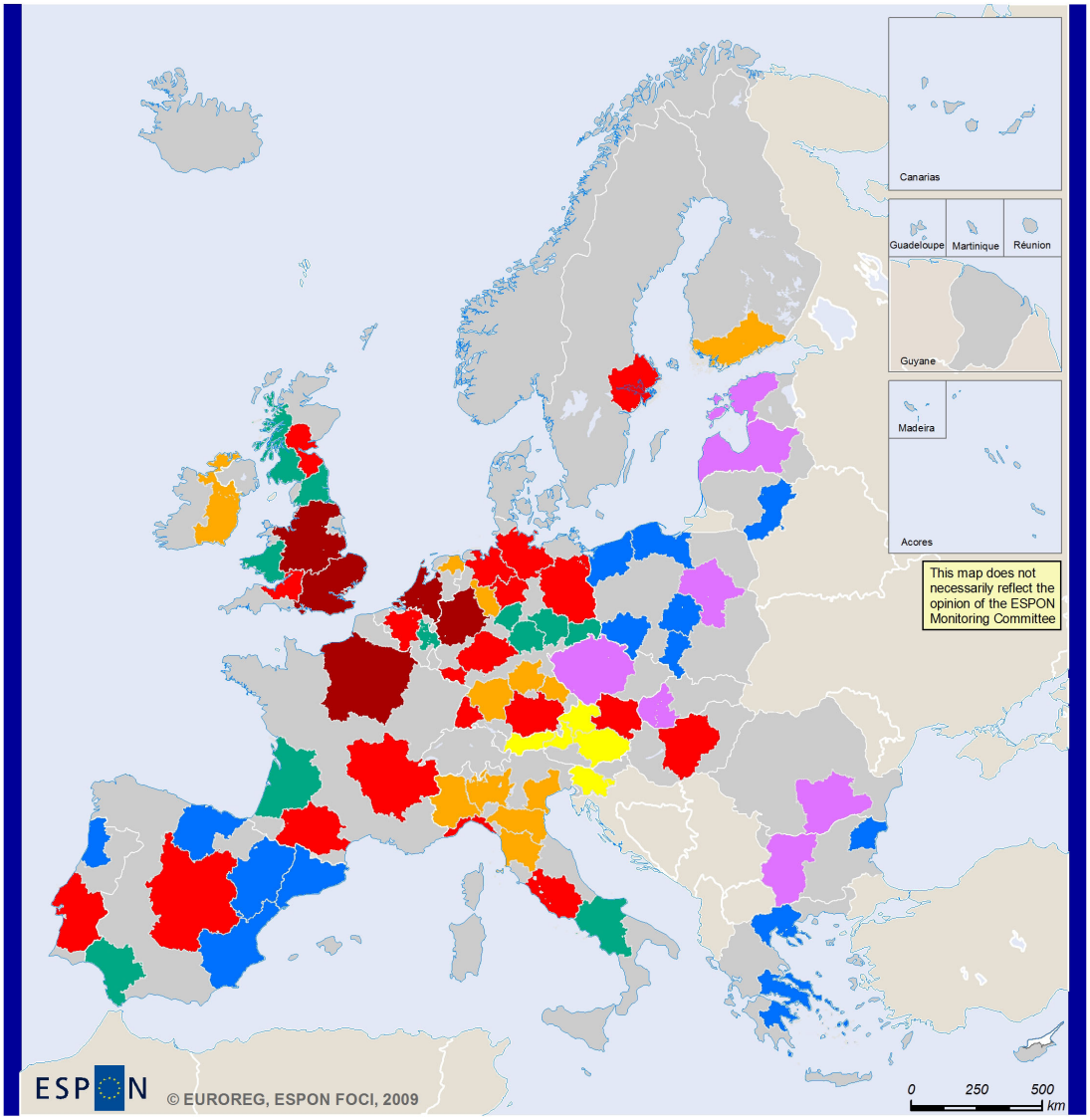
On this basis (**Table 27; Figure 19**), we can identify seven typological categories of metropolitan areas, which, with some degree of simplification, could be defined as follows:

- (1) Highly-developed large service centres. The French city of Lyon can be regarded as a typical example of this category, and similar metropolises could be found in many other countries, from Sweden to Portugal. This group of metropolitan areas also included a subgroup of capital city metropolises. Most of these areas were characterised by a relatively high level of population monocentrism.

- (2) Highly-developed small and monocentric metropolitan areas. The Austrian city of Salzburg was a typical example of this category, which could be found only in Austria and Slovenia. Their characteristic features also included low labour productivity in the agriculture of the suburban zone, which was probably associated with their location in mountain areas.
- (3) Large polycentric metropolitan areas. Two subtypes could be distinguished within this category, characterised by somewhat dissimilar economic structures: the service subtype: London, Paris and Randstadt Holland, and the industrial subtype: Rhine-Ruhr and Central England.
- (4) Highly-developed small metropolitan areas with nation-wide functions. The Italian Turin was a typical example of this category, characteristically encountered in northern Italy and southern Germany.
- (5) Secondary nation-wide metropolitan areas. The Belgian Liège was a typical example of this type, and its basic characteristic feature was its occurrence in countries with a complex settlement structure. It included e.g. metropolitan areas situated in eastern Germany, southern parts of Italy and Spain, as well as Scotland and northern England.
- (6) Traditional monocentric metropolitan areas with nation-wide functions. Tallinn (Estonia) was a typical example of this type, which included nearly all capital cities of CEE countries (except Budapest).
- (7) Traditional medium-sized metropolitan areas. Gdańsk (Poland) was a typical example of this category, which included primarily metropolitan areas situated in CEE countries, Greece and on the Iberian Peninsula. Most conspicuous members of this type in terms of size (measured by the population and functions performed) were the metropolitan areas of Athens and Barcelona.

Types of metropolitan areas	Modern economy	Demographic potential	National growth pole	Weak suburban zone
(1) Highly-developed large service centres	0.62	0.53	-0.20	0.38
(2) Highly-developed small and monocentric metropolitan areas	0.87	-0.87	0.19	1.61
(3) Large polycentric metropolitan areas	0.32	2.04	0.06	-1.16
(4) Highly-developed small centres with nation-wide functions	0.79	-0.70	0.77	-0.82
(5) Secondary national metropolitan areas	-0.28	-0.23	-1.66	-0.47
(6) Traditional monocentric metropolitan areas with nation-wide functions	-0.99	0.23	1.40	0.99
(7) Traditional medium-sized metropolitan areas	-1.27	-0.50	0.14	-0.13

Table 27. Average principal component values in identified types of regions
Source: prepared by the author.



* Note: the values for regional hinterlands were presented in graphic layer for metropolitan macroregions.

Figure 19. Classification of metropolitan areas - map
Source: prepared by the author.

Classification of the regional hinterland of metropolises

On the basis of factor analysis, we can distinguish four major dimensions of disparities between the regional hinterlands of metropolises in terms of the demographic and economic potential **(Annex 5)**:

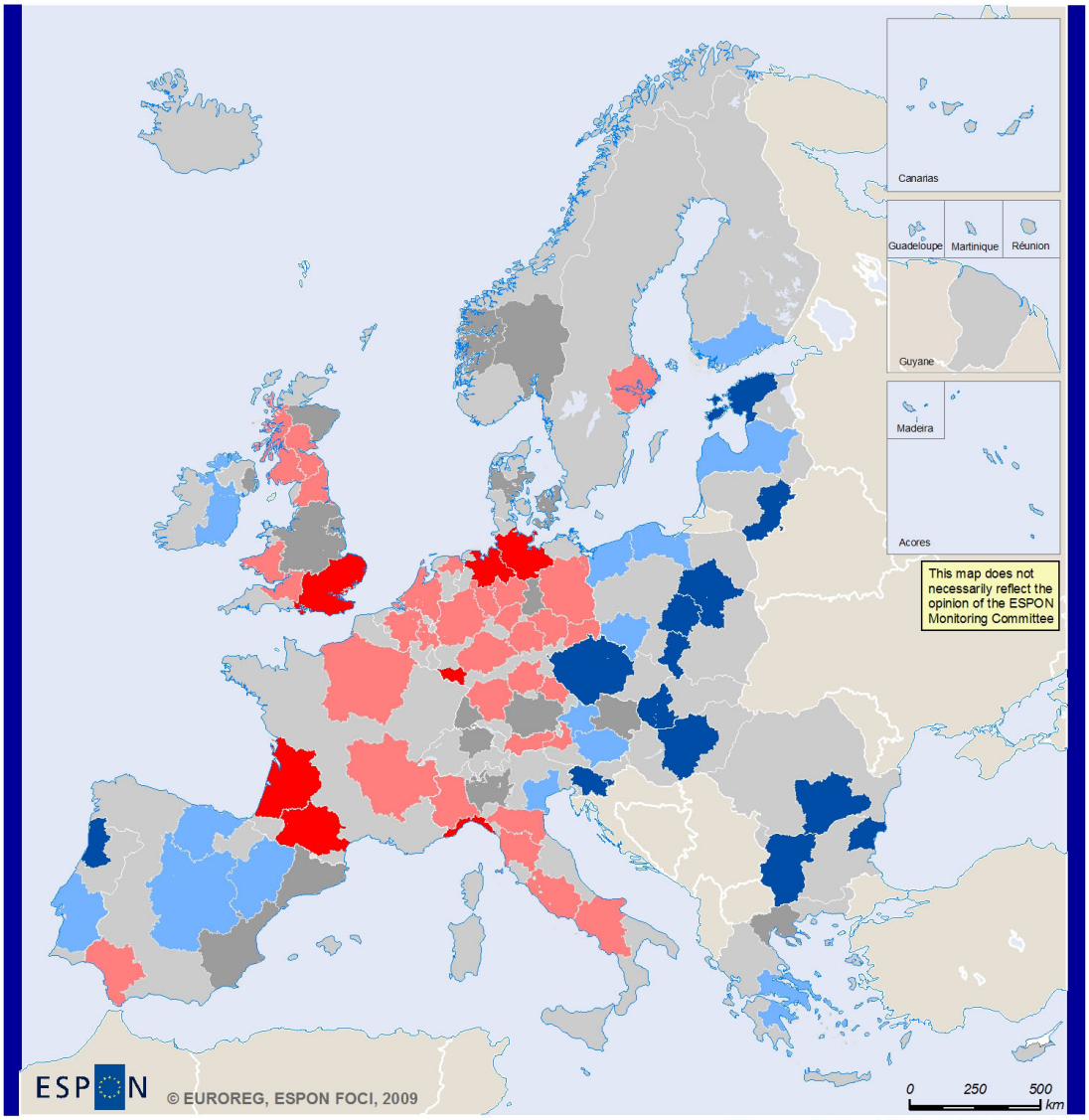
- Component 1 "modern economy" (20% of the total variance), which indicated regions with highly-developed economy, a large share of services, high labour productivity (also in agriculture), and a good labour market situation;
- Component 2 "well-developed labour market" (16% of the total variance), which indicated regions with a good labour market situation, a significant role of industry in the economy and a high level of development by comparison with the rest of the country;
- Component 3 "demographic potential" (14% of the total variance), which indicated densely-populated regions with large cities and highly productive agriculture;
- Component 4 "duality of the economy" (10% of the total variance), which indicated regions with low labour productivity in agriculture and high productivity of labour outside agriculture, characterised by a considerable share of simple services in the economic structure.

A better evaluation of the diagnostic value of the adopted components will be possible with an analysis of the spatial distribution of their actual values **(Figure 20).**

The first component showed the disparities between macroregions regarding the level of economic development – which was higher in the EU core countries and lower in the former EU-15 cohesion countries and the new Member States. A high level of development was strongly correlated with a high share of the service sector in gross value added and a low share of industry in the economy, as well as high labour productivity in agriculture owing to a small number of employees in this sector. As a result, this component illustrated the classical dimension of disparities, to modern economy in the European the centre–the periphery system.

The second component showed a good situation in the regional labour market with a relatively high role of industry in the economy. As a rule, such regions occupied a prominent place in the national economic space. Regions with high values of this component made up a distinct cluster with its core in southern Germany, northern Italy and western Austria, and with a wide external zone comprising: central Germany, Czech Republic, eastern Austria and Slovenia. In addition, the high values of this component were characteristic for the regions of Barcelona and Porto, and for the regions of southern and central England. By contrast, the regional hinterlands of metropolises in

CEE countries (including the former GDR), in France, Spain and southern Italy were characterised by low values of this component. In general terms, we can say therefore that this component illustrated well-developed labour markets in industrial regions.


Canarias
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Réunion
Guyane
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Acores
This map does not necessarily reflect the opinion of the ESPON Monitoring Committee
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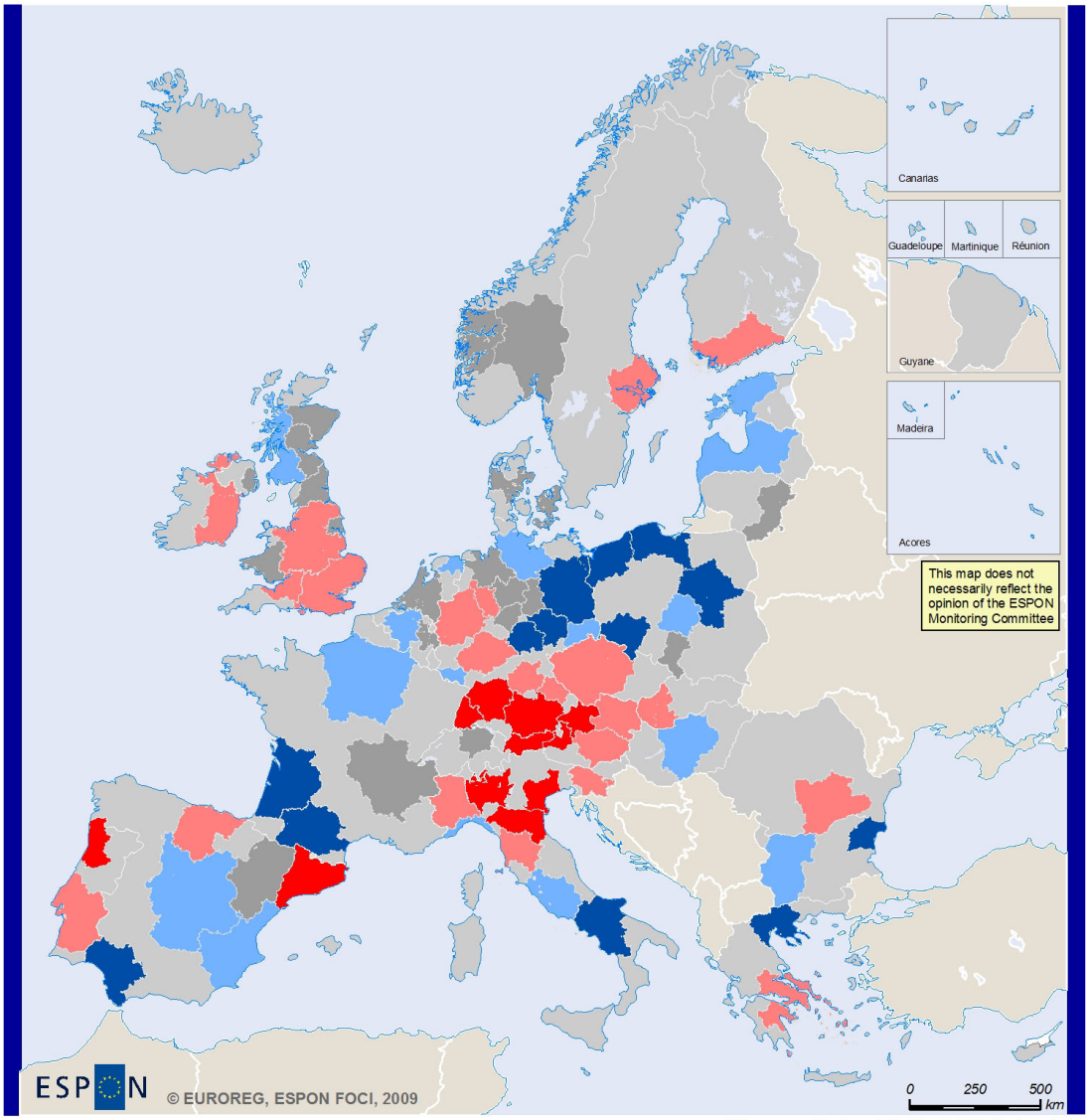
Regional level: NUTS 3
Origin of data: ESPON project FOCI
Source: ESPON 2013 Database
Component 1 "modern economy"
-2,67 up to -1 (13)
-1 up to -0,25 (14)
-0,25 up to 0,25 (8)
0,25 up to 1 (32)
1 up to 1,82 (7)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This map does not necessarily reflect the opinion of the ESPON Monitoring Committee
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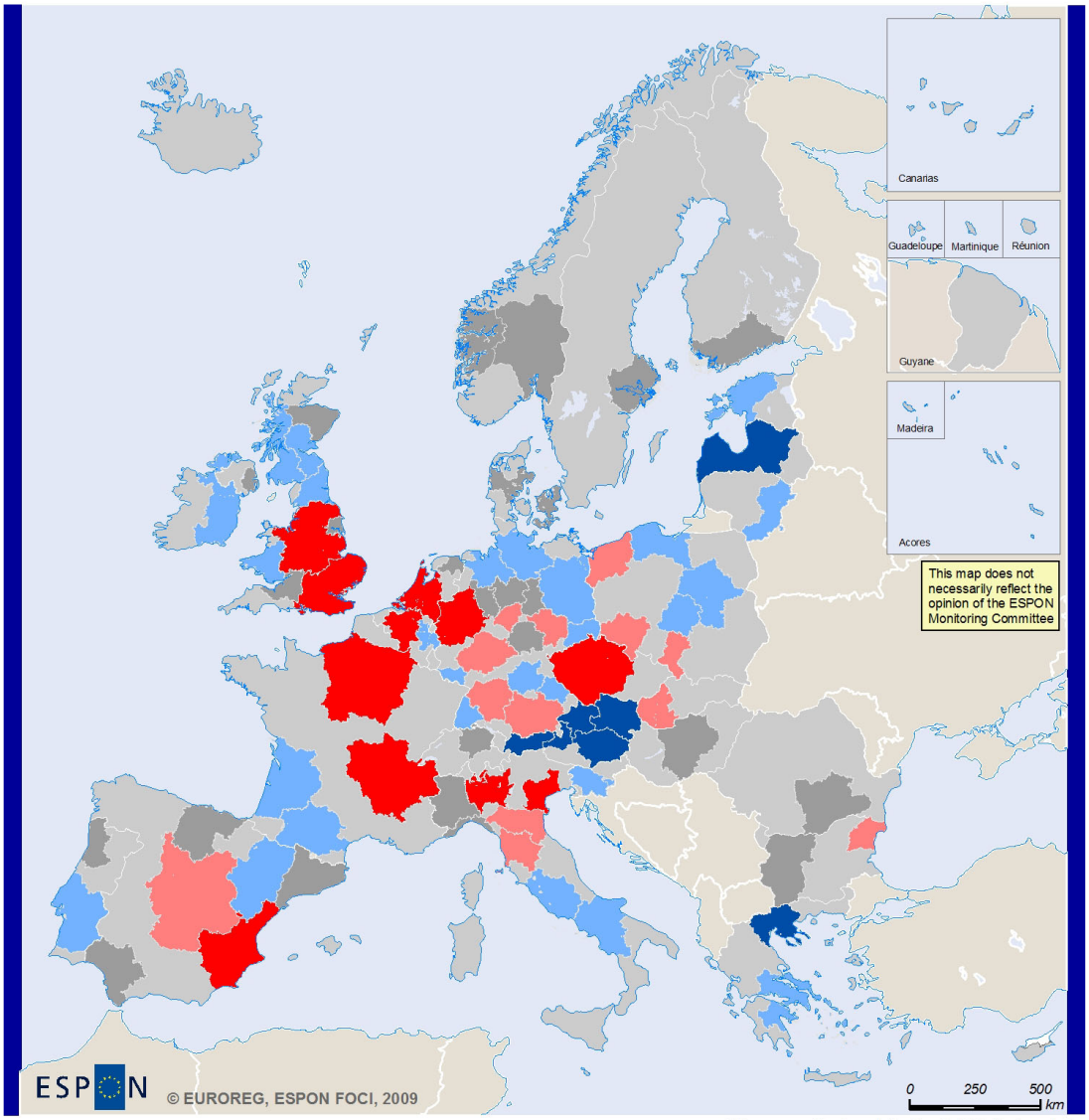
Regional level: NUTS 3
Origin of data: ESPON project FOCI
Source: ESPON 2013 Database
Component 2 "well-developed labour market"
-3,13 up to -1 (13)
-1 up to -0,25 (16)
-0,25 up to 0,25 (12)
0,25 up to 1 (22)
1 up to 1,65 (11)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EUROPEAN UNION
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Regional level: NUTS 3
Origin of data: ESPON project FOCI
Source: ESPON 2013 Database
Component 3 "demographic potential"
-2,19 up to -1 (7)
-1 up to -0,25 (27)
-0,25 up to 0,25 (16)
0,25 up to 1 (13)
1 up to 3,05 (11)

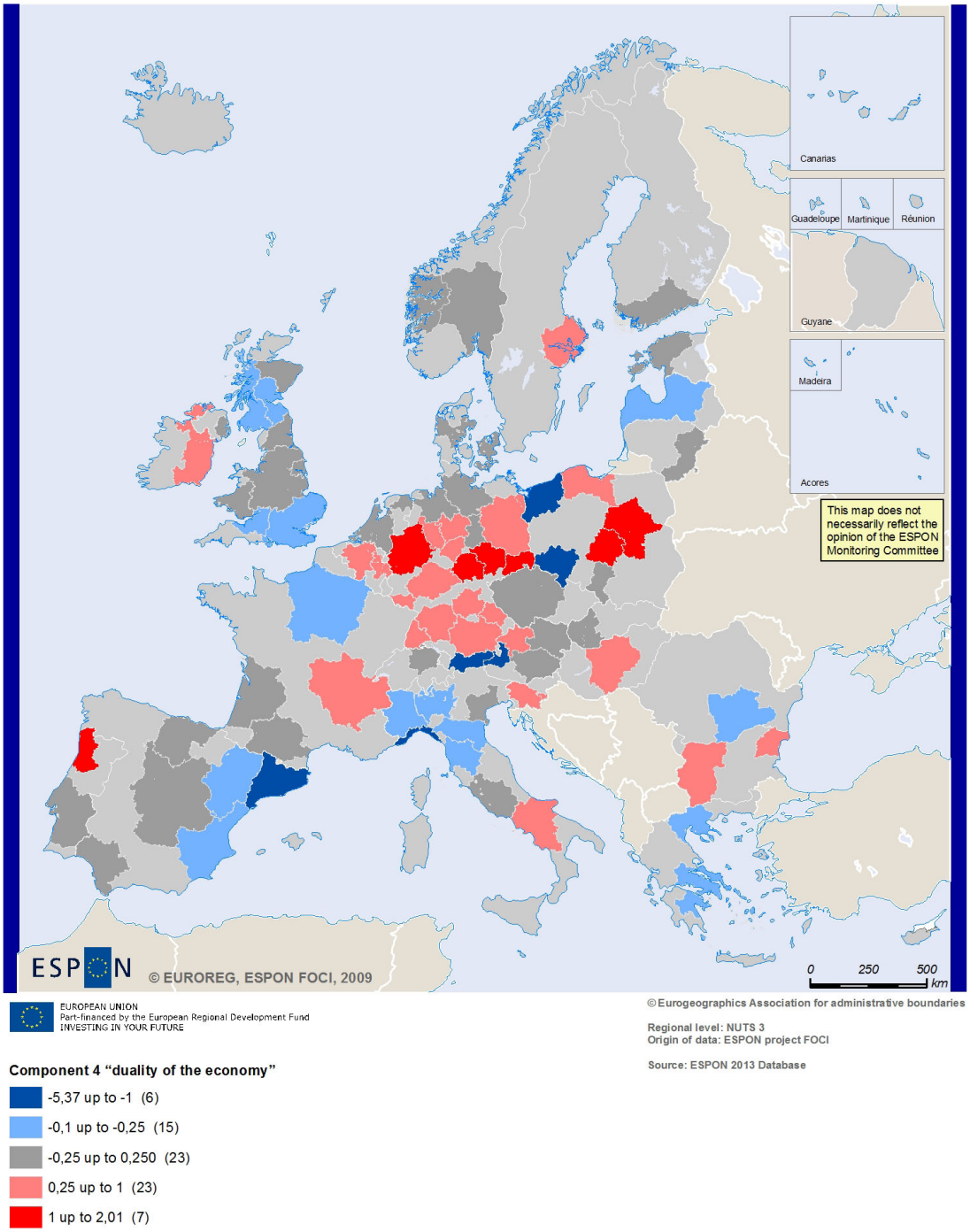


Figure 20. Spatial distribution of principal component values in regional hinterlands
Source: prepared by the author.

The third component was associated with the existence of other large cities in the regional hinterland of the metropolis, coupled with a high population density and a relatively high labour productivity in agriculture. High values of this meta-dimension of

the disparities were characteristics for the regional hinterlands of Paris, London, metropolises in the Benelux countries, western and southern Germany, northern Italy and the Czech Republic. As a rule, more peripheral regions (excluding the regional hinterlands of Varna and Valencia) had lower values of this component. We can say therefore that this component illustrated the demographic dimension of the disparities, while simultaneously showing some degree of polycentrism in the regional hinterlands of metropolises.

The high values of the last component of the disparities identified regions with a high labour productivity in services and industry, associated with low productivity in agriculture. Furthermore, simple services played a considerable role in the economic structure of these regions. This type of regional hinterlands was characteristic for Germany save for its northern part, and for some regions of Central and Eastern Europe. It was also occasionally encountered in other European countries (Sweden, Italy, Ireland, Portugal). This component suggests the dual character of the economy, associated with wide disparities in labour productivity existing between agriculture and non-agriculture sectors, and with functions provided by the metropolitan centres to their regional hinterlands.

It should be emphasised that the selected principal components explained only some of the disparities in the regional hinterlands of the analysed metropolises (59.6% of total variance, that is less than in the case of metropolitan areas).

The values of these four principal components of the disparities were used to make a classification of regional hinterlands of metropolises, which is shown in the dendrogram below (**Figure 21**).

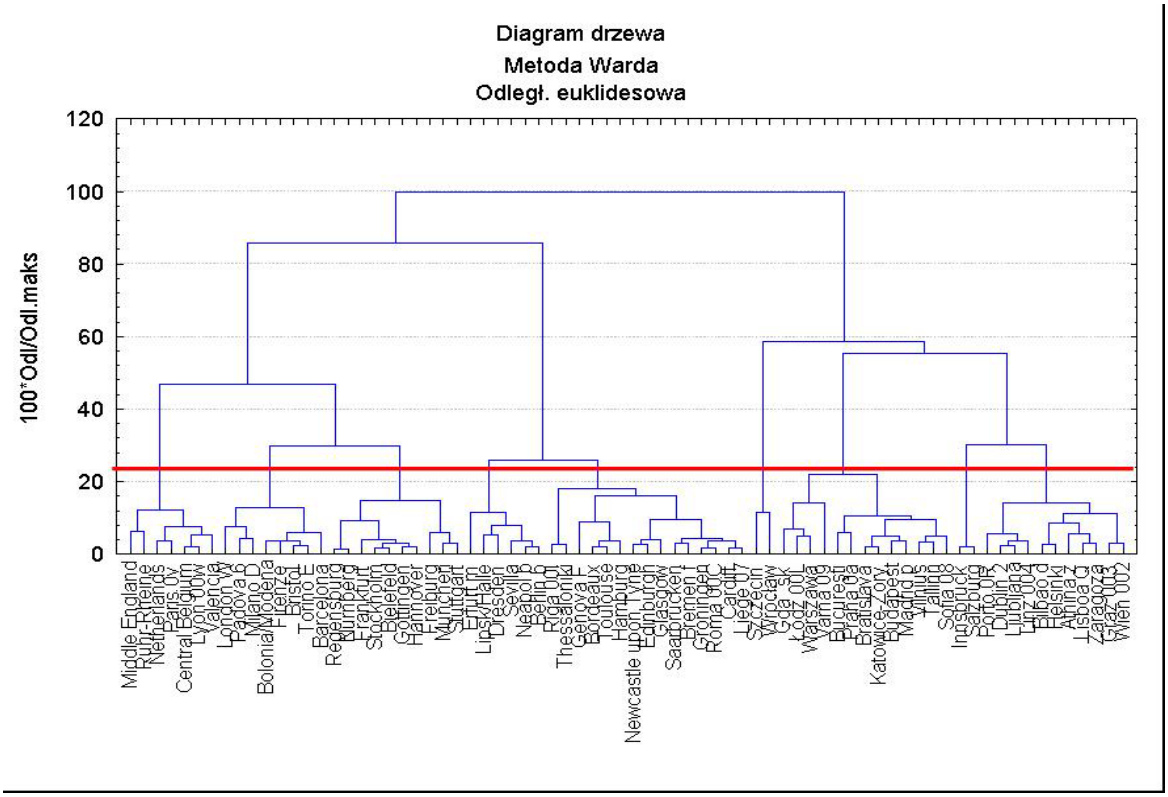


Figure 21. Classification of regional hinterlands of metropolises
Source: prepared by the author.

Type of regional hinterland	Modern economy	Well-developed labour market	Demographic potential	Duality of economy
(1a) Well-developed labour market and considerable industrialisation in regions with small population density	-0.66	0.77	-0.74	-0.10
(1b) Variation of type 1 with considerable duality of economy	0.66	1.42	-2.17	1.55
(2a) Traditional economy with underdeveloped service sector	-1.55	-0.43	0.12	-0.39
(2b) Variation of type 2 with considerable duality of economy and labour market problems	-0.85	-1.71	0.65	4.28
(3) Labour market problems with considerable duality of economy	0.63	-0.67	-0.44	0.65
(4) Serious labour market problems	0.51	-1.56	-0.22	-0.77
(5) Well-developed labour market and considerable industrialisation	0.54	0.75	0.01	-0.47

(6) Well-developed labour market, considerable industrialisation and demographic potential	0.49	1.05	0.78	0.47
(7) Large demographic potential in polycentric regions	0.41	-0.09	2.02	-0.20

Table 28. Average principal component values by types of regional hinterlands
Source: prepared by the author.

On this basis **(Table 28; Figure 22)**, we can distinguish seven main typological classes of regional hinterlands, which can be broadly described as follows:

- (1) Well-developed labour market and considerable industrialisation in regions with small population density. Subtype (a) – the regional hinterland of Helsinki can serve as a typical example of this class, which is primarily characteristic for the former EU-15 cohesion countries, i.e. Spain and Portugal, Greece and Ireland, even though regions belonging to this class were also found in Austria and Slovenia. Subtype (b) – the above features coupled with a high degree of duality in the economy. The latter subtype included two regions only: Salzburg and Innsbruck, both situated in mountain areas.
- (2) Traditional economy with underdeveloped sector of services (mostly specialised). Subtype (a) – the regional hinterland of Budapest could serve as a typical example, and this category was primarily characteristic of CEE countries and the hinterland of Madrid. Subtype (b) the above features plus a high degree of duality in the economy. It included only two regions: Wrocław and Szczecin, situated in the west of Poland.

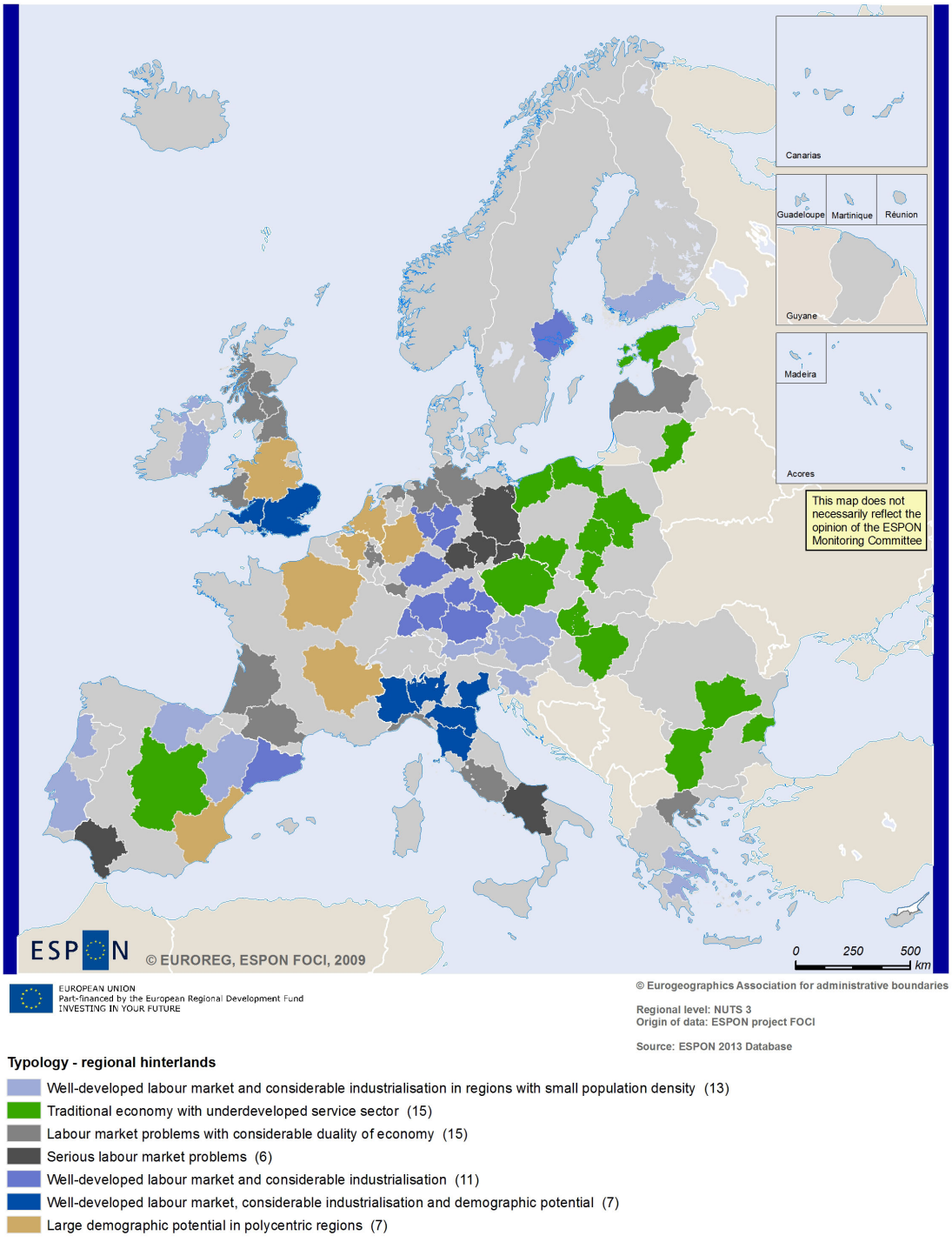


Figure 22. Classification of regional hinterlands - map
Source: prepared by the author.

- (3) Labour market problems and a high degree of duality in the economy. The regional hinterland of Thessaloniki was a typical example of this category, which included inter alia former traditional industrial regions: Saarbrűcken, northern England, Scotland and Wales, as well as the regional hinterlands of metropolises which underwent rapid economic restructuring: Riga, Rome, Toulouse and Bordeaux, as well as metropolises of northern Germany.
- (4) Serious labour market problems. The regional hinterland of Erfurt in Germany was a typical example here. This category was typical for regions of the former GDR and southern Italy (Naples) and Spain (Seville).
- (5) Well-developed labour market with considerable industrialisation. The regional hinterland of Nuremberg was a typical example of this class, which was generally characteristic for southern and central Germany and for the regional hinterlands of Barcelona and Stockholm.
- (6) Well-developed labour market with considerable industrialisation and high demographic potential. Tuscany was a typical example of this category, which also included other regions of northern Italy, as well as southern England.
- (7) High demographic potential in polycentric regions. The Rhine-Ruhr was a typical region in this category, which also included the regional hinterlands of metropolises in the Benelux countries, as well as Lyon in France and Valencia in Spain.

Typology of metropolitan macroregions

Based on the identification of the above categories, a typological matrix was produced with the dimensions of 7x7[23]. Of 49 cells in the matrix showing the types of the metropolis – the region systems, 23 fields were occupied (47%), which means that similar conditions determining the relationships between the metropolis and its regional hinterland could be observed in many macroregions. Below, we provide short characteristics of those types which occurred most frequently, while leaving out the most unique types. In their identification, correspondence analysis was additionally used (**Annex 5**) to indicate the major types of metropolitan macroregions.

[23] For simplification, types 1a and 1b and types 2a and 2b were combined.

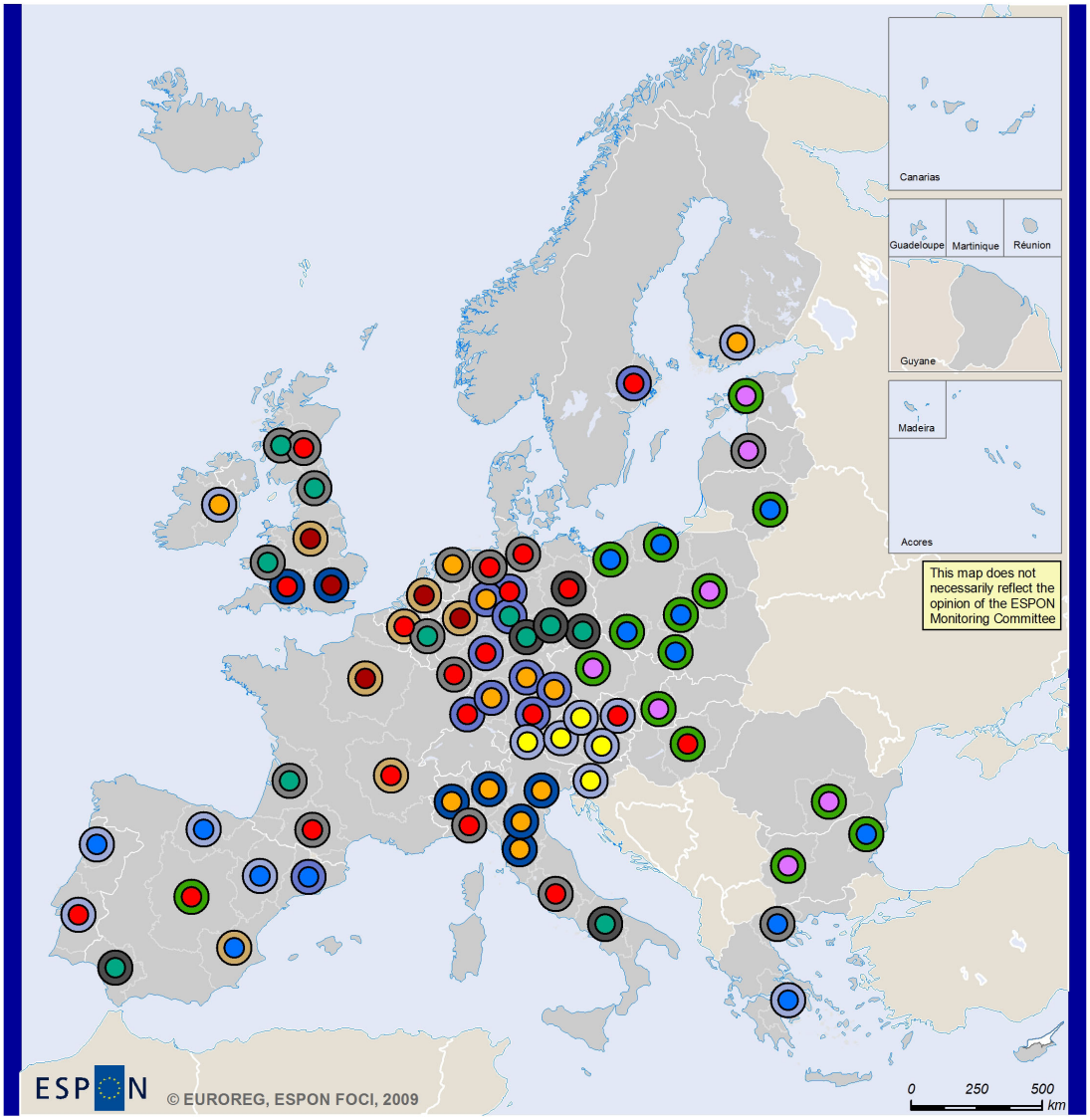


Figure 23. Typology of metropolitan macroregions
Source: prepared by the author.

RH MA	1	2	3	4	5	6	7	Total
1	2	2	7		5	1	2	19
2	5							5
3						1	4	5
4	2		1		4	5		12
5			5	5	1			11
6		6	1					7
7	4	7	1		1		1	14
Total	13	15	15	5	11	7	7	73

Bold borders denote similar typological classes of the metropolis and the regional hinterland.

Table 29. Typological matrix of metropolitan macroregions*
Source: prepared by the author.

Among the identified types (X/Y_1Y_2 – where x – category of metropolitan region, y_1 – category of regional hinterland, and, potentially, y_2 – similar category of regional hinterland), the following proved to be the most important ones **(Table 29; Figure 23)**:

- Type 1/3 (N=7) – highly-developed monocentric, large service centres surrounded by regions with labour market problems. This type was found in three countries, and – more importantly – was usually characteristic for coastal macroregions – northern Germany (Bremen and Hamburg), Scotland (Edinburgh) and Italy (Rome and Genoa).
- Type 1/5 (N=5) – highly-developed large service centres surrounded by regions with well-developed labour markets, considerably industrialised. This type was characteristic for Germany (Frankfurt am Main, Munich, Hanover and Freiburg), and therefore it can be summarily referred to as "central", and outside Germany it also included the metropolitan macroregion of Stockholm.
- Type 2/1 (N=5) – highly-developed small and monocentric metropolitan areas surrounded by well-developed industrialised regions in areas with low population density, frequently in mountain areas. This type was characteristic for Austria (except Vienna) and the neighbouring Slovenia.
- Type 3/7 (N=4) – huge polycentric metropolitan areas surrounded by highly-developed polycentric regional hinterlands. This type was characteristic for

densely populated areas of the European core, enclosed within the quadrangle: Central England, Paris, Rhine-Ruhr and the Netherlands.

- Type 4/56 (N=9) – modern national growth poles surrounded by well-developed industrial areas. This type comprised two subtypes, represented by German macroregions (southern Germany and Bielefeld), as well as macroregions of northern Italy.
- Type 5/34 (N=10) - national metropolitan areas surrounded by areas undergoing economic restructuring – composed of two subtypes with a similar number of regions, differing by the scale of labour market problems. This type includes the EU-15 convergence regions – macroregions in the former GDR, southern Italy and Spain, as well as British macroregions (Glasgow, Newcastle, Cardiff), Bordeaux in France and Liège in Belgium.
- Type 6/2 (N=6) - traditional national growth poles surrounded by traditional farming areas. This type only covered capital city macroregions in Central and Eastern European countries (with the exception of Budapest, Vilnius and Riga).
- Type 7/12 (N=11) - traditional metropolitan areas surrounded by industrial (7) and farming (4) regions. This type comprised peripheral regions of smaller cities in Central and Eastern Europe, in northern Spain (Bilbao and Saragossa) and Portugal (Porto), and also the metropolitan macroregion of Athens, different from other regions in this category.

The remaining metropolitan macroregions (16) were so unique that they made up individual types. As a rule, this was associated with their capital city functions – 10 cases, i.e. the majority of the analysed capital city macroregions of the EU-15.

Type	Degree of distribution		Degree of concentration	
	European	National	Dispersed	Concentrated
Type 1/3 "Monocentric"	x		x	
Type 1/5 "Central"		x	x	
Type 2/1 "Mountain"		x		x
Type 3/7 "Polycentric"	x			x
Type 4/56 "Industrial"		x		x
Type 5/34 "Problem"	x		x	
Type 6/2 "CEE capitals"	x		x	
Type 7/12 "Peripheral"	x		x	

Table 30. Characteristics of the distribution of identified types of macroregions
Source: prepared by the author.

Most of the major types that we identified (5) were European in character, i.e. they could be found in at least three countries **(Table 30)**. What is more, as a rule these were not neighbouring countries, which justified referring to this type as "spatially dispersed". On the other hand, three other types were national in character (could be found in not more than two countries), which as a rule was associated with a relatively high degree of their spatial concentration, frequently manifested by their direct vicinity.

As the next step, the identified types were characterised using the earlier adopted indicators to show the degree of their internal cohesion regarding the level of economic development, economic structure, demographic processes and the labour market situation. The differences were then subject to the t-test. Based on the results of these tests capital city macroregions in CEE countries, proved to be the only group which turned out to be statistically distinguishable when compared to the remaining types of macroregions. This type was characterised by wide disparities in the development level between the metropolis and the region, and also by a rapidly increasing rate of these disparities. The similarity of the economic structure of the metropolitan area and the remaining part of the macroregion was relatively small, with considerable differences in terms of the labour market situation and attractiveness of migration. Very probably, this led to intensive backwashing processes from the regional hinterland to the centre, involving primarily the best educated and the most enterprising individuals, which was bound to negatively affect the endogenous potential for growth in the regional hinterland of the metropolis. On the other hand, resources offered by the regional hinterland were not attractive for companies based in the capital city, whose cooperation links would as a rule bypass the direct regional vicinity of the metropolis.

Type (N) "summary names"	Development level disparities [GDP per capita ratio]	Dynamics of development level disparities [Change of GDP per capita ratio]	Similarity of demographic processes [difference in migration balance]	Structural dissimilarity [composite index]	Labour market dissimilarity [difference in unemployment rate]
Type 1/3 "Monocentric"	1.37	0.04	1.9	7.5	2.2
Type 1/5 "Central"	1.40	0.01	2.0	13.5	0.5
Type 2/1 "Mountain"	1.52	-0.01	5.4	12.6	0.5
Type 3/7	1.32	0.04	1.7	11.1	1.2

"Polycentric"					
Type 4/56 "Industrial"	1.21	0.02	1.8	5.1	1.0
Type 5/34 "Problem"	1.18	0.05	3.1	5.9	2.8
Type 6/2 "CEE capitals"	2.25	0.37	5.5	22.6	5.5
Type 7/12 "Peripheral"	1.29	0.09	4.0	14.0	5.8

Table 31. Characteristics of selected types of metropolitan macroregions
Source: prepared by the author.

Wide disparities in the development level were also characteristic for "mountain" macroregions, where the outflow of the population from peripheral areas could also be observed. On the other hand, the level of structural similarity was much higher, and the labour market situation comparable, which resulted in the stabilisation of disparities in the level of economic development.

By comparison, "industrial" and "problem" macroregions regarding the development level and the economic structure were characterised by considerable internal cohesion, which might be a proof of well-developed linkages within these macroregions. Nevertheless, development level disparities in the "problem" macroregions were increasing quite rapidly, and the scale of differences in the migration balance between the metropolis and the region was high, similarly to the disparities in the unemployment rate. In contrast, the situation concerning these aspects in the "industrial" regions was relatively stable.

The scale of increase in the development level disparities was high in the "peripheral" macroregions, characterised by a low structural similarity between the metropolis and its region. This was expressed as wide disparities regarding the unemployment rate, which was much higher in the peripheral areas, while backwashing processes were similar to those discussed in the example of the "CEE capital city macroregions". At the same time, despite a speedy increase, the scale of development level disparities between the metropolis and the region remained relatively low.

Demographic processes relating to migration were similar in highly-developed "polycentric" and "monocentric" macroregions. This was coupled with a simultaneous increase of disparities in the development level, with considerable differences in the economic structures but a rather similar situation in the labour markets of both the metropolis and the region.

The labour market situation manifested many similarities in the "central" macroregions, and the dynamics of disparities in the level of economic development remained stable, despite a relatively small level of structural similarity and a large scale of these

disparities, which could mean that metropolitan centres were central places for their regional hinterlands.

5.3. Conclusions

To sum up, we should emphasise considerable dissimilarities related to the correspondence between the directions of change in the component parts of metropolitan macroregions. This, however, makes generalisation difficult and points to a significant role of the national and regional contexts, which prove a clear *differentia specifica* of each of the surveyed macroregions.

One of the major factors differentiating both metropolises and their regional hinterlands was the modern character of the economic structure, expressed by a large share of services, including specialised services, which was associated with a high level of economic development. In addition, the disparities in the demographic potential of the macroregions played an important role as they signalled the size of the local labour pool and sales markets, which in turn would usually foster the development of the service sector. In case of metropolitan areas, their place in the respective national settlement structures was important, with an additional differentiating factor being the degree of integration of the suburban zone with the metropolitan centre, expressed by the disparities in the economic structure and labour productivity. On the other hand, for regional hinterlands of metropolises, the labour market situation was more important; in many cases it was linked to the level of industrialisation of the regional economy. Furthermore, the level of the duality of the economy, expressed by the disparities in the labour productivity between agriculture and non-agricultural activity, was another significant factor.

Taking into account the above dimensions of disparities, we identified several main types of conditions determining the economic relationships between the metropolis and the region observable in Europe. Most of the types of such conditions could be encountered across Europe and were spatially dispersed. Nonetheless, there were also groups of macroregions with similar conditions which could be found in one or several neighbouring countries, e.g. southern Germany and northern Italy, Austria and Slovenia, as well as the remaining macroregions of large German cities. On the other hand, the capital city macroregions of Central and Eastern European countries were the most conspicuous of metropolitan macroregions. In this group, it could be clearly observed how metropolises break ties with their regional hinterlands. This was probably caused by the rapid pace at which the capital city metropolises joined the mainstream of an open networked economy, with a dominance of traditional functions such as low-productivity agriculture and declining traditional industries in the economies of their regional hinterlands. To some extent, this type was imitated by other, usually smaller cities with peripheral

locations, where similar processes took place but with a lower degree of macroregional divergence. At the same time, highly industrialised regions (here referred to as "industrial" or "problem" regions) were relatively the most internally coherent. However, during the process of adapting their economic structures to the conditions of global information economy, their intraregional convergence would as a rule decrease. The remaining types of regions were quite varied despite a similar scale of intraregional disparities in the economic development level. Divergence could be observed both in highly-developed monocentric and in polycentric regions. Nevertheless, in the former type of regions, this process took place in the conditions of an extensive and complex network of flows both regarding migration and local labour market linkages, whereas in monocentric regions the degree of complexity of these relationships was much smaller. In contrast, metropolitan regions situated in Germany, Austria and Slovenia manifested the greatest stability in terms of development disparities between the metropolis and the region, which was largely a result of a similar situation in the macroregional labour markets and could be seen as a proof of considerable integration of regional production systems. However, capital city macroregions yielded the least to such attempts at generalisation – particularly those in smaller countries, where the relationships between the metropolis and the region were uniquely distinctive.

6. Determinants of macroregional convergence

As shown above, the analysed metropolitan macroregions showed considerable differences regarding the scale and dynamics of intraregional disparities between the metropolis and the region. Therefore, this part of the Report sets out to identify factors which were first and foremost responsible for these disparities. The analysis comprised the indicators discussed in the previous chapter, and highlighted the following issues: demographic situation and the settlement system, labour market situation, economic structure and labour productivity. The presented data illustrated the situation in 2004/2005 as well as the changes that took place in the period 1998-2004/5.

Undoubtedly, there are many causes underlying both the internal disparities in metropolitan macroregions in terms of the level of economic development measured by GDP per capita as well as their dynamics. The factors responsible for this divergence have been defined in an exploratory manner. As the first step, we constructed the correlation matrix for the quotients of per capita GDP in the metropolitan areas and their regional hinterlands (in the case of dynamics, the differences in the quotients were analysed for the years 1998-2005) and for the above groups of indicators. This enabled us to make a preliminary identification of variables which could affect the level of macroregional convergence. Then, we set out to indicate the key factors with the use of the general regression model (the least squares method) – and a supplementary use of

forward stepwise regression. Originally, this was intended to help build a model incorporating variables which are strongly correlated with the dependent variable and, at the same time, as weakly as possible intercorrelated with one another.

6.1. Disparities in the development level between the metropolis and the region

The scale of disparities in the level of economic development between the metropolitan area and the surrounding region (*degree of macroregional convergence*), which was the dependent variable, was defined as:

W_{MC} = GDP per capita $_{MA\ 2004}$ / GDP per capita $_{RH\ 2004.}$

In consequence, the more the value of the WMC coefficient diverged from 1, the larger the scale of disparities in metropolitan macroregios. A coefficient value of less than 1 indicates a higher level of development of the regional surrounding than in the metropolitan area and the values over 1 the opposite situation. However, the first situation (RH higher than MA) was only observed in 5 macroregions and in those cases the index was very close to 1, so in the following analyses we will consider that a high WMC coefficient means divergence, and a low coefficient (i.e. close to one) means convergence.

Demographics

Among indicators from the "demographics" category, the share of the largest city (within its administrative boundaries) in the population of the entire metropolitan region had the biggest impact on the level of macroregional convergence **(Table 32)**. However, it should be borne in mind that, to some extent, this correlation could result from the differences in the adjustment of the boundaries of individual metropolitan areas to the extent of the metropolitan labour market. Leaving this objection aside, this correlation (upon its testing) meant that the surroundings of polycentric metropolitan areas was relatively better developed economically than the surroundings of monocentric metropolises with a clear domination of the centre. What is more, the degree of monocentrism of the metropolitan area was the more significant the greater the polycentrism of the regional hinterland, expressed by the share of the largest urban centre in the number of the population living in the remaining part of the macroregion. As a result, the lack of big urban centres in the regional hinterland when the metropolitan centre had a large number of the population as a rule signified wider disparities in the level of economic development.

Index	Metropolitan region	Regional hinterland	MA/RH ratio
Similarity of demographic processes**	*0.16*		
Population	*-0.08*	0.00	*-0.12*

Population density [pax/km2]	*-0.02*	**-0.28***	*0.14*
Natural increase in ‰ [average 2000-2005]	*-0.09*	*-0.18*	*0.11*
Migration balance in ‰ [average 2000-2005]	*-0.03*	**-0.33***	*-0.09*
Population of largest city	*0.12*	*-0.09*	*0.15*
Share of largest city in population [%]	**0.47***	*-0.10*	**0.34***

* significance at the level of 0.05
**sum of absolute differences in natural increase and migration balance in the metropolis and regional hinterland

Table 32. Correlation coefficients between the level of macroregional convergence and demographic factors
Source: prepared by the author.

The characteristics of the regional hinterland affected the level of macroregional convergence to a lesser extent (bordering on statistical significance). In particular, this was true for the population density, which was higher in regions with lesser disparities in the economic development level. In addition to that, the migratory balance of the regional hinterland was negatively correlated with the degree of macroregional convergence of the level of economic development. This could mean that in the conditions of more tangible disparities in per capita GDP, an outflow of the population from the regional hinterland to the metropolis can be observed (e.g. to seek employment). In contrast, when the disparities are low, the regional hinterland could be attractive for some metropolitan dwellers (e.g. old age pensioners looking for cheaper real property and better living conditions). However, it should be emphasised that although statistically significant, these two correlations were very weak and could be produced by other analysed factors.

Economic structure

The similarities between the economic structure of the metropolitan area and its hinterland had a substantial bearing on the degree of macroregional convergence **(Table 33)**. This can be clearly seen in the case of the composite dissimilarity index, which was strongly correlated with the macroregional convergence index. It means that wider disparities in the level of economic development were accompanied by wider disparities in the economic structure. An analysis of partial dissimilarity indices will show whether this could be explained by the disparities in the roles of the agriculture and services sectors between the metropolis and the region. In particular, the more agricultural the

nature of the metropolis' regional hinterland, the greater the degree of macroregional divergence in the development level.

Indicator	Metropolitan area	Regional hinterland	MA/RH ratio
Dissimilarity index	**0.64***		
GVA in agriculture [%]	*-0.15*	**0.48***	**-0.50***
GVA in industry [%]	*-0.10*	*0.21*	*-0.23*
GVA in services [%]	*0.12*	**-0.42***	**0.50***
GVA simple services (sections G-I) [%]	**0.38***	*-0.14*	**0.51***
GVA - specialised services (sections J-K) [%]	*0.06*	**-0.37***	**0.51***
GVA – public services (sections L-O) [%]	**-0.41***	*-0.18*	*-0.22*
GVA - specialised services (sections J-K) [% GVA of the service sector]	*0.01*	*-0.23*	**0.30***

* significance at the level of 0.05

Table 33. Correlation coefficients between macroregional convergence level and dissimilarity index

Source: prepared by the author.

In contrast, a well-developed service sector in the regional hinterland was more likely to foster structural similarity, which in turn was manifested by small disparities in the economic development level between the metropolis and the region. At the same time, disparities in the industrialisation level did not affect the level of macroregional convergence, which was probably due to the differences in the stages of restructuring processes in this sector in individual metropolitan macroregions.

The role of the service sector for macroregional convergence could also be clearly seen in the analysis of the internal disparities in the sector, broken down into "simple" services which included: trade, hotels and restaurants, as well as transport, storage and communication; "specialised" services such as: financial intermediation and real estate and business activities, as well as "public" services such as: public administration, education, health care and social assistance. Interestingly, a higher share of simple services in the metropolitan area economy, just as a smaller share of specialised services in the economy of the regional hinterland, signalled a higher level of macroregional economic divergence. This could indicate barriers to the development of simple services in the peripheral areas of regions with strongly developed central features in the metropolis. This, however, did not apply to public services as in their case a higher share in the economic structure of the metropolitan area would normally foster a greater macroregional convergence. On the other hand, disparities in the role of specialised

services vis-à-vis other types of services only marginally affected the scale of intraregional disparities in the level of economic development.

Labour market

Similarities in the labour market situation were distinctly related to the scale of disparities in the level of economic development between the metropolis and the region **(Table 34)**. This was primarily indicated by the composite indicator - a sum of absolute differences in the number of employees per 100 population and the unemployment rate between the metropolis and the region. As the partial indices revealed, this was mostly due to a higher degree of economic activity and a higher number of jobs per 100 inhabitants of the metropolitan area. On the other hand, the smaller the differences in the unemployment rate within the metropolitan macroregion, the greater the degree of macroregional convergence. Nevertheless, it should be pointed out that the above correlations (other than the composite indicator), were very weak.

Indicator	Metropolitan area	Regional hinterland	MA/RH ratio
Dissimilarity of labour market situation**	**0,48***		
Employees per 100 population	**0.35***	*-0.09*	*0.23*
Activity rate [%]	**0.27***	*-0.02*	*0.10*
Unemployment rate [%]	*-0.20*	*0.02*	**-0.30***

* significance at the level of 0.05
**sum of absolute differences in the number of employees per 100 population and the unemployment rate

Table 34. Correlation coefficients between macroregional convergence level and labour market indicators
Source: prepared by the author.

Labour productivity

Another factor directly related to the degree of macroregional convergence was labour productivity, defined as gross value added per one employee **(Table 35)**. Quite naturally, the greater were the disparities in labour productivity between the metropolitan area and the remaining part of the metropolitan macroregion, the was greater the degree of macroregional divergence. This was mostly due to a lower labour productivity in the regional hinterland both in services and in industry. At the same time, the relativisation of labour productivity in individual sectors vis-à-vis the average for a given macroregion in many cases made the correlation with development disparities very weak or statistically insignificant.

Indicator	Metropolitan area	Regional hinterland	MA/RH ratio
Total productivity [EUR]	*-0.22*	**-0.52***	**0.86***
Productivity in agriculture [EUR]	**-0.33***	**-0.32***	*0.21*
Productivity in industry [EUR]	*-0.04*	**-0.43***	**0.51***
Productivity in services [EUR]	**-0.29***	**-0.51***	**0.76***
Productivity in agriculture [total =100]	*-0.20*	*0.14*	**-0.24***
Productivity in industry [total=100]	*0.05*	*0.12*	*-0.04*
Productivity in services [total=100]	*0.04*	**0.29***	**-0.25***

* significance at the level of 0.05

Table 35. Correlation coefficients between macroregional convergence level and productivity indicators

Source: prepared by the author.

General regression model - disparities in the development level

At the next stage of investigating the determinants of macroregional convergence, we discarded the variables which were very strongly correlated (k>0.8) (e.g. labour productivity, very strongly linked to per capita GDP), and those with an insignificant correlation (p>0.05). From the correlation matrix produced in this way, we removed interdependent variables at the correlation level (k>0.6). In effect, we obtained a set of variables which were then used in the multiple regression analysis. In the process, we additionally used the forward stepwise regression method, whereby we successively added the most strongly correlated variables, having set the minimum increase threshold of the adjusted determination coefficient (r^2) for the model at a level of 0.05. As a result, the following regression equation was produced:

$$\mathbf{W_{MC} = 0.486 * DI + 0.340 * LMI + 0.308 * LP + 0.6}$$

where:

W_{MC} – intraregional economic development disparities;

DI – dissimilarity index (the higher the index value the smaller the similarity of the economic structure);

LMI – dissimilarity index for labour market situation (the higher the index value the smaller the similarity of the labour market situation);

LP – intraregional disparities concerning labour productivity in (the higher the index value the higher the labour productivity quotient between the metropolis and the region).

On this basis, we can conclude that the level of intraregional disparities was the most dependent on the structural similarity of the metropolis and its regional hinterland, as well as on the comparability of their labour market situations. In addition to that, disparities in the labour productivity in the industrial sector played an important part for the macroregional convergence in the level of economic development.

It should be observed that a similar economic structure largely determined the average labour productivity in the three major sectors. The reason for this were substantial disparities in labour productivity between the agricultural sector on the one hand and the industrial and service sectors on the other. The structural similarity could also produce similar responses of the component parts of metropolitan macroregions to trade cycles and development megatrends. In addition, a similar structure most likely fostered the development of linkages between businesses situated in different parts of metropolitan macroregions. On the other hand, the well-developed service sector in the regional hinterland could signify a greater self-sufficiency of the region in this regard, which in effect reduced the role of services provided to its regional hinterland by the metropolitan area.

In contrast, a similar situation on the labour market could explain lesser disparities in the development level between the metropolis and the region on the one hand, and on the other – it could be caused by such disparities. In particular, this applied to the similarities between the metropolis and the region in terms of the number of jobs per 100 population, which could restrict the flows from the metropolis to the region and vice versa, particularly in case of commuting to work. Secondly, a similar unemployment rate could suggest a similar response of the macroregion's component parts to economic performance or be seen as a proof of well-developed cooperation linkages regionally.

The disparities in labour productivity in industry were interesting determinants of the level of macroregional convergence. A similar labour productivity in this sector could signify a similar capital intensity of the sector or a similar level of technological advancement. This could naturally generate similar responses in the two macroregional components to economic performance in the industrial sector, although this was probably influenced by the dissimilarities in the sectoral structure. The similarity of both parts of the macroregion in terms of the value of this indicator could also point to a similar stage of restructuring processes in traditional branches of industry.

To sum up, it should be noted that the above determinants were not the sole factors affecting the degree of macroregional convergence of the economic development level as

the adjusted determination coefficient of the regression model was only 0.61. This can undoubtedly be attributed to a strong internal differentiation of the metropolitan regions under analysis, relating to a number of aspects ranging from demographic through economic to social ones. In addition, incorporating additional variables into the model, mostly those illustrating the differences between the metropolis and the region in terms of the quality of human capital and degree of innovation, would in all likelihood significantly increase the value of that coefficient.

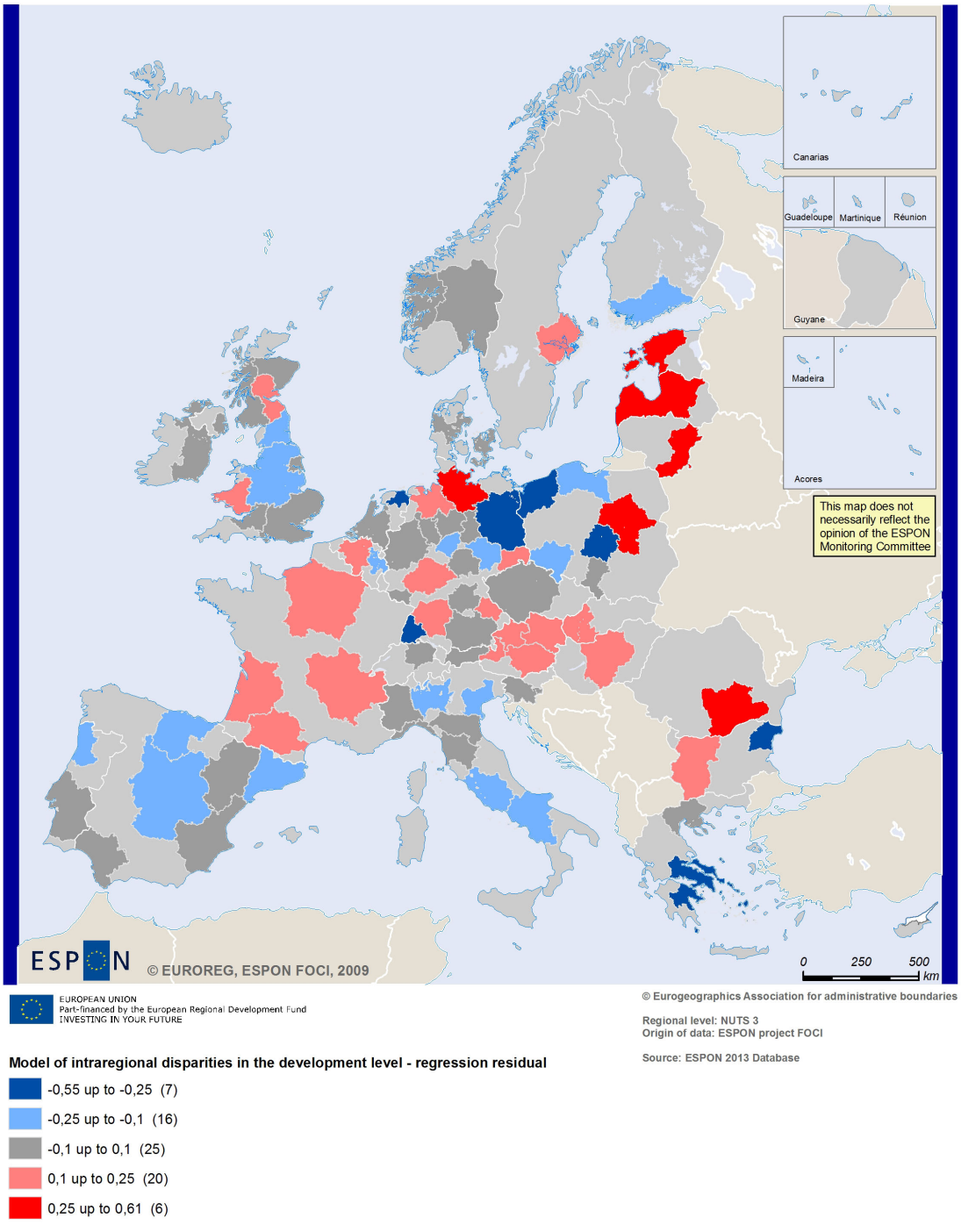


Figure 24. Regression residual – intraregional development disparities
Source: prepared by the author.

To better verify the model summarised above, we made a residual regression analysis and examined the resultant spatial distribution. It should be emphasised that the analysis of regression residuals did not reveal any significant deviations from the normal distribution. The spatial distribution of residuals also corroborates the correctness of our model, and does not show any disruptions related to the spatial concentration of regression residuals in one or several neighbouring countries. However, based on the analysis of residual distribution, we can indicate those metropolitan macroregions which most strongly diverged from the correlation revealed in the model. Those macroregions primarily included Central and Eastern European capital city regions of the Baltic countries, Poland and Romania. This group also included the macroregion of Hamburg, which encapsulated a part of the former GDR in the vicinity of Schwerin. At the other extreme of regions departing from the model, we have Berlin and Athens, as well as smaller industrial regions in CEE countries, i.e. Szczecin, Łódź and Varna, as well as Groningen and Freiburg. On the other hand, German, Italian, British, Dutch, Iberian and Irish regions made the best fit with the presented regression model.

6.2. Change in the development disparities between the metropolis and the region

The change in the scale of disparities in the economic development level between the metropolis and the region (*macroregional convergence process*), adopted as the dependent variable, was defined as:

ΔW_{MC} = (GDP per capita $_{MA\ 2004}$ / GDP per capita $_{RH\ 2004}$) - (GDP per capita $_{MA\ 1998}$ / GDP per capita $_{RH\ 1998}$)

Positive values of this indicator denoted an increase in the macroregional divergence of the development level, and negative ones – its decrease.

Just as before, the independent variables belonged to four groups and illustrated the situation in 1998 and its dynamics in the years 1998-2005[24] both in the metropolitan area and in the regional hinterland. Moreover, the quotients of these indicators and the differences in these quotients between 1998 and 2005 were used in the analysis 2005.

Demographics

The juxtaposition of macroregional convergence processes with demographic indicators shows the following, weak or very weak, correlations **(Table 36)**. Firstly, the lesser population density in the regional hinterland coincided with a greater increase in the disparities in the level of economic development. Secondly, the monocentrism of the

[24] In case of changes in the labour market structure for calculating labour productivity in metropolitan macroregions of: Greece, the Netherlands, Poland and Romania, the data for the years 2002-2005 were used; while the data concerning changes in the internal structure of the service in Bulgaria, France, Poland and Italy come from the years 2002-2005.

metropolitan area, expressed by a significant share of the largest city in the population of the metropolis would increase the macroregional divergence. Thirdly, the demographic collapse in the metropolis and the region, manifested by a fall in the number of the population and a negative natural increase, also coincided with an increase in intraregional divergence. In addition to that, the migratory outflow from the regional hinterland would as a rule take place in the conditions of a divergence of the development level.

Indicator	Value in 1998			Change in 1998-2005		
	Metropolitan area	Regional hinterland	MA/RH ratio	Metropolitan area	Regional hinterland	Difference - MA/RH quotients
Population	*-0.07*	*-0.06*	*0.07*	**-0.37***	**-0.51***	**0.30**
Population density [pax/km2]	*-0.14*	**-0.28***	*0.12*	-	-	-
Natural increase in ‰ [average 2000-2005]	-	-	-	**-0.41***	**-0.47***	*0.01*
Migration balance in ‰ [average 2000-2005]	-	-	-	*-0.16*	**-0.41***	**0.35**
Population of largest city	*0.01*	*-0.11*	*0.06*	-	-	-
Share of largest city in the population [%]	**0.37***	*0.13*	*0.13*	-	-	-

significance at the level of 0.05

Table 36. Correlation coefficients between macroregional convergence level and demographic indicators
Source: prepared by the author.

Economic structure

The similarity in the economic structure within one metropolitan region determined not only the degree of convergence of the level of economic development but also its change **(Table 37)**. In particular, the greater was the share of agriculture and the smaller the share of services in the regional hinterland's economy, the greater was the increase of macroregional divergence. On the other hand, the analysis of economic structure dynamics points to some role of industry in equalising the development levels between the metropolitan area and its hinterland. As a rule, an increased role of industry, especially when it was accompanied by a simultaneous decrease in the role of agriculture in the regional hinterland, usually led to a decrease in intraregional disparities. This could suggest positive consequences of the industrialisation of agricultural areas (which probably mostly applied to areas situated in the transport corridors) for macroregional convergence processes. What is more difficult to explain, however, is the positive

correlation between an increase of the macroregional divergence in the level of economic development and the share of the quotient of the agriculture's share in gross value added in the years 1998-2005. Most probably, this is a superficial correlation arising from other factors such as for example an extremely low share of agriculture in the economies of metropolitan regions, which could cause some accidental disruptions (high coefficient of variation values for this indicator).

Another determinant of the macroregional divergence process was a high share of simple services in the metropolitan area's economy. This could mean that a high penetration rate of such services in metropolises can restrict the development of such services in the regional hinterland. To a large extent, this is compatible with the central places theory, according to which the metropolitan centre "services" the regional hinterland. To some extent, this hypothesis has been corroborated by the fact that an average share of simple services in gross added value reached 24.4% in metropolises and only 20.7% in their regional hinterlands. Nevertheless, it should be pointed out that in the years 1998-2005 no correlation between macroregional convergence processes and the dynamics of the role of simple services in the metropolis and in the region could be observed.

To add further to this picture, a higher share of other types of services, not only those which usually represented the public domain, but also specialised financial and other B2B services indicated an increased macroregional convergence. It should be noted, however, that specialised services could at least to some extent perform the role of a growth engine for the regional hinterland. This is manifested by the positive correlation between the increase of macroregional convergence and the development of such services in the metropolises' regional hinterlands, particularly in the situation of a relative stagnation with respect to the increasing role of such services in the economy of the metropolitan region.

Indicator	Value in 1998			Change in 1998-2005		
	Metropoli-tan area	Regional hinterland	MA/RH ratio	Metropoli-tan area	Regional hinterland	Difference - MA/RH quotients
Dissimilarity index	**0.52***			-0.01		
GVA in agriculture [%]	*0.20*	**0.55***	*-0.22*	**-0.28***	**-0.46***	**0.45**
GVA in industry [%]	*-0.01*	*0.09*	*-0.01*	*-0.06*	**0.26***	**-0.30**
GVA in services [%]	*-0.03*	**-0.50***	**0.52***	*0.11*	*0.05*	*0.07*
GVA simple services (sections G-I) [%]	**0.49***	*-0.09*	**0.61***	*0.22*	*0.10*	*0.12*
GVA specialised services (sections J-K) [%]	**-0.30***	**-0.29***	*0.10*	*0.10*	**-0.26***	**0.31**
GVA public services (sections L-O) [%]	**-0.29***	**-0.33***	*0.12*	*-0.19*	*0.03*	*-0.23*
GVA specialised services (sections J-K) [% GVA of the service sector]	**-0.37***	*-0.10*	*-0.10*	*0.12*	**-0.26***	**0.37**

- significance at the level of 0.05

Table 37. Correlation coefficients between macroregional convergence level and economic structure indicators
Source: prepared by the author.

Labour market

The linkages between labour market indicators and macroregional convergence processes were to a greater extent associated with the labour market dynamics in the years 1998-2005 than with the initial situation of 1998 **(Table 38)**. One exception were disparities in the unemployment rate in 1998. The smaller these differences, the greater the increase of the macroregional convergence in the level of economic development in 1998-2005 and, conversely, a divergence increase could be observed in the conditions of a manifest segmentation of the labour market. The differentiation of the labour market situation was mainly connected with its deterioration in the regional hinterland, which frequently accompanied the macroregional divergence process. On the other hand, increased labour market similarities, particularly in terms of the number of jobs per 100 employees and an increased activity rate in the regional hinterland of the metropolis, fostered the equalising of development disparities between the metropolis and the region.

Indicator	Value in 1998			Change in 1998-2005		
	Metropoli-tan area	Regional hinterland	MA/RH ratio	Metropoli-tan area	Regional hinterland	Difference - MA/RH quotients
Dissimilarity of labour market situation	*0.01*			**0.32***		
Employees per 1000 population	*-0.15*	*-0.09*	*-0.13*	**0.64***	**0.44***	**0.58**
Activity rate [%]	*0.06*	*-0.07*	*0.05*	*0.03*	**-0.38***	**0.27**
Unemployment rate [%]	*0.02*	*0.22*	**-0.35***	*-0.16*	**-0.27***	*0.19*

- significance at the level of 0.05

Table 38. Correlation coefficients between macroregional convergence process and labour market situation
Source: prepared by the author.

Labour productivity

Indicator	Value in 1998			Change in 1998-2005		
	Metropolitan area	Regional hinterland	MA/RH ratio	Metropolitan area	Regional hinterland	Difference - MA/RH quotients
Productivity - total [EUR]	**-0.60***	**-0.60***	**0.46***	**0.63***	**0.50***	**0.60**
Productivity in agriculture [EUR]	**-0.43***	**-0.39***	*0.14*	**0.54***	**0.51***	*0.10*
Productivity in industry [EUR]	**-0.49***	**-0.55***	*0.14*	**0.71***	**0.53***	**0.44**
Productivity in services [EUR]	**-0.61***	**-0.62***	**0.44***	**0.58***	**0.41***	**0.59**
Productivity in agriculture [Total=100]	*0.01*	*0.13*	*-0.12*	*0.06*	*0.20*	*-0.10*
Productivity in industry [Total=100]	*-0.19*	*0.07*	*-0.21*	*0.01*	*0.11*	*-0.08*
Productivity in services [Total=100]	**0.28***	*0.24*	*-0.06*	*-0.02*	**-0.26***	*0.23*

* significance at the level of 0.05

Table 39. Correlation coefficients between macroregional convergence level and labour market indicators
Source: prepared by the author.

Quite naturally, both labour productivity measured in EUR and its change in the analysed period were rather strongly correlated with macroregional convergence processes. As a rule, a wider disparity in labour productivity between the metropolis and the region in the base year led to an increase in the macroregional divergence of the economic development level, which, first and foremost, was due to the disparities related to labour productivity in the service sector. In addition to that, an increase of intraregional disparities in labour productivity in industry and services widened the macroregional divergence. This process was mainly fostered by a faster increase in labour productivity in metropolitan areas in the industry sector, although such an increase, albeit on a smaller scale, could also be observed in the service sector. On the other hand, the relativisation of labour productivity in individual sectors to the average as a rule made these correlations statistically insignificant.

General regression model - change in the development disparities

At the next stage of constructing a regression model, we discarded all variables which were not significantly ($p<0.05$) correlated with macroregional divergence processes concerning the level of economic development. Then, we removed those variables which were strongly intercorrelated ($k>0.6$) from the correlation matrix. In effect, we obtained a set of variables to use in the multiple regression analysis. In the process, we used forward stepwise regression whereby we successively added the most strongly correlated

variables, with the adopted minimum increase of the adjusted determination coefficient (r^2) of 0.05%. This ultimately produced the following regression equation (r^2 = 0.57).

On this basis, it can be observed that the macroregional convergence process was largely dependent on the similarity of the metropolises' economic structure and their regional hinterlands in the base year. In 1998-2004, the divergence of the development level could be observed mostly in the circumstances of wide disparities in the economic level between the metropolis and the region. On the other hand, similarities between the metropolis and the region in terms of the share of individual sectors in gross added value fostered convergence, and in any case led to a slower increase of intraregional disparities.

$$\Delta W_{MC\ (1998\text{-}2004)} = 0{,}253 * DI_{\ (1998)} + 0{,}478 * \Delta LI_{\ MA\ (1998\text{-}2005)} - 0{,}240 * \Delta AR_{\ RH\ (1998\text{-}2005)} - 0{,}169 * MB_{\ RH\ (2000\text{-}2005)}$$

where:

ΔW_{MC} – change of intraregional disparities in the level of economic development

DI – dissimilarity index

LI – employees per 100 population

AR – activity rate in %

MB – migratory balance in ‰

and:

MA – metropolitan area

RH – regional hinterland

Other factors associated with macroregional convergence processes included the number of employees in the metropolitan area, with a simultaneous fall in the number of people economically active in the regional hinterland and the migratory outflow from the regional hinterland. Most likely, this was a proof of the backwashing of development resources from the regional hinterland to the metropolis.

It can be concluded that while structural disparities point to one of the key reasons for the increase of disparities in the development level between the regional hinterland and the metropolis, the labour market situation and migration flows are consequences of an increase in macroregional divergence. In a nutshell, metropolitan areas with their quickly increasing share of services (particularly those situated in regions which were still agricultural in character or were dominated by traditional industries) represented the poles of growth "draining" the human capital from their hinterland, which in effect led to a negative feedback related to the shrinking of resources needed for an endogenous development of these areas.

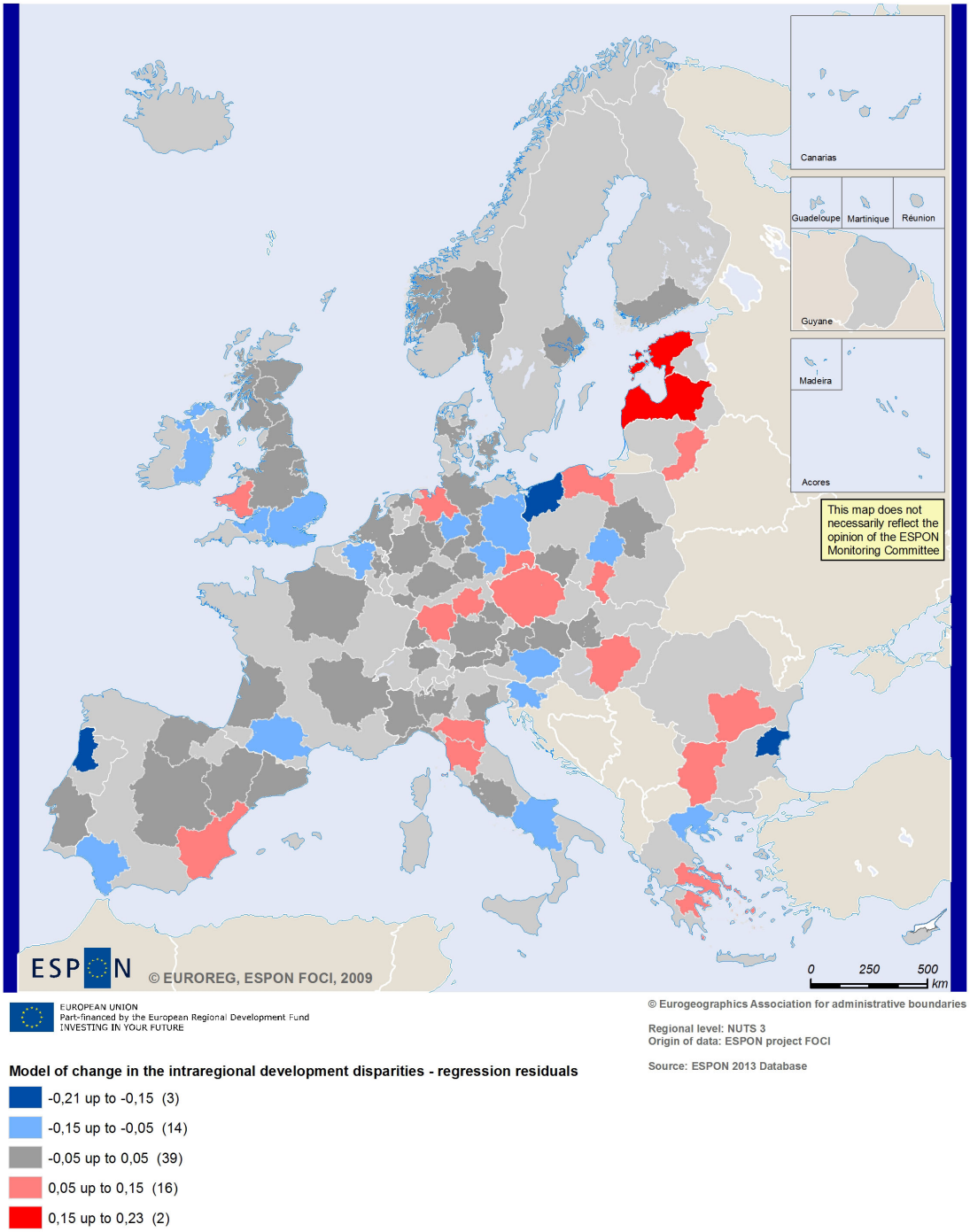


Figure 25. Regression residuals – intraregional development disparities
Source: prepared by the author.

Just as in the case of the degree of macroregional convergence, in order to gain a better understanding of the nature of the model presented above, we examined the regression residuals and their spatial distribution. The residual analysis did not reveal any significant

deviations from the standard distribution; likewise, the spatial distribution of residuals was also very even. Among metropolitan macroregions which diverged the most from the correlation shown in the regression model in question, there were: coastal macroregions situated in new Member States (e.g. Tallinn and Riga) Szczecin and Varna. Nevertheless, their distribution was so patchy that its precluded any generalisations concerning their spatial structure.

6.3. Conclusions

On the basis of the foregoing analysis, the following conclusions can be drawn:

- Both the scale of intraregional disparities and their changes were quite strongly dependent on the national and regional contexts, while the indicators and the regression models used showed only some of the factors that determined them. The incorporation of indicators related to the quality of the human capital and innovation of the enterprise sector would probably help better understand the intraregional disparities that can be observed.
- The key factor affecting the disparities in the economic development level and their change was the similarity of the economic structures of the component parts of the metropolitan macroregion. A similar economic structure could point to the existence of direct or indirect linkages between metropolitan areas and their regional hinterlands which lessened the disparities in the development level. Wider structural differences were manifested in dissimilar development paths for the metropolises and their regions and led to macroregional divergence. Nonetheless, the increasing level of similarity between the economic structures of the metropolis and the region was not the key factor underlying macroregional convergence.
- Similarity of the labour market situation was a manifestation of minor intraregional disparities in the level of economic development, which could be seen as a proof of linkages within the macroregional labour market. Furthermore, an improved situation in the metropolitan labour market with its simultaneous deterioration in the regional hinterland was the main reason (or consequence) for the macroregional divergence in the development level. Seen together with the migratory outflow from the regional hinterland to the metropolis, this could testify to the backwashing of development resources (mostly human capital), from the periphery to the core.
- Labour productivity was very strongly correlated with the development level (to some extent, this was due to the structural disparities), which was manifested inter alia by the fact that the differences in labour productivity in industry (testifying to a varying degree of capital intensity of the sector, and thereby

probably to the level of its technological advancement) were an important factor differentiating the development level macroregionally. Nevertheless, the growing similarity of labour productivity figures was not included among the factors that we employed in the model explaining convergence processed in the analysed macroregions.

Among other observable correlations which were not incorporated in our regression models, the following should be mentioned in particular:

- Regarding the disparities in the economic development level:
    - The level of monocentrism of the metropolitan area. This correlation meant that the hinterlands of polycentric metropolitan areas were in relative terms better developed economically than the metropolises with a clear domination of the centre; this could be viewed as a proof of stronger intraregional linkages generated by urban centres making up conurbations.
    - The share of simple services in the economy of the metropolitan area. A higher share of simple services in the metropolitan economy generated wider disparities in the development level, just as a smaller share of specialised services in the economy of the regional hinterland. This could point to barriers to the development of services in regions with strongly developed central functions in the metropolitan centre.
- Regarding the changes in the disparities in the economic development level:
    - Labour productivity was quite closely connected with macroregional convergence processes. As a rule, the higher the labour productivity the smaller the increase in development disparities, which was basically due to the disparities in labour productivity in the services sector. On the other hand, an increase in macroregional disparities in labour productivity led to macroregional divergence, which was mainly due to a faster increase in labour productivity in metropolitan area in service and industry sectors.
    - Specialised services performed, to some extent, the role of the growth engine for the regional hinterland, which was primarily due to the fact that a high share of such services in the regional hinterland usually coincided with macroregional convergence processes. Secondly, a decrease in the disparities concerning the role of specialised services in the metropolis and in the region (both with regard to the economy at large and their share in this type of services) signified a smaller increase of macroregional divergence in the development level.

Metropolitan macroregions in Europe – Case studies

Metropolitan macroregions selected for detailed analysis were intended to represent a diverse set in order to show both the variety of intraregional linkages and factors which determined them, and their significance for the development of the metropolis and its regional hinterland. In this case, the aim of the study was to show the mechanisms underlying the linkages between the metropolis and the region.

The selection of the case studies was purposeful and was done on the basis of the typologies discussed in Chapter 4, using data on intraregional development disparities based on per capita GDP. The selected macroregions were intended to represent extreme cases in terms of the scale of disparities in the level of development between the metropolis and the region, and show changes in these disparities also with regard to the national GDP dynamics **(Annex 7)**. In effect, the following were selected for further research:

a) macroregions with a wide and rapidly growing scale of intraregional disparities: the macroregion of Warsaw (fast development both of the metropolis and of the regional hinterland in comparison with the national average) and the region of Stockholm (weaker development of the regional hinterland as compared to the national average); which allowed for the drawing of comparisons between an "old" EU Member State and a "new" one;

b) the macroregion of Toulouse with a considerable scale of intraregional disparities, however with a tendency for their reduction in the circumstances of a rapid pace of growth of the entire macroregion as compared to the national average;

c) the macroregion of Glasgow with a small scale of intraregional disparities, but with their fast increase and a low rate of macroregional growth as compared to the rest of the country;

d) the macroregion of Barcelona with a very small and stable scale of intraregional disparities (a comparable development level of the metropolis and the regional hinterland) with a relatively low rate of economic growth as compared to the rest of the country.

Quite naturally, the above selection cannot be considered as a representative sample, and the conclusions drawn on this basis can hardly be expected to encompass all the situations taking place in the extremely diverse research area covered by the ESPON programme. Nevertheless, it can be expected that the analyses of these cases will improve our understanding of the relationships between the metropolis and the region in

rather extreme situations, which should in turn make it easier to put forward relevant recommendations regarding activities aimed to strengthen the positive aspects of metropolisation processes and reduce its negative aspects.

In the case studies, the following spatial ranges were applied (Table 40):

- The city in its administrative boundaries;
- The metropolitan region, as a rule corresponding to the NUTS3 subregion;
- The metropolitan macroregion, corresponding in three cases to the NUTS2 region, and in two other cases being a combination of NUTS3 subregions.

Spatial ranges	Spain	United Kingdom	Sweden	France	Poland
City in its administrative boundaries	Barcelona (1.7 mil.)	Glasgow (600 000)	Stockholm (830 000)	Toulouse (440 000)	Warsaw (1.7 mil.)
Metropolitan area	Barcelona metropolitan area - NUTS3 in approximation (3.2 – 4.9 mil.)[25]	Glasgow metropolitan area 9 local council areas (1.75 mil.)	Stockholm Lan (NUTS2/NUTS3) (2.0 mil.)	Aire Urbaine de Toulouse (1.1 mil.)	Warsaw metropolitan area - NUTS3 in approximation (2.6 mil.)
Macroregion	Catalonia (NUTS2) 7.4 mil.	Western Scotland (8 NUTS3) 2.5 mil.	Mälar (5 NUTS3) 3.1 mil.	Midi-Pyrénées (NUTS2 and 1 NUTS3) 3.25 mil.	Mazowsze (NUTS2) (5.2 mil.)

Table 40. Component parts of the analysed metropolitan macroregions
Source: prepared by the author.

The case studies mostly used the results of qualitative analyses, supplemented by the quantitative results of questionnaires circulated among local governments and enterprises.

Qualitative analyses included study visits of experts, in the course of which a number of in-depth interviews were made with representatives of institutions in charge of the development of a given city and region (moreover, in the case of Glasgow, Stockholm and Toulouse, we used analyses prepared by the local experts[26]). In each of the

[25] For more information see the case study of Barcelona.
[26] The expert's studies were prepared by: Prof. Iain Docherty and Malcolm Leitch (for Glasgow); Tuija Meisaari-Polsa (for Stockholm); Prof. François Taulelle (for Toulouse).

macroregions, about 10 interviews were conducted (Annex 7), which focused on the following aspects:

- The spatial range of the city's influence;
- The key strengths and weaknesses of the metropolis and of the region and major differences between these territorial systems;
- The crucial socio-economic relationships between the metropolis and the region and factors which determined them, as well as their role for the development of these territorial systems;
- The directions and extent of public intervention concerning the linkages between the metropolis and the region;
- The development prospects for the metropolitan macroregion.

As part of quantitative analyses, questionnaires[27] were distributed among local governments located in the analysed metropolitan macroregions (Annex 9), and among enterprises situated in the city's metropolitan area (Annex 10). Altogether, 1500 questionnaires were sent out to local governments, and dealt with such issues as: transport accessibility; the impact of the central city on the development of local systems, and cooperation with other local government levels. The rate of return varied from region to region, and ranged from over 30% in the metropolitan macroregion of Stockholm to 3% in the metropolitan macroregion of Glasgow[28] (Table 41). Quantitative analyses were carried out using two approaches: for the municipalities situated at a distance of not more than 50 km from the city centre (in broad terms, the local governments making up the metropolitan region), and for areas located further away, which constituted the external zone of the city's influence. Due to the low rate of return and a small size of the sample (in some cases), the results obtained should be treated with caution, only as a supplementary source of information to the qualitative analyses made on the basis of the interviews.

[27] In the emails sent out in October and November 2009 (stage I) and faxes (stage II), we provided links to the electronic versions of the questionnaires uploaded to a designated server.
[28] Due to the low rate of return and the small size of the sample, the Glasgow macroregion was not included in the quantitative analyses.

	Barcelona	Glasgow	Stockholm	Toulouse	Warsaw
Total municipalities	**454**	**239**	**52**	**570**	**356**
MA questionnaires*	**14**	**4**	**9**	**17**	**25**
RH questionnaires *	**20**	**3**	**9**	**11**	**59**
Rate of return	**7.5%**	**2.9%**	**34.6%**	**4.9%**	**23.6%**

* The general rule was that municipalities situated within 50 km from the city centre were regarded as ones situated within the metropolitan area, and the areas situated further away were treated as the external zone of the city's influence.

Table 41. Surveyed sample of local governments in metropolitan macroregions
Source: prepared by the author.

As regards enterprises operating in the metropolitan areas, the number of circulated questionnaires was about 20 000 altogether (based on the KOMPASS database); they tackled such issues as: spatial linkages; evaluation of the local environment and potential for innovation. The companies selected for the survey represented two sectors of activity, i.e. manufacturing (Section D) and services for enterprises (Section K).

	Barcelona	Glasgow	Stockholm	Toulouse	Warsaw
Total sample size	**2 500**	**1 583**	**2 500**	**2 500**	**10 000**
Number of questionnaires	**35**	**10**	**73**	**26**	**118**
Industry	**25**	**3**	**23**	**6**	**19**
Services	**10**	**7**	**50**	**21**	**109**
Rate of return	**1.4%**	**0.6%**	**2.9%**	**1.0%**	**1.2%**

Table 42. Surveyed sample of enterprises in metropolitan macroregions
Source: prepared by the author.

As a result the qualitative analyses for respective case studies were presented below followed by synthesis supported by selective use of quantitative analysis.

1. City-region relationships: Barcelona – Catalonia case study

The introduction offers a general presentation of Catalonia and its main component parts: the Barcelona metropolis and the metropolitan region, that is the Catalonian territory comprising the rest of Catalonia. In the description of this region, the issue of the dissimilarity of its territorial divisions, the so-called old and new ones, or the Spanish and the Catalonian, is extremely important. This will be discussed further in the study. Unfortunately, since statistical data are provided for differently understood statistical units, conservatism in their application is recommended. For reasons explained below, unless it is specified otherwise, the provided data concerning the metropolis, alternately referred to as the metropolitan area (and marked as a STAT source), as a rule refer to the province of Barcelona (a NUTS3 subregion; cf. Maps 1 and 5). Regardless of its weaknesses (the boundaries do not overlap with the functional metropolitan area and they include large rural areas), a NUTS3 unit gives access to comparable statistical data, and – unlike the proposals for the delimitation of the Barcelona metropolitan area discussed below, the province has fixed borders, competences and financial resources. Most of Catalonia's inhabitants live here (Kaczmarek, Mikuła 2007: 103). At the same time, numerous analytical works focus on other planning units. In this context, in-depth interviews with representatives of research centres, consulting companies and public

administration (interviews in the body of the text) provided an invaluable source of information)[29]

Catalonia lies in south-eastern Spain on the Mediterranean Sea. In the east, the natural boundary of the Pyrénées divides it from France and Andorra (where Catalonian is the official language). It mostly comprises mountain and upland areas with few lowland valleys along the largest rivers (the Ebro) and some areas on the sea coast. Catalonia occupies an area of 31 700 km2, and has 7.4 million inhabitants (2006). Catalonia's capital, Barcelona, has a population of 1.7 million and occupies an area of only 101 km2[30]. (Papers 50: 54) (see below).

Beside Barcelona, Catalonia's major cities include Hospitalet de Llobregat (250 000 inhabitants, in practice territorially integrated with Barcelona), Terrasa (202 000 inhabitants), Sebadell (202 000), Tarragona (140 000), Lleida (136 000). Both Catalonia and the city of Barcelona as well as the metropolitan area (regardless of how it is defined) have a high population density (**Annex 11**) (cf. Matheu 2003: 43), which for the region is 218 inhabitants/km2; for the metropolitan region - 674 inhabitants/km2, and for the city of Barcelona - 17 171 inhabitants per km2 (STAT). The characteristic feature of the metropolis is that there are no large rivers: those which flow through Barcelona (the Besos and the Llobregat) are – especially in dry season – streams rather than rivers and do not satisfy the residents' demand for water.

The very high population density of Barcelona, coupled with exorbitant costs of living and other inconveniences of living in the centre of the vast metropolis leads to continuing suburbanisation, facilitated by the relatively well developed centric transport network connecting it with the surrounding areas and the metropolitan region. In 2005, the metropolitan area had 4.7 million inhabitants, i.e. over than 2/3 of Catalonia's population.

Over the last decade, each of these cities – excluding Barcelona – absorbed several thousand immigrants. The region is characterised by a high concentration of the population in the Barcelona metropolitan area: only ca. 1/4 of Catalonia's population inhabit the surrounding metropolitan region.

Catalonia, which accounts for 16% of the population of Spain, generates nearly 1/5 of the country's GDP. In 1995-2004, it recorded 128% of GDP growth (up to a level of EUR 19 700 per capita in 2004). The EU enlargement in 2004 provided an additional growth stimulus which was only halted by the financial crisis of 2008. What distinguishes

[29] I would like to extend special thanks to all those who shared their knowledge and materials with me during my stay in Barcelona in October 2009, in particular to: Mr Camarasa J.A., Mr Canals M.J.M., Mr Domenech R. B., Ms Herrero M., Lopez J., , Mr Munoz-Torrent X., Mr Redondo J.L., Mr Thomas J. T., Mr Ulied A. I would also to thank their associates. Special thanks are also due to Mr Jaume Fons-Esteve.
[30] In 1979, it had over 1.9 million inhabitants.

Catalonia from the remaining metropolises under analysis is the higher level of per capita income in the metropolitan region than in the metropolitan area. Moreover, this disparity is growing in favour of the metropolitan region: whilst in 1995 the ratio of the area's GDP to the region's GDP was 0.95, in 2004 it was only 0.92 (STAT). In 2004, Catalonia's GDP was EUR 23 741, which accounted for 120.5% of the Spanish average. In 1995-2004, the GDP dynamics reached 108.8%, which was only minimally higher (by 0.4%) than the country's average. Starting from 2004, another round of accelerated development took place.

The share of the metropolis in the generation of GDP was prevalent, but – as mentioned below – lower per capita than in other parts of Catalonia, and in 2004 it was EUR 23 276.4 (as compared to EUR 13 967.2 in 1995), i.e. a 24.6% increase. By comparison, however, it meant a relative deterioration of its position vis-à-vis the national average, from 120.5% to 118.2% in 2004.

In 1998, the structure of the metropolitan economy 1998 was dominated by services (with 62.7% share in GVA generation), with a considerable role of industry (36.5% GVA) and an insignificant share of agriculture (0.7% GVA). For obvious reasons, the role of agriculture in other parts of Catalonia was greater (5.7% GVA), but there both services and industry played nearly the same role as in the metropolitan area (60.9% and 33.4%, respectively). The years 1998-2005 were characterised by an increased significance of services both in the metropolitan area (by 3.3pp), and in the metropolitan region (by 2.1pp), mostly achieved at the expense of industry. For many years now, industry has been relocated to the external ring of the metropolis (Figure 26).

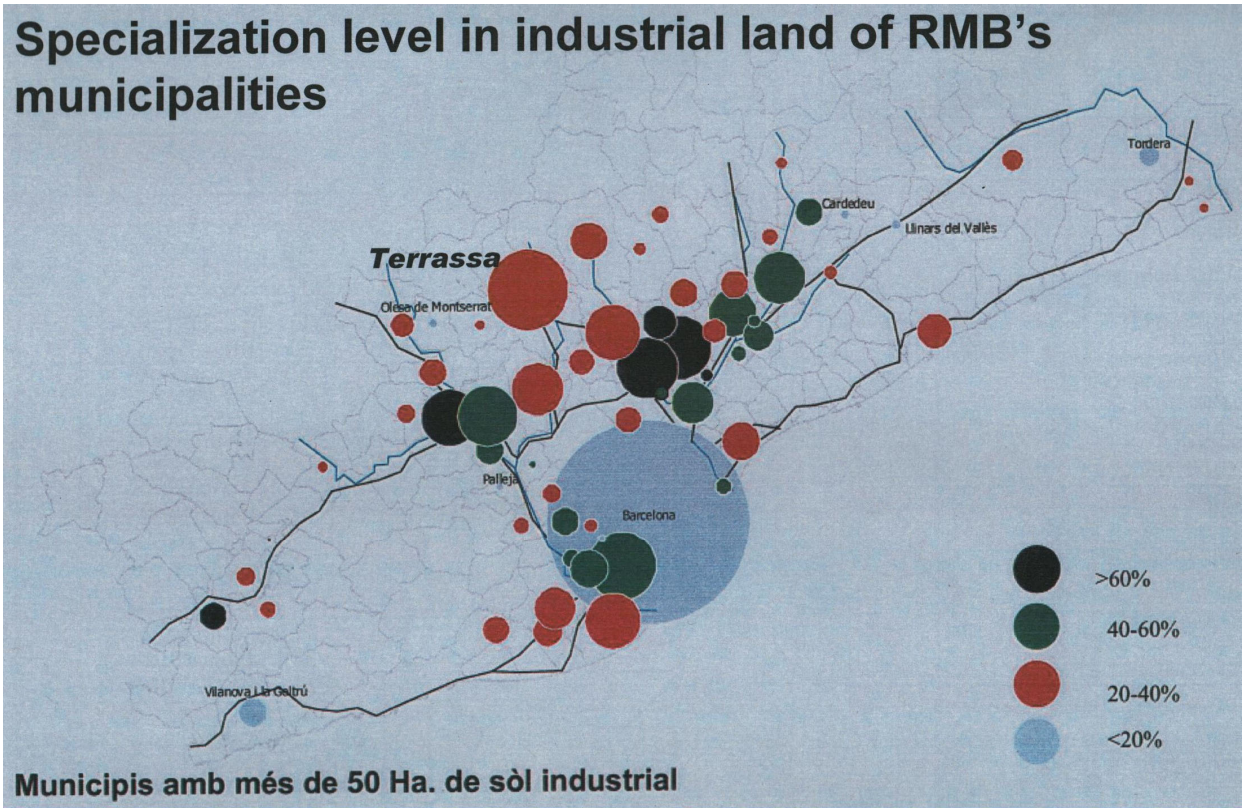


Figure 26. Specialisation levels in the industrial land of the Region Metropolitan of Barcelona municipalities.
Source: Xavier Munoz and Torrent, 2009.

The problem of the positioning of the Barcelona metropolis (and thereby of Catalonia) in Europe and globally (for various reasons, Spain is rarely adopted as a frame of reference for Catalonians) is seen in a new light when we analyse the structure of the service sector. It is commonly acknowledged that Barcelona (the metropolitan area) has made an attempt to become a centre of fashion and related new technologies and services. Coupled with the well-developed sector of culture and tourism, this would make it possible to promote a new image of the city and improve its position in competitiveness rankings, and in this way replace the collapsing industry with new sources of work and income. So far, none of these aspirations has been put to life. The data for the metropolitan area (for 2002) prove that while the share of simple services in GVA generation was 26.2% and was higher than specialised services (22.0%), the latter indicator had worse values than in all the remaining case studies (including Warsaw, where specialised services had a 25.1% share). The year 2002 can probably be regarded as a starting point for the implementation of a new development policy for the metropolis (let us recall that in 2003 the Metropolitan Plan was adopted). In 2002-2005, a considerable increase in the share of advanced services in the service sector GVA could be observed in the metropolitan area (by 1.3pp – it is worth noting that this was a much worse result than in the case of the Glasgow and Warsaw metropolises). In 2002, the Catalonian metropolitan region had a higher share of simple services (28.8%), and a

slightly lower share of specialised services (18.0%) than the metropolitan area. The only considerable difference has been a small increase in the share of specialised services in the service sector GVA in the years 2002-2005 (by 1.6pp). The share of public services has changed only minutely (by 0.5pp).

In 2001, 38.3% of all people in work in Catalonia were employed in industry and construction, 58.9% – in services, and 2.5% - in agriculture (AMB 2003: 167). Catalonia's exports accounted for 28% of all Spanish exports and generated 29% of Catalonia's GDP. The share of the MRB in Catalonia's industrial output reached over 70% in medium-tech and over 80% in hi-tech exports, and 69.2% in income (GDP) (ibidem: 167). Agriculture is developing in river valleys, and the best developed area with a modern agricultural and food production complex is situated in the west of the region, in the environs of Lleida. As we can see, non-metropolitan areas do not play a considerable role in employment and economic activity. This rather uncommon situation is the consequence of many years of development processes. For over 150 years, these processes were underpinned by the industrialisation of Catalonia, which produced a concentration of activity around the capital. The region's relief (mountains) played a part in the physical fragmentation of the area which was bound together by several centripetal transport routes. The success of industrialisation not only resulted in the concentration of the population in the Barcelona metropolitan area, but also led to a considerable depopulation of the region's remaining areas, whose inhabitants migrated to Barcelona and its environs in search of work. The modernisation of agriculture and a dynamic development of tourism in weakly-populated areas (or, more broadly – increased functional ties with Barcelona) fostered a rapid increase of incomes in areas which were earlier regarded as peripheral. Today the quality of life and per capita income are higher outside the metropolitan area than in it.

7.1. The metropolitan region and its component parts

The region of Catalonia is one of 17 NUTS2 regions in Spain. Similarly to Basque Country, it enjoys a greater deal of autonomy than most Spanish regions. In the traditional division, Catalonia has 4 provinces [provincias] (NUTS 3) and 946 municipalities [municipios]. (cf. Maps 1a and 1b) These structures were determined nationally as early as the 19th century, during the early stages of Catalonia's industrialisation. For instance, the capital province (Barcelona) occupies 7 718 km2, and has 311 municipalities (Figure 27). 95% of the province's population live in cities with over 5 000 inhabitants, and 80% - in cities with over 20 000 inhabitants. The provinces inter alia distribute funds for investment projects in Catalonia (mainly for municipalities). They are administrative in character and are objects of an ongoing controversy (which is justified as the division into provinces has for a long time been divorced from the Catalonian reality, which

evolved during the massive industrialisation in the last two centuries). To some extent, it is also due to separatist ambitions shared by many Catalonians, and the gradual taking over of the duties of state administration by the Catalonian authorities (e.g. tax collection, police). Catalonia's territorial system will be discussed in more detail in the following chapter. The existing and planned territorial divisions are utterly incompatible. Paul Strijp (2008) referred to the status quo as "administrative crowdedness". In some areas of Catalonia, 7 tiers of territorial units can be found.

Figure 27. Catalonia, groups of *comarcas* (Regional Spatial Planning Areas). Metropolitan Region de Barcelona marked as "Ambit Metropolita".
Source: AMB.

Under to the statutes accorded to autonomous regions, they had the right to make internal divisions into counties or districts (*comarcas*), but most of them did not exercise this right. Today, Catalonia consists of 41 *comarcas*. On their basis, attempts are being made to form groups of *comarcas* for planning purposes. There are 7 such groups, known

as the Regional Spatial Planning Areas (RSPA) (see Map 3). Apparently, these groups are to provide an alternative to *provincias*. They are better attuned to the actual settlement reality which was evolved inter alia following the development of Barcelona's satellite cities and the dynamic urban sprawl than the 19th century provinces. However, neither *comarcas* nor their associations, nor forms of cooperation listed below, are furnished with sufficient powers or funds to replace the now compulsory nation-wide division into regions, provinces and municipalities. Though various institutional forums and communities (academic, territorial associations), Catalonia propagates its own proposed divisions, which are however merely planning in character, and only exceptionally stipulate some real forms of cooperation such as inter-municipal associations in Poland. We can say therefore that Catalonia has its own concept of separate territorial structures of its own design, but their actual role in steering development is limited mainly to analytical and planning functions. Just as every territorial system drawn on the map, this one does not fully correspond to the description of the metropolis. For example, on Figure 28, the area of the metropolis should in fact be also delineated in the area of *Comarques Central*, especially along the main transport routes. It goes without saying, naturally, that planners have every right to mark the boundaries using their own criteria.

Figure 28. Barcelona metropolitan area covered by the operation of three municipal associations
Source: Redondo 2009.

In addition, the Barcelona metropolitan area is demarcated for planning purposes (*Metropolita de Barcelona*; or MRB, i.e. the Metropolitan Region of Barcelona) which is purely planning in character (one of *comarcas* groups with 163 municipalities and 4.9 million inhabitants, spanning an area of 3 200 km2). Moreover, the literature of the

subject distinguishes the Metropolitan Agglomeration of Barcelona (MAB; 93 municipalities over an area of 1 578 km2, with a total population of 4.1 million). The criteria for the identification of the MAB and the underlying definition were the following: " a grouping of contiguous Urban municipalities situated around a central city (with over 100,000 inhabitants and a density greater than 1 500 inhab./km2) and which make up an urban unit with a population greater than 250 000 inhabitants and with average density of over 1,500 inhab./km2." (AMB, 2003: 151). To sum up, we can say that there is no single uniform definition of the Barcelona metropolitan area (Kaczmarek, Mikuła 2007: 103)

Other than the division into provinces, groups (associations) of municipalities or organisations in the Barcelona metropolitan area (more precisely: in a part of this area) operate on the ground, in a much smaller area, viz.:

- (a) 33 municipalities with competences in environmental protection (*Entitat Metropolitana del Medi Ambient*);
- (b) 18 municipalities (including Barcelona) which co-manage the transport in the metropolis (*Entitat Metropolitana del Transport*);
- (c) The area of *Mancomunitat de Municipis de l'Area Metropolitana de Barcelona*, which connects the city of Barcelona plus 30 neighbouring municipalities, intended to carry put other tasks than transport and environment (**Figure 28**).

Groups (a) and (b) were established by the Parliament of Catalonia following the liquidation of the Metropolitan Corporation of Barcelona, and deal with specific tasks (environmental protection, transport) in the metropolitan area, and it is commonly believed that they perform their tasks satisfactorily. Group (c) is a voluntary association of municipalities with practically no influence on real activities. The city of Barcelona plays a key role in the work (and financing) of this group (Kaczmarek, Mikuła 2007). It is also widely believed in Catalonia that the existing municipal associations prove that there exists a need to establish anew a territorial unit that would cover the entire metropolitan area and would administer its development.[31]

These main groups of municipalities and the Strategic Plan association are regarded as exponents of the opinions and interests of metropolitan municipalities. Additionally, an initiative involving cooperation networks (the Arc[32]) between the mainly industrial satellite cities surrounding Barcelona arch-wise, currently undergoing deindustrialisation and difficult transformation processes (from Villanova in the south-west through Terrassa

[31] In addition, there is an association with the aim of developing the Strategicznego Plan for the Barcelona Metropolitan area comprising solely the area of **31+5** metropolitan municipalities. Such a plan was devised in 1999 and 2003 (AMB 2003).

[32] Some publications refer to its as the "ring", which is less accurate because the Arc cities do not surround Barcelona from all directions.

in the north to Mataro in the east) has lately become more active. The network of cities (Arc) lies beyond the zone of influence of the three earlier groups of municipalities, and slightly remains in opposition to the city of Barcelona, with a strong sense of the unique nature of many of its problems and an awareness that this uniqueness forces them to cooperate regardless of Barcelona. Terrasa and Sebadell were among the key textile industry centres in Europe, whereas the remaining Arc cities also evolved on the basis of traditional industries. Most of these cities have strong ties with Barcelona (which is within a distance of not more than 1 hour's journey), but also, in their majority, they represent labour markets independent of Barcelona.

Why is there no metropolitan structure with some tangible powers (e.g. within the boundaries of the group of *comarcas* of *Metropolita de Barcelona*, the MRB)? The answer is: because of Catalonia's structure and conflicts of interests. The Barcelona metropolitan area with its specific institution (Metropolitan Corporation de Barcelona[33]) was established in 1974, but was disbanded by a decision of the regional Parliament in 1987. The reasons for this should be sought in politics: its existence was not favourable neither for the city of Barcelona, nor for the Catalonian authorities, because the metropolitan authorities were the strongest player in Catalonia, threatening the status of the authorities of Barcelona and of the region. At that time, a similar situation took place in several other areas of Spain (Valencia, Bilbao) (Kaczmarek, Mikuła 2007). Political conflicts have divided (and still do) individual areas making up the metropolitan area. This was compounded by the local traditions and identities of historic cities which, as a result of urban sprawl processes, were surrounded by the metropolis (Garcia 2003).

Owing to the role that it plays in the regional economy, its metropolitan functions, strong European linkages and a well-developed culture and tourism sector, Barcelona in fact extends its influence not only over the metropolitan area but also – as many researchers point out – over the whole of Catalonia. Regardless of the importance that Catalonia (the metropolitan area) still enjoys in the Spanish economy and culture, there can be little doubt that in the recent years Barcelona lost in the competition for the dominant position with Madrid (Strijp 2008; interviews 2009). This is manifested by the outflow of great transnational corporations which more frequently opt for Madrid as their seat, and by visible difficulties in completing the economic restructuring process whereby traditional industries are to be replaced by hi-tech sectors. The collapsing industry and increasing unemployment are particularly acutely felt in the cities of the Arc surrounding Barcelona from the north-west, where many groups of recent migrants, with low vocational qualifications and poor cultural roots (unassimilated) still remain unemployed. The case of the old industrial district of Barcelona – Poblenou – is very symptomatic; there,

[33] Its initial name was: *Entitat Municipal Metropolitana de Barcelona*.

extensive investments were made with a view to creating 120 000 to 130 000 new jobs in the IT and media sectors (the so-called 22@ project, covering an area east of *Placa de les Glories* and in the vicinity of the new high-speed railway station).[34] So far, the results of the exercise have been partially satisfactory. Even though Barcelona's industry plays a limited role, but it still remains an important sector in the metropolitan area (particularly textiles, car manufacturing, chemical, pharmaceutical, electronic, printing and other industries). Attempts are also made to introduce new sectors in the metropolitan area (e.g. Terrassa: The Audio-Visual Park of Catalonia; in the former hospital) (Munoz and Torrent 2008).

The characteristic feature of Barcelona is the long tradition of arts, crafts and trade. Together with strongly-developed tourism which draws on its unique cultural assets, this makes Barcelona one of the major tourism and conference centres, one of a few cities which can organise the largest conference or congress events in the world.

It is virtually impossible to evaluate the role of Barcelona as a separate city because it is wholly functionally integrated with the surrounding municipalities, and neither its functioning as a self-standing entity nor its planning or development management would be possible. This is true not only for transport or water management and environmental protection. We should remember that Barcelona occupies an area of a mere 101 km2 and has a population of some 1.67 million. Many important institutions were located outside the city (which not in all cases was fortunate, for example the *Universidad Autonoma de Barcelona*, which had to start its own bus service for students and staff).

The metropolitan area comprising Barcelona exerts an influence reaching far beyond Catalonia. This role is primarily a result of its metropolitan functions. In the social and political aspect, the still stimulating idea of the national identity of Catalonians (though according to some only ethnic) remains a characteristic feature of such influence. Economically, this area is the principal centre of services, relatively modern industry and tourism as well as culture industries; it also shows a great deal of changeability: while traditional industries in Barcelona have basically disappeared, in the city's external areas (the Arc cities and the second line of satellite cities), the traditional industry is undergoing a painful restructuring stage.

Barcelona's labour market is among the most versatile, open and attractive in Spain. Especially during the last decade, it has drawn thousands of immigrants who – depending on their education – sought better life opportunities in Barcelona, in the industrial centres of the metropolis or in peripheral metropolitan areas. However, experts emphasise that due to the slower than expected development of hi-tech sectors, many of the best

[34] For the presentation of the project, see: The 22@ Barcelona Project, http://www.insyncbv.nl/pdf/22aBarcelona.pdf; October 2009.

qualified graduates and employees move to Madrid, which is being transformed into a dynamic and modern metropolis, dominating in Spain (even though the Barcelona metropolis is larger).

Due to the high living costs in Barcelona, and problems related to living in the central zone having quite good transport links with the surrounding areas, many people working in Barcelona live in the outer cities (municipalities) making up the metropolitan area, or even beyond. And, while the residents of the metropolitan area usually commute to work on a daily basis, those living at a further distance opt for travels to work at weekly intervals.

Catalonia is a region with a strong sense of togetherness which goes beyond today's borders and draws on the land of the former Kingdom of Aragon. An interesting feature of the Catalonian society is its openness to migrants, based on the repudiation of the bonds of blood in ethnic identification. Everybody who considers himself a Catalonian and accepts the social values is one. The metropolitan area has strong functional linkages with the metropolitan region, which is similar to the former in terms of the generated income (which is even fractionally higher in the region than in Barcelona). Some researchers even claim that Catalonia's metropolitan regions should be treated as an integral part of the metropolitan area (Kaczmarek, Mikuła 2007; interviews 2009).

In the opinion of many Catalonians, including development specialists, the boundaries of today's Catalonia do not correspond to the historical range of the Catalonian population (who inhabited the area from Perpignan in France to Valencia in the west and Saragossa in the north). The present boundaries of the Spanish regions (NUTS2) and provinces (NUTS3) were delineated in the 1830s. The real impact of the Barcelona metropolitan area – although dwindling according to some – still reaches beyond the region's borders (for instance, extremely strong cooperation ties link Barcelona with the nearby Valencia). The functional metropolitan area (not in the meaning of the administrative boundaries of the province of Barcelona) comprises areas lying at a distance of even more than 100 km from Barcelona (in the areas situated along the five main transport routes).

The strengths of the Barcelona metropolitan region include mainly the highly-developed tourism and culture sectors as well supra-regional services. Despite the still existing enclaves of traditional industry, the metropolitan area is characterised by a high percentage of people with higher education. It is an important supraregional transport hub, a major sea harbour and a trade centre in the western part of the Mediterranean. Barcelona has a well-developed transport network connecting it with the rest of the region and with the Spanish capital.

The weaknesses of Barcelona include its competitiveness, which in the last decade or so has deteriorated as compared with Madrid and other growth centres in Western Europe.

Likewise, Catalonia's income is on the decrease. The attempt to replace jobs lost in the collapsing industry (the deindustrialisation process has not as yet been completed in the satellite cities of the metropolis) by new jobs in hi-tech sectors or in financial services has not been successful. In effect, well-educated professionals more and more frequently move to Madrid in search of work, whereas lowest-qualified employees, who are frequently foreigners poorly assimilated with Catalonia, start to live on the unemployment benefit. Development is also hampered by the prevalent, centric linkages within the metropolitan area, with Barcelona as the hub of the system. Another obstacle is posed by the exorbitant costs of housing in the centre of the metropolitan areas (Barcelona), which leads to a steady decrease in the number of Barcelona's population and the growing urban sprawl. The long-standing problem of the metropolis is a clear deficit of water, which is provisionally solved by the water desalination station in Prat de Llobregat and water supply systems supplying water from far-off rivers (such as the Ebro). There are no new quality investors; also the old investors are leaving the metropolis, which can be viewed as a proof of the deteriorating competitive advantage of Barcelona and its environs. In the conflict around water, the neighbouring regions of Spain suffering from water shortages are also involved. However, the main dimension of the conflict pertains to intra-regional relations: non-metropolitan agriculture which employs less than 10% of the region's human resources and generates ca. 2% of Catalonia's GDP uses nearly 80% of the water resources (Stasiński 2008).

The regional hinterland of the metropolis has well-developed functional linkages with Barcelona. Most of the region is well accessible owing to a number of major transport routes. High productivity in agriculture and well-developed food processing and the tourist sector in the mountains and historic cities (Tarragona, Girona and others), coupled with low population density, have contributed to the fact that the level of income is slightly higher in the regional hinterland than in the Barcelona area.

Other weaknesses of the region include the prevalence of centric transport links connecting it with Barcelona. Transport routes bypassing Barcelona are poorly developed, which is regarded as an impediment to the stimulation of the peripheral centres. In addition, difficulties in the development of other than tourist functions in cities situated outside the Barcelona metropolitan centre can be viewed as a weakness. One example here is a not very successful attempt at making Tarragona a congress centre: the city's central area is poorly developed and cannot win in the competition against Barcelona. The endogenous resources of the regional centres prove too weak (excluding certain forms of tourism) to move out of the shadow cast by Barcelona.

A review of statistical data (see: Introduction) and the strengths and weaknesses of Catalonia reveals an unquestionable domination of the Barcelona metropolitan area over

the region. This refers not only to the demographic domination but also to the human capital and attractiveness for investors and tourists. On the other hand, owing to their relatively well-developed industries (food and tourism), the weakly-populated areas of Catalonia reach per capita incomes several percentage points higher than is the case in the metropolitan region. They also often offer a better quality of life and – at least along the main transport routes – an easy access to the country's capital. Catalonia as a region may serve as an example of well-developed, functional linkages which foster development. Nevertheless, it is now experiencing development problems, objectively expressed in the relative GDP decrease.

1.2. Relationships between the metropolis and the region

Commuting to work

Commuting to work is concentrated in time and in space. On weekdays, we can observe three rush hour periods: in the morning and in the afternoon (mostly related to travelling to and from work), and in the evening, which is unrelated to work. The characteristic feature of Catalonia and its metropolitan area is that most commuting is enclosed within this area, particularly the *Comarcas Central* group. As many as 91.6% of commuting done by the residents of the *Comarcas Central* begins and ends in the region (Cebollada, Riera 2008: 180). A very small group of work-related journeys goes beyond this area, which is to a large extent explained by the concentration of the population in the metropolis. In the metropolitan area, commuting is mostly done using means of public transport, whereas most of journeys from outside the metropolitan area are made by car (ibidem). Journeys to and from the non-metropolitan area primarily originate in the largest urban centres lying at a distance from Barcelona: Girona, Tarragona and Leida.

Migrations

Migrations flows are frequently connected with commuting to work. Also, migrations in the Catalonian region are bi-segmental in character. The first segment refers to the outflow of residents from the central city, which has been in progress for some time now, underpinned by a considerable increase in the costs of living and greater inconvenience associated with living in the centre of the metropolis – the extremely densely populated Barcelona. Those who leave Barcelona for other places to live include people who work in the city but cannot afford to live there, and wealthy people who wish to live in the suburbs. In effect, Barcelona is constantly losing population while the nearby municipalities making up the metropolis absorb it. The extended transport system which allows for commuting to work even from distant locations makes it much easier. It could be said that the majority of traffic takes place in a very large metropolitan area where the definite majority of Catalonia's inhabitants live. We could see that the growth of the population observable during the last decade was mainly limited to the Barcelona

metropolitan area and was produced by immigrants. Owing to the high costs of living in Barcelona, migrants would mainly settle at the outskirts of the metropolis. Also coastal cities recorded a significant population increase. In general terms, only a large influx of foreign migrants (mostly from South America) more than made up for the decrease of the metropolitan area's population, lasting for over a decade (Redondo 2009).

Trade exchange between enterprises

For over 1 700 industrial estates identified in Catalonia, nearly 1/3 are located in Barcelona. They cover areas located along the main exit routes (Miralles-Guasch, Donat, 2007). Most of the trade exchange is done within the boundaries of the metropolitan region or with the European or global environments. This is driven by supra-regional trade and a well-developed tourism and culture sector. Trade with the metropolitan region is insignificant in volume, save for two exceptions: the agriculture and food sector (the environs of Leida in particular) and tourist sector (excluding the coastal belt, mountain resorts and cities which abound in historic and culture monuments).

Higher-order services for individuals

Barcelona with its direct surroundings is an important centre of higher-order services. Taking account of the very high degree of population density in the metropolis in any of its delimited borders, Barcelona is definitely its dominant centre. This applies both to higher education and other services (administration, business, financial, tourism, information, media, technology). The very high place occupied by Barcelona (and Spain) on the map of European and global tourist attractions promotes the internalisation of the metropolis. A modern sea harbour and the recently enlarged international airport facilitate this process. Studying in Barcelona is attractive not only to students from Catalonia, but also – through exchange programmes – from other regions of Europe. However, there is also an observable tendency for the outflow of the most ambitious youth to study in Madrid, which in the future can offer better employment prospects in attractive occupations. Internationalisation of Barcelona only marginally affects economic development not connected with tourism: the long-lasting processes of relocating industrial activity to the outskirts of the metropolis and off-shoring lasting for about a decade have dented Barcelona's competitive advantage. Interestingly, the neighbouring regions of Valencia and Aragon (interviews 2009) are regarded as Catalonia's main competitors in attracting investors (interviews 2009). The advantage of the offer of the metropolis over the remaining centres is so great, that their offer may only be supplementary.

None of Catalonian cities and only few in Europe can match the quality of cultural services offered by Barcelona.

Barcelona is the seat of the Union for the Mediterranean.

Entertainment and leisure

In terms of tourism and recreation, Catalonia is one of the most attractive regions of Europe, with an offer that combines cultural and natural assets (the sea and the mountains). Recreational, tourist, weekend and holiday journeys play an important role in the mobility of Catalonians. In this context, two issues command special attention. Firstly, the residents of Catalonia – similarly to many Mediterranean regions (in France, Italy, Greece, etc.) leave for holidays outside their region relatively seldom, and even more seldom go abroad. For obvious reasons (concentration of the population at the seaside), most journeys, especially short-term ones, are limited to the coastal area, the major part of which is located in the metropolitan area. The accessibility of leisure destinations, and well-developed tourist infrastructure does not exert such a pressure on having holiday homes as is the case e.g. in northern European countries. Cultural factors also seem play a certain role in this regard: the Catalonian society is much less atomised.

Relationships with public authorities

As mentioned earlier, public authorities at different levels have strongly divergent views on many matters, from the territorial division of Catalonia, to institutional arrangements to the division of competences. Here, both the attitude to the degree of autonomy (independence?) of Catalonia, and division of influences in the region come into play. The establishment and subsequent liquidation of a joint metropolitan institution is a proof of the intensity of internal conflicts. Various coalitions are created, which are frequently limited to specific spheres, e.g. water management, transport, etc. However, due to voluntary participation, even the very core of the metropolitan area resembles a patchwork rather than an area managed in a uniform way.

From developmental perspective, there exist two interesting divisions. The first is metropolitan in character: the external areas where the industry has been relocated from Barcelona, feeling the lack of any support, initiated cooperation bypassing Barcelona in the construction of the transport infrastructure connecting the cities involved (the so-called Arc) and overcoming the centric layout of the current connections with the centre of the metropolis. What also commands attention is the growing conflict for the use of the deficit water resources in the region, which still awaits a permanent solution. The metropolis lies on two small rivers which cannot satisfy its needs, and its population faces severe restrictions in this regards. Given this situation, most of Catalonia's water is used up by agriculture.

The division of public funds among territorial units is an obvious object of controversy; the usual practice being to concentrate the funds in the hands of the regional and

provincial administration (NUTS2 and NUTS3). The planning units, consistently developed using the support from many Catalonian institutions, have very limited means and powers accorded to them.

1.3. Factors affecting the relationships between metropolis and its region

The functional ties between the metropolis and the region are definitely a key factor in the description of Catalonia. The metropolis is a modern city which however is undergoing a difficult stage associated with a gradual loss of the competitive advantages it had during the industrial era. Similarly to many metropolises built around industry, the process of transition to a knowledge based economy proved more difficult than expected. The strongly-developed sector of culture and tourism represents a significant resource, yet one which is insufficient to build a new image and a competitive advantage for the city. The metropolitan region is too weak (from human resources to the economy) to make any pertinent contribution to new solutions. Its potential is far too low. At the same time, the metropolitan region makes a very efficient use of the metropolis' potential to promote its own development.

Political differences manifested in a variety of aspects represent an important factor defining the relationships between the region and the metropolis. Whilst the conflict for the control and use of water resources clearly has a territorial dimension, other bones of contention do not. The issue of the autonomy, underpinning Catalonia's political life, is an important factor differentiating the regional community.

The ties linking the metropolis with the region evolved many decades ago and today are mature and based on functional adaptations (interviews 2009). The economic activity of the metropolis, where for some time relocation from the central districts to the outskirts of the metropolitan region could be observed, is absolutely dominant. The metropolitan region is not involved in these processes in any serious way: the industry there has always been overshadowed by the metropolis and was mostly local in significance. Adaptation processes ultimately led to the development of centres of agriculture and food industry and tourism.

In consequence, the region has a relatively small share in economic development and in migrations: the greatest influx of migrants was recorded in the external areas of the metropolis, where both the economic structure and costs of living met the demands and expectations of migrants. The proximity of Barcelona is and has been the main factor of attraction. For this reason, the diffusion of development processes of the metropolis has been possible on a relatively limited scale and is restricted to the relocation of economic activity towards the edges of the metropolis, but not to the region as such. Due to its scale, commuting to work, mostly enclosed within the metropolitan region, has little influence on financial transfers from the metropolis to the region and vice versa. The

process of urbanisation of the coastal belt is under way; among its many attractions, it also has good transport connections with Barcelona.

Contemporarily, there is no room for backwashing in Catalonia as it ended with the last stage of industrialisation. The depopulated areas outside the Barcelona metropolis show a very small influx of the population, usually in waves and mostly from outside Catalonia. Thanks to improved transport connections, the number of people who spend weekends in the region is growing. As a rule, however, journeys in the metropolitan area start and end there. The metropolis seems to be nearly self-sufficient, which does not mean that it is not subject to internal territorial transformations. The depopulation process in Barcelona (which is the core of the agglomeration) is a specific type of backwashing. This process, affecting over 100 000 people over the last three decades, involved moves of the population within the metropolitan boundaries.

1.4. Interrelationships between the metropolis and the region

After nearly two hundred years of industrial development, we can say that the metropolis and the metropolitan region still maintain strong functional ties, rarely encountered in European regions. In view of the fact that 2/3 to 3/4 of Catalonia's population is concentrated in of the metropolis (the actual number depends on the definition of the metropolitan boundaries used), the process of the region's depopulation is no longer an option. Much more likely is the continuation of a relatively moderate suburbanisation process in the immediate surroundings of the metropolis. The further improvements of transport links, not only the centre-oriented ones but also those directly connecting more peripheral centres with themselves, with Barcelona and with the largest centres of the neighbouring regions (Valencia, Saragossa) should stabilise the population of the region as the supplier of relatively simple services, foodstuffs and medium-tech industry. The provision of tourist services which were complementary rather than competitive vis-à-vis metropolitan tourism to the metropolis' inhabitants also played an important role.

1.5. Activities of public authorities in metropolis-region context

In the recent years, we have seen a considerable increase of activity related to development studies and development planning where attention is mostly focused on the development strategy with the metropolis as the dominant growth centre in Catalonia. Many units of regional and local authorities, self-governing associations and research institutes take part in the organisation and financing of these efforts. Despite the plethora of works diagnosing the situation of the metropolis in the context of the region, it can hardly escape attention that one of the limitations concerning the usefulness of these efforts is that they are carried out in isolation from the formally binding territorial division of Spain into autonomous regions and provinces. The administrative and

planning units do not overlap territorially and, without making some changes, both the effectiveness and efficiency of the research and planning efforts will be limited.

Financial instruments

Owing to the high development level of the metropolis and the region, the EU funds do not play such a significant role as they do in Objective 1 regions (Convergence). Efforts were made to ensure the co-financing of the development of new, innovative economic sectors in the metropolis, mostly in connection with the 22@ project, and of transport projects. Generally speaking, development activities in the metropolitan area are financed from the own funds of the constituent municipalities. The city of Barcelona plays a special role in this regards owing to its dominant share in the financing of joint projects. The current financial crisis negatively affected the region's income, and, on the other hand, due to the growing unemployment, it exerted pressure on an increase of public expenditure, including social. This problem mainly affects the more peripheral areas of the metropolis.

Budgetary subsidies to development projects, transferred from the state budget via provincial administration (NUTS 3), represent an important source of public funding supporting development. In the metropolitan area understood as a *provincia*, this function is discharged by the Barcelona-based *Diputacio de Barcelona* (DIBA). The mission of DIBA is to: "to ensure adequate provision of the services that form part of municipal responsibilities and powers, guaranteeing a high level of quality and equality of access for all our citizens" (DIBA 2009). The needs observatory (a list of projects submitted by the local authorities) provides the basis for intervention, in addition to contracts for specific projects approved by DIBA. The scale of intervention is shown in Figure 29.

The Map clearly shows that municipalities lying at a distance from the core and rural in character receive preferential treatment in the selection of projects for financing.

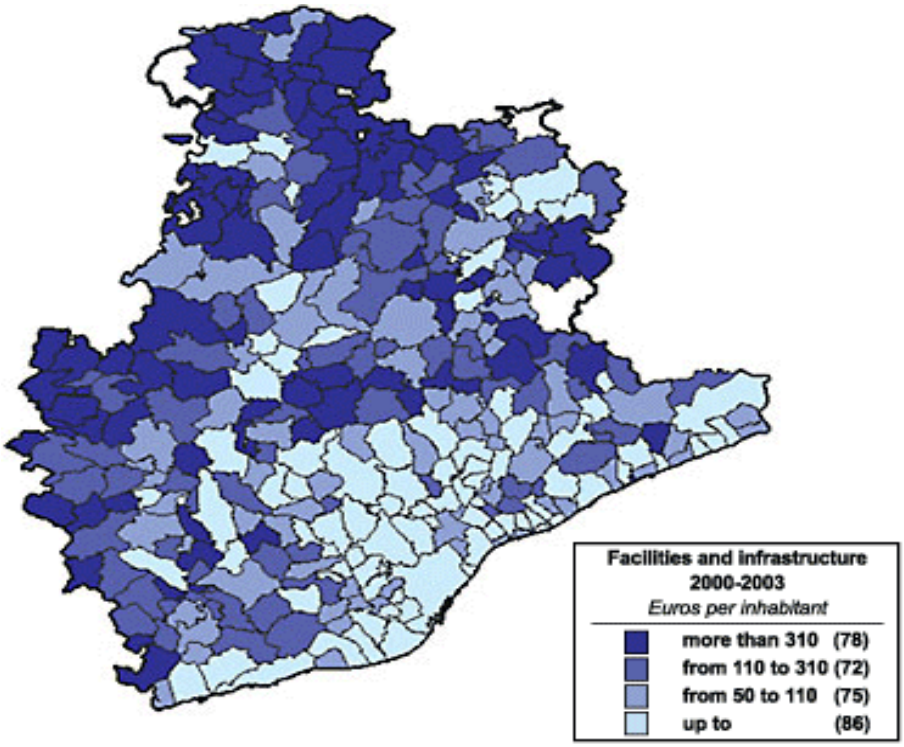


Figure 29. Co-financing facilities and infrastructure within DIBA activities in *provincia de Barcelona* (NUTS3), by municipalities, in EUR per capita, 2000-2003.
Source: DIBA 2009.

Infrastructural investments

The development of transport infrastructure is largely dispersed territorially. The local and regional authorities pursue independent development policies, in addition to central investments related to motorways and high-speed railways. Despite these circumstances, the road and railways transport network is well-developed; what is regarded as a problem is the shortage of connections which bypass Barcelona, the core of the metropolis. The great number of carriers running services mainly in the metropolitan area may seem an inconvenience for customers, but this is a typical situation in the majority of metropolises.

Major efforts to adapt infrastructural investments to the needs of revitalisation and development of post-industrial areas include investments made in preparation to the Olympic Games and the 22@ project. However, we should wait to see their synergy effects.[35]

[35] In the case of the 1992 Olympic Games, it is commonly acknowledged that despite promises and circulated opinions, the Games led to a temporary collapse of tourism in Barcelona, which was to the advantage of the tourist resorts on the Mediterranean Sea competing with the city (Kozak 2009).

Education

Similarly to other EU countries and regions, European funds are used to provide supports to the development of human resources in addition to local funds. Due to the high level of regional development (which in Spain is only surpassed by Madrid), these funds are decreasing, but are now more focused on projects related to the fostering of competitiveness and knowledge-based economy. However, to achieve the desirable results, it is necessary not only to educate top-quality specialists but also to create relevant jobs for them in Catalonia. The fact that many graduates and specialists leave for the Spanish capital proves that there is no synergy in this regard.

Summary

The results of the activities discussed above are not spectacular, and the degree of their coordination may only be evaluated as moderate. In consequence, they have not significantly fostered the development of linkages between the metropolitan centre and the remaining part of the metropolitan region. It should be remembered however than many plans and projects have not as yet been implemented or finalised. We should also take account of the fact that the incoherence of the administrative and planning divisions if not the institutional territorial chaos is certainly an obstacle. It so happens that funds for investments and other developmental activities are controlled by traditional division units (regional government, provinces and municipalities), whereas planning activity is apparently being developed at the level of units furnished with small competences and means (*comarcas*, groups of *comarcas*).

1.6. The metropolitan area governance

The debate on the establishment of metropolitan areas has been going on in Spain for a long time, and the changing fortunes of the Barcelona metropolis have spurred an extraordinary mobilisation of efforts on the definition and delimitation of the metropolitan area in Catalonia. The results achieved so far are less than satisfactory, but they produced many studies and analyses which significantly expanded knowledge about this part of Catalonia. To date, no agreement has been reached regarding either the definition (and thereby the delimitation of the boundaries), or a uniform mechanism for managing metropolitan development. The situation concerning political conflicts around the implementation of any new territorial division (whether only in Catalonia, or in Spain as such), as well as inter-municipal, inter-institutional or party conflicts within of the metropolis effectively blocked making any changes in the status quo. There is a widespread opinion that the national authorities will hamper the process of replacing the traditional division into regions, provinces and municipalities by other territorial divisions (although the creation of *comarcas* was allowed, they have not been furnished with significant funds). In effect, in the near future the new divisions will not have any other

advantages save for the planning aspects. The real funds and competences will still be connected with the traditional, official, nation-wide division. It is difficult to predict what conditions must be fulfilled to make the change happen. There is little doubt that the adaptation of the administrative and competence-related divisions to the actual development of Catalonia in territorial terms would be a move that could be politically difficult but certainly rational. However, difficulties encountered in the setting up of voluntary associations of municipalities show that these problems have a strong inter-Catalonian and even intra-metropolitan dimension. This is not merely a question of relations with the national authorities.

As stressed above, despite some features denoting elements of chaos, Catalonia is trying to delineate the boundaries of the metropolis on the basis of studies and analyses, using the combined efforts of many institutions and decision-making bodies. They would provide the basis for the building of institutions which would manage development and successfully implement strategies.

Conflicts of interests have so far proved less acute at the stage of research, but where the recommendations refer to real issues "on the ground", particularly distribution of funds and competences, these differences of opinion gain in significance. Controversies regarding the scope of Catalonia's autonomy provide a background that is certainly not conducive to working out shared opinions or solutions. But can things be different if nearly every single proposal is examined insofar as it may affect the political standing of Catalonia in Spain? For this reason (and due to common conflicts of interest in the region, and in the metropolis), there has been little progress in the development of a mechanism for managing metropolitan development. The plethora of ideas concerning the delimitation of the metropolitan area can serve as a perfect proof of Catalonian impossibility. On the other hand, positive examples include in particular cooperation in public transport in the metropolitan area (or rather part of it), but this does not satisfy all needs related to metropolitan management, especially in view of the fact that the metropolis faces many long-term development problems (water provision being one of them).

1.7. Development prospects

Catalonia is not a typical region, not as much because of its ambitions for autonomy as because of the very strong position of the metropolis in the region and strong ties with the surrounding metropolitan region. The role played by the metropolis is crucial to understanding the situation of the whole Catalonia. And Catalonia is visibly at the crossroads. The general improvement in the economic climate post 2002 led to a considerably influx of the population, which offset the fall in the Catalonian population leaving the region in search of a better life. The main reason for the propensity for

migration is the collapse of traditional industry, relocation and off-shoring, which phenomena – despite the efforts undertaken by the authorities – were not compensated by new jobs created in new, modern economy sectors. The prospect of curtailing jobs to the medium-tech sector e.g. in the car industry and tourism turned out to be a stimulus propelling increased migration. The competitive advantage of the metropolis diminished perceptibly, and the efforts made to re-work the image and create thousands of new jobs in new sectors (such as the 22@ project) did not produce the anticipated results. In the time of the crisis, the factor which initially helped improve the situation, that is the influx of employees from outside the region and mostly from outside Spain, became a source of problems, particularly in more peripheral parts of the metropolis, burdened with traditional industries (the so-called Arc). Immigrants, who frequently had low qualifications, a poor command of the language and poor knowledge of the local culture, suddenly began to exert pressure on the local budgets.

In the present situation, two broad scenarios are feasible.

The first envisages a further deterioration of the competitive advantage of the metropolis, and thereby of the entire Catalonia. Migrations of top specialists out of the region (to Madrid and other European countries), which could be observed for many years now; the outflow of investors, a lack of political stability in internal relations and at the national level – all these factors are conducive neither to endogenous development nor to attracting inward investment. The leading industries of culture and tourism industry will sustain the prosperity of the metropolis, but will it be all of the metropolis? This is not so certain. The attempts made so far to revert this trend (1992 Olympic Games, global fashion events[36], the 22@ project) can be regarded as spectacular if not quite successful strategically.

The intensive analyses and planning efforts made in the recent years could underpin the development of a new strategy and restructuring of the Catalonian economy in tune with the new development paradigm of knowledge-based economy. However, the political context of these works, lack of coherence between the territorial units, uncertainty concerning the powers and competences, local and regional ambitions pose serious threats to the results of these. Nevertheless, it can be hoped that further aggravation of the situation will force a consensus, consistent reforms and re-entry of the development path by Catalonia. Still, global trends must be taken into account, and these are not favourable for Europe. Will they prove favourable for Catalonia? From today's perspective, this does not seem very likely. Building the region's future around a strong

[36] The prestigious Bread&Butter fashion event (which happens to be a German brand), after being held for several years in Barcelona, in 2009 was moved to Berlin, to the former Tempelhof airport location.

sense of community and Catalonian identity may not be enough to ensure success in the international competition. Investors rarely base their decisions on such criteria.

2. City-region relationships: Glasgow – West Scotland case study

Glasgow is located in the southern part of Scotland, in the so-called Central Belt area which stretches from Glasgow in the west to Edinburgh and Dundee in the east. This area has the largest number of the population in Scotland and the highest urbanisation rate (all Scotland's major cities except Aberdeen are located in this area), and is characterised by the greatest economic potential.

Initially, the power of Glasgow was built around trade and later, in the time of the Industrial Revolution, around the shipbuilding, textile and machine-building industries. The processes taking place at the time in the city had a strong bearing on its hinterland: Glasgow provided employment not only to citizens of Scotland but also to Irish workers. Towards the end of the 19th century, the city's population exceeded one million, which made Glasgow the third largest agglomeration after London and Paris. Such a situation continued for over half a century. However, the problem of overcrowding caused by the city's increasing population was not solved through the construction of new housing estates with multi-family residential buildings. The 1960s saw the introduction of a policy of residents' relocation to new cities (the so-called "overspill" plan). Coupled with significant changes in the administrative boundaries of Glasgow, this led to a substantial decrease of the population living within the city's boundaries (Rae G., Brown C., 1966). Today, Glasgow, being the largest urban centre of Scotland, has only 584 240 inhabitants (i.e. 11% of Scotland's overall population).

In addition to Glasgow, there are only 3 cities in Scotland with a population over 100 000 inhabitants. These are: Edinburgh (471 650), Aberdeen (210 400) and Dundee (142 470). The cities with the greatest significance within the area of Glasgow's dominant influence include: Paisley (74 000), East Kilbride (73 000), Hamilton (49 000), Cumbernauld (49 000), Ayr (46 000), Greenock (44 000), Kilmarnock (44 000), Irvine (39 000), Motherwell (30 000), Clydebank (29 000), Bearsden (28 000), and Dumbarton (20 000)[37].

Following the 1997 reform, the administrative structures in Scotland were changed yet again: 9 higher-order administrative units (regional councils) were abolished, and their tasks were taken over by 32 council areas, governed by elected councils. At that time, the area corresponding to the functional extent of Glasgow's influence (Strathclyde

[37] http://www.gro-scotland.gov.uk.

Region Council) was abolished, to be replaced by 12 councils: Argyll and Bute, Renfrewshire, East Ayrshire, East Dunbartonshire, East Renfrewshire, Glasgow City, Inverclyde, North Ayrshire, North Lanarkshire, South Ayrshire, South Lanarkshire, and West Dunbartonshire.

2.1. The metropolitan region and its component parts

The administrative areas of Glasgow City do not encompass all processes and functional ties which connect entities located in Glasgow with entities of its broadly understood hinterland. The spatial extent of the influence of the Glasgow metropolitan centre on its hinterland does not yield easily to clear-cut definitions. and varies depending on a given aspect of such impact. The studies which were carried out to delimit the zones of influence of the largest Scottish cities (Glasgow, Edinburgh, Dundee, Aberdeen) confirm a broad spatial extent of Glasgow's influence (The City Region…, 2002). An analysis of the housing market, commuting to work, strategic transport linkages and the retail market suggest that the impact of Glasgow reaches much further than the council areas making up the metropolitan area. The influence of Glasgow in different spheres of life, particularly regarding commuting to work and education, reaches as far as: North, South, East Ayrshire, Argyll and Bute, and Stirling (Metropolitan Glasgow…, 2008). Also, the Glasgow metropolis performs a very important role for the Highlands and Islands region, notably with regard to the educational base and health care services.

The relationships of the Glasgow city with its internal hinterland are marked by the proximity of another large urban centre – Edinburgh. Glasgow exerts influence not only on Edinburgh but also on the council areas located outside Edinburgh (albeit to a lesser degree), e.g. the Lothians, Fife, or Scottish Borders (Glasgow and the Clyde…, 2006). Due to the small distance between Glasgow a Edinburgh, their zones of influence penetrate each other. Nevertheless, the mutual impact of these cities is much smaller than could be expected on the basis of the small distance between them, and good transport connections. The reasons for this are historical, and are associated with a divergent sense of regional identity of the residents of these two cities. Making use of the proximity of Glasgow and Edinburgh is currently perceived as a development challenge and opportunity for Scotland, and cooperation between these cities is believed to be indispensable for the development of Scotland at large (National Planning…, 2009). However, strengthening the linkages between the two cities, and generating synergy effects calls for additional cooperation and coordination of activities on the part of their authorities.

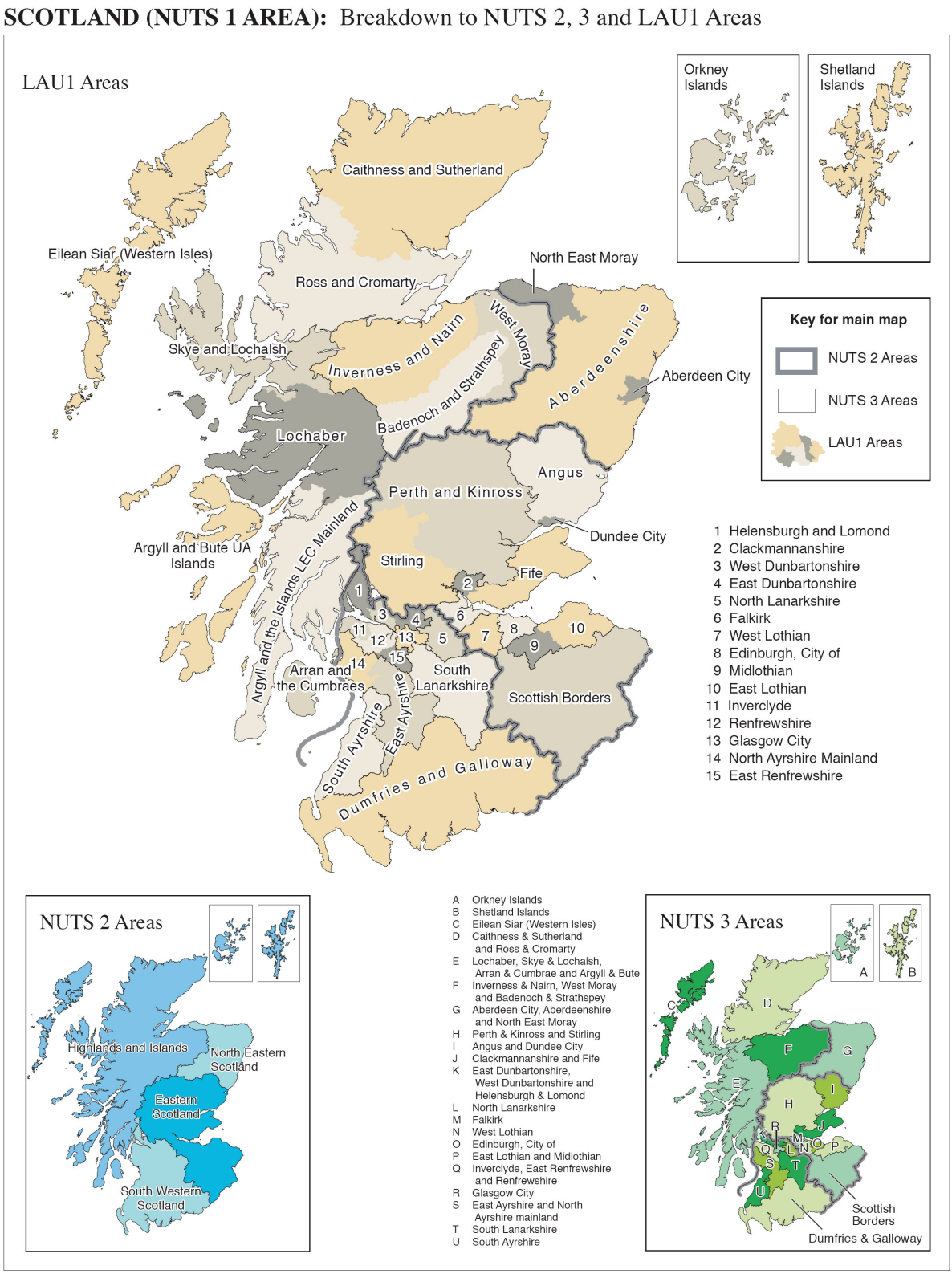


Figure 30. Scotland NUTS regions and LAU1 areas
Source: maps received form Malcolm Leitch, Glasgow City Council.

It should be emphasised that at present neither the metropolitan area nor the metropolitan region of Glasgow are reflected in Scotland's current administrative

structure. In 1975, a two-tier system of local government was introduced in Scotland, with 9 regional councils. The largest of them, the Strathclyde Regional Council, indicated the zones of Glasgow's functional ties and corresponded in size to the Glasgow metropolitan area. In addition to Glasgow, it covered 11 other units of the lowest administrative level (see Introduction). The regional authorities were in charge of providing a framework for the area's operation in the sphere of strategic planning and of service provision for the population in the sphere of education, social assistance, police and fire services, sewerage, roads, passenger transport.

In 1996, this system was replaced by a network of 32 "unitary" authorities. The reasons for abolishing the regional management level include inter alia the blurred powers of the individual authorities caused by the system's operation, its low degree of acceptance and mismatches between the spatial extent of the services provided. However, regional experts emphasise that political interests played an important role in this process, and the 1996 reform was not an optimum solution for Western Scotland (P. Carmichael, A. Midwinter, 2000). Currently, many local administration tasks are coordinated as joint undertakings, e.g. Police and Fire services are still organised at the level of the now nonexistent Strathclyde region, whilst the responsibility for Water and Sewerage services was delegated to 3 regional water authorities, which merged in 2002 to form the Scottish Water.

The currently used notion of the Glasgow metropolitan area, comprising: Glasgow City, Renfrewshire, East Renfrewshire, South Lanarkshire, North Lanarkshire, East Dunbartonshire and West Dunbartonshire councils, and Inverclyde) was first used in 2003, when the political leaders of the 8 local authorities mentioned above and comprised by the Glasgow and Clyde Valley Structure Plan established the Glasgow and the Clyde Valley Structure Plan Joint Committee (GCVSPJC) in response to a Scottish Government initiative named the Cities Growth Fund[38]. In February 2009, under the new regulations of the Scottish Government (Town and Country…, 2008), the tasks of the GCVSPJC associated with the preparation of development plans for the metropolitan area were formally taken over by the Glasgow and the Clyde Valley Strategic Development Planning Authority (GCVSDPA).

The criteria for the delimitation of this area are basically historical as they refer to the Strathclyde region; at the same time, they reflect the strong linkages existing between the city and the surrounding area in terms of family ties, education, transport, recreation and culture. The metropolitan area Glasgow delimited in this way has 1.75 million inhabitants, which represents 34% of the entire population of Scotland.

[38] http://www.gcvcore.gov.uk

The current NTS2 area (South Western Scotland) where the Glasgow metropolitan area is located has only a minor significance from the point of view of public administration because it is not furnished with any powers or competences. Likewise, it cannot be regarded as an area which closely corresponds to the area of the metropolitan influence because, on the one hand, South West Scotland comprises vast farming areas of Dumfries and Galloway which have very few economic, social or political ties with the Glasgow metropolis. On the other hand, South Western Scotland does not comprise areas with stronger or weaker ties with the Glasgow metropolis, i.e. Lomond, Argyll and Western Highlands areas, which have always traditionally leaned towards Glasgow (and not Inverness), particularly with regard to the provision of higher-order services. Moreover, as part of the NTS, there is South and East Ayrshire, which emphasise their autonomy despite their linkages with the Glasgow metropolis through the use of its service functions.

There are distinct differences between the so-called Central Belt of Scotland in which the Glasgow metropolis is located and the rest of the area regarding the number of the population, population density, sources of income and lifestyles. Therefore, we can say that the metropolis and the surrounding region are characterised by different sets of strengths and weaknesses. The metropolis is primarily an urban area with a considerable population density, which distinguishes it significantly from the rarely populated areas of the regional hinterland. The perception of the Glasgow metropolis was determined by the gradual reworking of the city's image associated with the overcoming of the negative consequences of the decline of traditional branches of industry. At present, efforts are aimed to foster development in 8 strategic sectors (life sciences, energy, financial services - back office and contact functions, tourism, creative industries, food and drink and electronic markets), which is expected to foster transformation towards a knowledge-based metropolis. As compared with the metropolis, the regional hinterland of Glasgow has only few strengths, and is building its potential on limited endogenous resources. These are mostly natural environment assets, which underpin the development of tourism, agriculture and renewable energy generation based e.g. on biomass. To some extent, the development of the metropolitan hinterland is also based on the stimuli generated by the metropolis regarding employment opportunities or tourism and recreation of the metropolitan inhabitants (Turok T. at all, 2003; Metropolitan Glasgow.., 2008; Lowlands & Uplands…, 2008; Highlands & Islands; 2008.). The differences in the demographic and economic structure also have a bearing on the social dimensions of the disparities. The metropolis faces different types of challenges than the region; they are mostly connected with the industrial past and the negative consequences of the restructuring processes. The most pertinent ones include both the adverse social consequences of structural and long-term unemployment, i.e. poverty,

weak family structures, low incomes, health problems, and such consequences of industrial past for the natural environment as contaminated soils or derelict and undeveloped land. The metropolis is also a region with a higher level of deprivation and crime. All these factors still define the negative external image of the city, which undoubtedly is one of the reasons for a small presence of international corporations in its space. On the other hand, the metropolitan hinterland is struggling with completely different problems, such as insufficient accessibility, depopulation processes, and outflow of educated youth to Glasgow or other areas of Scotland (Turok T. at all, 2003; Metropolitan Glasgow.., 2008; Lowlands & Uplands…, 2008; Highlands & Islands; 2008.). One example of the interdependence between the strengths and weaknesses of the metropolitan area and the metropolitan region is the sector of tourism, in which the attractiveness of the Glasgow metropolis as a cultural and conference centre adds to the tourist offer of Scotland's rural areas, in this way creating an all-rounded offer. On the other hand, the shortages of the educational offer in the West Highlands and Islands are compensated by the educational potential of the Glasgow metropolis.

2.2. Relationships between the metropolis and the region

The Glasgow metropolitan area is largely self-sufficient as the economic interactions take place mostly between the metropolitan city and its immediate hinterland. Interactions with more distant hinterland are much less important. The major types of flows include: commuting to work, higher-order services (education, health care), flows related to consumption, while the trade linkages of enterprises, relocation of business activity and migrations of the population play a lesser role.

Commuting to work

Commuting to work is the basic type of economic relations which take place between the metropolis and the and region. The city of Glasgow is the main magnet attracting employees as the majority of new jobs are created there owing to an expansion of the financial services sector. According to the Census 2001 data, of 331 000 employees working in the metropolitan city, 52% live in the city, 40% in the metropolitan area, whereas the remaining 8% outside it, and a half of them live in the former Strathclyde area[39]. The spatial range of commuting to work reaches 50-70km, and covers Ayrshire, South Lanarkshire and even Dumfries and Galloway in the south, and Stirling, Falkirk and the Lothians in the north and east. The radial-shape road and railway infrastructure investments undertaken over the past 20 years are an important factor facilitating daily commuting to work in the metropolitan region.

39. http://www.gro-scotland.gov.uk/census/censushm/index.html

City council area	Residents working/studying outside place of residence	Employees/students living outside place of residence
Argyll & Bute	16%	14%
East Ayrshire	36%	22%
East Dunbartonshire	64%	36%
East Renfrewshire	70%	36%
Glasgow	19%	48%
Inverclyde	27%	23%
North Ayrshire	34%	20%
North Lanarkshire	40%	28%
Renfrewshire	40%	38%
South Ayrshire	26%	27%
South Lanarkshire	40%	28%
West Dunbartonshire	48%	32%
West Region (Strathclyde)	4%	3%

Table 43. Commuting to work/studies in selected areas of the metropolitan area [2001]
Source: *West Region Economic Review*, Scottish Enterprise, p. 36, based on: *Census 2001*, General Register Office for Scotland.

Daily commuting related to higher education is as important, and it is done on the most intensive scale also within the metropolitan area. The directions and intensity of flows associated with studying outside the place of residence are similar to those related to commuting to work and result from the expansion of the higher education sector.

Interestingly, the area of the former Strathclyde region enjoys a high degree of self-sufficiency with regard to the labour market and education: only 4% of the region's residents work or live outside the place of residence, and 3% of the workforce/students come from outside this area. At the same time, significant processes involving individuals take place within Western Scotland; they are the strongest in the metropolitan region, and somewhat weaker in the regions of Ayrshire, Argyll and Bute (cf. Tab 1.). The values of the indicators for Highlands and Dumfries and Galloway are much lower (below 10%)[40]. The highest percentage of employees commute to work to Glasgow (48% of employees from outside the city); shuttle commuting to work is observable on the largest scale in the East Renfrewshire and East Dunbartonshire regions (respectively, 70% and 64% of the residents of these council areas outside the region).

Glasgow is also the key retail trade centre in Western Scotland. Owing to a substantial concentration of shopping centres, the city is called the second destination for shoppers in Britain (after West End in London).

40. Calculated by the author based on the above sources.

Other types of services which are important for the external hinterland of the metropolis are related to health care. Even though local health care and social assistance centres are found across the entire Western Scotland, the advantage of the metropolis, and the city of Glasgow in particular, is that it has specialised hospitals. In this regard, Glasgow has no real competitors and its specialised health care services attract patients from distant areas, which is particularly well visible in the case of residents of regions located north of the Central Belt.

As regards recreation and leisure, we can say that mutual interrelationships exist between the metropolis and the surrounding region. Although valuable areas for recreation can be found within the boundaries of the metropolitan area, external locations also enjoy a great deal of popularity, e.g. the Loch Lomond National Park, Ayrshire golf courses, the coastal cities or the highlands. The hinterland offers a tourist base for the residents of the metropolis, which leads to increased incomes in some of the local communities. On the other hand, the metropolis, especially the city of Glasgow, is a magnet attracting tourists from the region for its cultural facilities and artistic events.

It is difficult to evaluate trade linkages between enterprises located in the metropolitan area and in the broader region owing to insufficient sources of data and the complexity of this type of interactions. We can observe, however, that such interactions evade any administrative boundaries and enterprises, in their activity, follow the principle of effectiveness. In addition, every sector has a different type of needs concerning such ties, and a different distribution pattern of both suppliers and recipients. The majority of flows in this regard occur within the metropolitan region, and relationships with the broader environment matter less; 41% of all corporate transactions from the Glasgow area are made with companies situated in the Glasgow metropolitan region (Turok T. at all, 2003).

The relationships between the metropolitan area and the hinterland as regards relocation of enterprises or opening corporate branches (industry, trade, higher-order services) are associated with changes in the profile of the Glasgow metropolis which took place over the recent decades. As the Glasgow region lost in significance as an industrial centre, efforts were made to attract new types of activity. By the 1970s, new investments in the electronics industry were located in areas with available "greenfield" industrial sites, particularly in the so-called New Towns. Three of them: East Kilbride, Cumbernauld and Irvine, were located within the metropolis or in the metropolitan area. However, starting from the 1980s, efforts have been made to develop "brownfield" areas, mostly located in Glasgow, for housing and industrial purposes. The region's weakness in this regard is the relative shortage of the headquarters of major British or foreign corporations, which restricts the possibilities of expansion into the metropolitan region.

Currently, migration plays a relatively small role as compared to other types of interactions between the metropolis and the region. The Census 2001 data indicate that the largest number of people in the metropolitan region who changed their place of residence in Scotland in the years 2000-2001 came from the city of Glasgow (63 000 people). The main waves of migration took place within the conurbation as most people settled in the counties bordering with the city, including South Lanarkshire (ca. 2 500) (C. Jones C., Leihsman C.,2006). The scale of migration from the remaining regions was not as significant owing to the smaller numbers of people involved. Still, it can be noticed that the prevalent direction of migration for people from all the non-metropolitan councils was the city of Glasgow (Dumfries and Galloway, Highlands, Argyll and Bute). The only exception was Ayrshire, whose population preferred to change the place of residence within this particular part of Scotland to migrate to Glasgow, which was definitely done on a smaller scale (A. D. Fleming, 2005). This confirms the relative autonomy of this area, discussed above. In the recent years, many activities were undertaken to revert the outflow of the population from Glasgow to the surrounding councils areas, e.g. construction of new residential estates or the initiatives launched by the Scottish Enterprise and encouraging people to settle down in Scotland. In 2002-2007, the influx of the population (mostly from CEE countries) was higher than the outflow of the Scottish population; as a result, the city recorded a small population increase (0.3% of average annual income) for the first time in 50 years.

Relationships with the local authorities

The Glasgow metropolitan area has a long history of regional planning and partner cooperation. We can find many examples of formal cooperation between the local authorities and/or other public administration bodies in the region. It should be borne in mind that public management in the region is extremely complex, and individual strands of public policy are characterised by dissimilar spatial ranges and legal status. The primary areas of cooperation are the following:

- The Glasgow and Clyde Valley Strategic Planning Authority prepares plans for the Glasgow metropolitan area understood as 8 local authorities / council areas;
- The Strathclyde Partnership for Transport (SPT) is a body responsible for strategic planning in transport in 12 local authorities / council areas;
- The Greater Glasgow and Clyde Health Board (NHSGGC) provides medical services in the Glasgow conurbation and is the largest such entity in Scotland – its activities cover 6 local councils and two cities of one of the councils;
- The Strathclyde Police and Strathclyde Fire and Rescue is the most formal of the agreements signed in the Glasgow metropolitan area, and covers the former area

of Strathclyde (12 councils).

The recent and very interesting Glasgow Edinburgh Collaboration Initiative strives to strengthen cooperation between the two cities in the hope of producing synergy in business and infrastructure development; it is also hoped to consolidate Scotland's cultural offer.

Despite the existence of partner agreements, each council area within the metropolitan region is autonomous, and therefore the council areas also compete in such spheres as e.g. jobs and residents. A particularly strong rivalry within the Glasgow metropolis can be observed between Glasgow city and the two Lanarkshire authorities regarding new jobs and residential housing. Likewise, there is a competition for attracting various business locations concerning domestic and foreign investments.

2.3. Factors shaping the relationships between metropolis and its region

The Glasgow metropolitan area is extremely varied in terms of the structure of sources and level of income, accessibility, level of educational services and health care. As a result, the complementarity of the economic structures within the Glasgow metropolitan area is manifested only to a limited extent, and the division between rural and urban areas is noticeable. For instance, Glasgow mostly hosts the sector of financial and business services and the public sector, while plants and enterprises connected with transport and logistics are located in other urbanised parts of the region (West Region…, 2009). However, it should be pointed out that due to the restructuring of the Glasgow metropolis towards a service economy, the ties arising from complementarity are becoming weaker, and are certainly not as strong today as they were in the times of industry-based development. At the same time, the endogenous resources of the rural areas of Western Scotland can supplement the metropolis' offer regarding tourism, food provision, and labour.

In this context, the mutually reinforcing relationships (although still relatively weak due to historical considerations and dissimilar identities) between Glasgow and Edinburgh are particularly interesting. Among other aspects, the complementarity of both cities in the sphere of the financial sector is pointed out: while the back office and contact functions prevail in Glasgow, high quality functions dominate in Edinburgh (Turok T. at all, 2003). Cultural services are another example of cooperation as both cities have initiated cooperation to gain benefits from an agreed agenda of major cultural events. In addition to that, the number of people commuting to work from Glasgow to Edinburgh and in the opposite direction is growing slowly but steadily. It can be clearly seen that business and economic linkages are gaining in significance, which has a bearing on the migration between these two cities. Although commuting to work affects only 5% of the labour force flows, 15% companies from Edinburgh and 11% companies from Glasgow have

revealed that their major business partners are, respectively, enterprises from Glasgow and Edinburgh (I.Turok, N.Bailey, 2004).

To sum up, there still exist strong stimuli coming from the regional hinterland towards Glasgow, whereas stimuli generated by the metropolis are directed to the supra-regional and international environments.

The Glasgow metropolis unquestionably serves as the growth engine for Western Scotland. We can distinguish several aspects showing how the metropolis positively affects the surrounding region. First and foremost, the metropolis provides jobs, also to the residents of the broader region. This is possible owing to a well-developed network of road and railway connections in the region, and the prospects for its further extension and modernisation. Although new residential estates are built in the metropolis, they will not be sufficient to satisfy the housing needs of all those who commute daily to work in the metropolis. Furthermore, the metropolis offers high-quality higher-order services (in health care and higher education) for the metropolitan hinterland, as well as caters to cultural and consumer needs of its residents.

Another element/aspect is associated with the sector of tourism, in which positive stimuli are diffused from the metropolis to the wider hinterland in the form of incomes expended by the metropolitan residents in attractive tourist destinations. At the same time, owing to its well thought-out strategy, the city of Glasgow is a magnet attracting many tourists to Scotland, mainly in the so-called business tourism (business visitors account for 28% of all visitors to the city). This offers an excellent opportunity to visit well-accessible and not so distant regions attractive for tourism and situated in the metropolitan area. Glasgow's tourism products are based on the organisation of major events (such as the Glasgow Garden Festival in 1988, the designation as European Capital of Culture in 1990 and the UK City of Architecture and Design 1999), organisation of business conferences and weekend urban tourism.

To some extent, the negative impact of the metropolis on the regional hinterland is the opposite of the positive impact. The transformation that was carried out in Glasgow required substantial investment outlays in the long term. As compared with other councils, the city absorbed a lot of financing from Scottish, national and European funds. Some of the resources allocated to the city's development may have been used for the development of other locations in the wider hinterland of the metropolis and thus have brought benefits for the local communities. Therefore, the jobs provided by the metropolis produce positive effects on the one hand, but on the other sometimes a different perspective is used to look at them – as alternative costs to other locations. The retail trade sector can serve as an example: it has been substantially enhanced in the Glasgow and Clyde Valley area. This led to the degradation of the centres of smaller

cities, as a result of which their residents must look for alternative sources of income. In addition to that, a new restructuring strategy for the city centres is needed to furnish them with a new function (Metropolitan Glasgow…, 2008).

The negative impact of Glasgow on the wider hinterland is also associated with its being perceived as a city associated with economic collapse, declining industries, widespread poverty, high level of crime and a low standard of the housing stock. Such a reputation may affect not only the tourism sector but also potential investors. It should be emphasised that the regional authorities are aware of such a threat, and initiate many activities aimed to change the image of the city, and thereby of the region.

2.4. The interdependency between the metropolis and the region

Due to the difference in the potentials between the metropolis and the region discussed above, the region needs the metropolis much more than the other way round, even though these two component parts need each other. The larger part of Western Scotland has a peripheral location and is relatively poor, and therefore needs higher-order services provided by the metropolis, the spreading of the effects generated by it, and the incomes of its residents (e.g. in the form of tourism and recreation). Glasgow is a driver of the region's growth and will determine the shape that this growth will take.

On the other hand, we can identify several areas in which it is the metropolis that needs the region. These include: supplementing the labour market offer and providing a place for residence for those who work in Glasgow (due to insufficient housing facilities), access to tourist areas for the metropolitan residents (e.g. the Green Network), food provision and valuable additions to Glasgow's tourism offer (e.g. Loch Lomond National Park, Ayrshire's golf courses).

2.5. Activities of public authorities in metropolis-region context

In Scotland, the local level is the key competence level in public administration[41]. The individual areas of the Glasgow macroregion are looking for ways to unlock their endogenous potential. Most frequently, such activities are associated with investments in the tourism facilities and renewable energy projects. Some other initiatives are more specific; for instance, the predominantly farming area of Dumfries and Galloway south of Glasgow undertakes activities jointly with the Scottish Border region located in the influence zone of Edinburgh relating to possible applications of modern design in the textile industry, which has had a traditionally strong presence in the region.

41. It is pointed out that following the 1997 reforms and the establishment of the Scottish Parliament with its seat in Edinburgh, the local authorities w Scotland have become more independent of the central government, although not to such a degree as it was expected (A. McConnell, 2006).

However, as mentioned in the earlier chapters of the study, many activities of the public administration are coordinated at the level of the metropolitan region. We cannot speak of a coherent strategy whereby the metropolis affects the surrounding region, although we can list examples of initiatives which potentially can strengthen the diffusion of positive stimuli from the metropolis to the regional hinterland. For example, this includes transport system projects, such as the development of regional airports (Prestwick Airport), or the construction of new road connections within the metropolis. Other projects are aimed to create new jobs, for example through the development of business or technological parks across the metropolis; still others target education, for instance a project intended to raise skills in the building industry (Construction Skills Action Plan). Efforts were also made to create jobs outside the metropolitan area; for instance, sites have been prepared for potential investments around the cities: Ayr, Irvine, Kilmarnock; transport connections between Prestwick Airport and harbours: Ayr, Troon, Hunterston, with the cities of the Glasgow metropolis in order to secure solid foundations for the development of clusters of export-oriented industries or services. Many projects are intended to strengthen the region's potential four tourism, e.g. initiatives for the regeneration of downtown Glasgow and centres of the regional cities, or activities related to the development of Loch Lomond for tourism purposes.

Measures to weaken the negative influence of the metropolis are undertaken via projects aimed to enhance the external image of the metropolis, inter alia the Clyde Waterfront project, which involves the regeneration of the former shipbuilding-dependable communities along the River Clyde, the redevelopment of the former Ravenscraig steelwork (North Lanarkshire) or the restructuring of Motherwell and Wishaw. Other activities included the construction of new residential estates in the metropolis, regeneration of the centres of regional cities, development programmes for derelict and vacant areas (Derelict and Vacant Land Programme), as well as the development of a network or recreation and leisure sites in the metropolitan area (the Green Network).

It is difficult to prove the thesis on the coordination of public activities in the macroregion which aim to strengthen the influence of the metropolis on the hinterland. Many activities which are important for Western Scotland are coordinated at the level of the Scottish Government, e.g. those intended to: enhance transport accessibility (including the construction of a high-speed railway between the Central Belt and London), improve railway connections in Renfrewshire, Inverclyde and Ayrshire, develop recreation and leisure areas (as part of the Green Network) or develop infrastructure associated with the 2014 Commonwealth Games. An example of a nation-wide instrument has been the Government Relocation Programme, intended to relocate some of the public services from London and the South-East. As part of this programme, the NHS Central Register has been relocated to Dumfries.

2.6. The metropolitan area governance

The recent years saw a substantial policy change concerning urban development in Scotland. Cities were to be no longer perceived as sources of problems; from now on, they were to be looked at as drivers of growth, places where important development resources – economic, social and cultural - are generated. This is visible in strategic actions which provide supports to the resources of the city-regions. These activities should be anchored in the idea that strong metropolitan regions will produce welfare and prosperity for the whole of Scotland (Turok I., 2007).

The most important body which coordinates the functioning of Glasgow metropolitan area is the Clyde Valley Strategic Planning Authority (GCVSPA), established in 2008 to replace the Glasgow is the Clyde Valley Structure Plan Joint Committee (GCVSPJC), in existence since 1998[42]. This change was formal in character, and followed the changes made in the strategic planning legislation in Scotland. In February 2009, the *Town and Country Planning Regulations (Scotland) 2008* came into force. This instrument introduced mandatory Strategic Development Plans and Local Development Plans for 4 city-regions of Scotland (including Glasgow), and Local Development Plans for the areas of outwith city-regions. The GCVSPA continues the tasks performed by its predecessor regarding a similar area. The main task is preparing the publication of, and submitting to the Scottish authorities, strategic development plans for the Glasgow metropolitan area understood as 8 local authorities. The GCVSPJC and its successor have a fine reputation for preparing high-quality strategic plans for the Glasgow metropolitan region. The works of the organisation is based on consensus, i.e. each of 9 local councils has the same number of votes in making strategic decisions, despite their dissimilar "weight" with regard to the surface area, population and the economic potential. This, in addition to the shortage of funds needed for implementation and insufficient impact on the key institutions, is identified as the main factor playing down the role of this institution (Turok T. at all, 2003).

Despite an unquestionable need to coordinate public activities at the level of the Glasgow metropolitan area, today there is a lack of political and social willingness to return to the earlier organisation of the regional government, i.e. restoring the second tier of public administration in the Glasgow region. It could be said however that less radical changes in metropolitan region management would be more preferable with a view to decreasing fragmentation and reducing efforts needed to ensure communication and political cooperation between different organisations. Such changes could involve for example harmonisation of the territorial scopes of local cooperation agreements and special-purpose organisations. According to regional experts, the reform could for example

42. http://www.gcvcore.gov.uk.

define the areas for their joint activities in e.g. health care, police and fire services, spatial planning and transport. A different alternative for the formalised form of organisation within the metropolis could be a system whereby management of specific functions within the metropolitan area would be entrusted to one local authority belonging to the metropolitan area[43].

2.7. Developmental perspectives

There is not enough evidence to prove the thesis that the metropolis and the surrounding region are becoming unified in terms of the economic and/or social structure. The region of Western Scotland is extremely varied, and disparities both in the level of, and access to education are difficult to reduce. The strategic decisions on investing mainly in Glasgow and several selected locations have resulted in creating a considerable competitive advantage of the metropolis. By contrast, building the potential in peripheral locations has been less successful, and the stimuli generated by the metropolis have been insufficient. If the current development trends relating to knowledge-based economy continue in the future, it can be expected that the disparities between the city and the surrounding region will increase, perhaps even quite significantly. The authorities of the metropolitan area are aware of these processes, and therefore development strategies for this area look for development opportunities in strengthening the cooperation with the Edinburgh metropolis or linkages with British cities rather than with the regional hinterland. It can be expected that more proposals will be submitted for tightening the coordination of activities in the Central Belt, where economic relations are important, and are gaining in significance also in the east-west context (I. Turok, N. Bailey, 2001).

It should be added that the prospects for the future concerning the disparities between the metropolis and the region naturally depend on many factors, but they first and foremost rely on the question what sectors will gain advantage in the future, and this – as recent history shows beyond doubt – can change very rapidly. As few as 10 years ago, the role of Glasgow decreased and that of the region increased owing to the development of the electronic industry and establishment of new (greenfield) enterprises outside the city. At present, the situation has changed radically in view of a robust development of the financial business services sector. Other factors which can have a potentially strong bearing on the future development of Western Scotland include: development trends in public transport, policies implemented by the Scottish Government, and dissemination of technological changes (e.g. teleworking).

43. Such solutions are already being introduced, e.g. Renfrewshire's administrative support of the metropolitan-wide strategic planning function, and the second Metropolitan Glasgow economic strategy (2008).

3. City-region relationships: Stockholm – Mälar Region case study

The Stockholm Mälar region is located in eastern Sweden, stretches across 27,2 thousand km^2 and is populated by 2,7 million inhabitants. The region is of monocentric character with Stockholm, the capital city of Sweden, being the core of the metropolitan area. The city is populated by 830 thousand people and the metropolis has around 2 million inhabitants. The metropolitan area is clearly separated from the rest of the region by the difference in the population density. Stockholm doesn't have any significant counterpart, however few other cities and towns play the role of regional centres: Uppsala (140 thousand people), Västerås (132 thousand people), Örebro (125 thousand people), Norrköping (83 thousand people) and Eskilstuna (60 thousand people).

Stockholm region is one of the most competitive regions in the world and ranks very high in terms of innovation, knowledge-based economy, quality of life and sustainable development solutions. After the transition in Central-Eastern Europe it managed to position itself in the new geopolitical context and adjust its economy to new growth paradigm even before the globalization and internationalization of the world economy became broadly acknowledged. Therefore, having significant competitive advantages the region experienced two decades of constant growth characterized by the importance of research and development activities, concentration of advanced business, rapid growth of high-tech sectors such as biotechnology and ICT and creative economy – music industry, fashion and design. The dynamics of these processes varied for the core metropolitan area and the surrounding hinterland, which within time led to significant development gap (OECD, 2006).

3.1. The metropolitan region and its component parts

Stockholm is one of the most important cities in Scandinavia and besides being the capital city of Sweden its influences range further across the Baltic Sea macroregion. The main role of Stockholm city can be derived from its metropolitan functions. The city hosts headquarters and offices of many multinational companies, especially those of Swedish origin. Furthermore, it's the biggest financial market in Scandinavia, concentrating more than 50% employees working in the sector in the country. Stockholm is also a very important transport hub in both national and Scandinavian context with the strategic location in the centre of road, train and sea transport networks. The city is also an important research and development centre with a lot of prestigious academic institutions, research institutes and technology parks. It is therefore one of the most attractive labour markets in the region offering diversified range of jobs in high, middle and lower segments. In this sense the city is attractive to foreign immigrants, who during

the last two decades were the group that most significantly contributed to the city's population growth.

The range of the metropolitan region (macroregion) is mainly defined by the labour market area and consequently by the range and capacity of the commuting transport system. This is the most popular definition of the region used for the purpose of spatial planning and business activities. Taking this into consideration the metropolitan region includes the Stockholm County, Uppsala County, and eastern parts Södermanlands and Västmanlands Counties. The working definition of the metropolitan region is the 1 hour long travel distance from the Stockholm City. Within this definition metropolitan region ranges along the main transport routes and includes secondary poles such as: Norrtälje, Uppsala, Bålsta, Enköping, Västerås, Strägnås, Eskilstuna, Gnesta, Flen, Oxelösund and Nyköping (with Skavsta airport) (Regionplaneämneden, 2010).

A more formal definition of the metropolitan region can be found in RUFS 2010 - Regional Development Plan for the Östra Mellansverige with a time range 2050. The spatial definition is broader and includes Stockholms, Uppsala, Sörmlands, Västmanlands, Örebro, Gävleborgs and Östergötlands Counties (Regionplaneämneden, 2010).

The definition of the functional metropolitan region mentioned in RUFS 2010 includes the whole Stockholm County, Uppsala County together with Gnesta, Strängnäs and Trosa municipalities in Sörmlands County (Regionplaneämneden, 2010).

Another definition of the Stockholm Mälar region is reflecting the political will to make the region one of the most competitive regions in Europe. The concept, or rather an initiative, is based on the bottom-up cooperation between various municipalities and county-level administration from five counties (Stockholm, Uppsala, Södermanland, Örebro and Västmanland). Despite not being yet functionally integrated, the definition of the "aspirational" Stockholm Mälar region can be justified by the current trends in commuting flows and labour market expansion (OECD, 2006).

Other factors such as access to public services, business links between enterprises, migration or regional identity play secondary role in determining the range of the metropolitan region or are simply related to the influence of the labour market and commuting factors. Since there is a free choice of public services accompanied by high quality of these services in most of the municipalities in the area, this factor cannot be pointed as crucial in terms of spatial range of the metropolitan region and basing on this definition it would make it difficult to generalize about the spatial range (SLL, 2009).

Business activities, especially biotech, financial, automobile, ICT and R&D clusters are still concentrated in the Stockholm City, however their functional links are constantly

expanding to other parts of the Stockholm Mälar region, which can be interpreted as a result of cooperation between companies and research institutions (OECD, 2006).

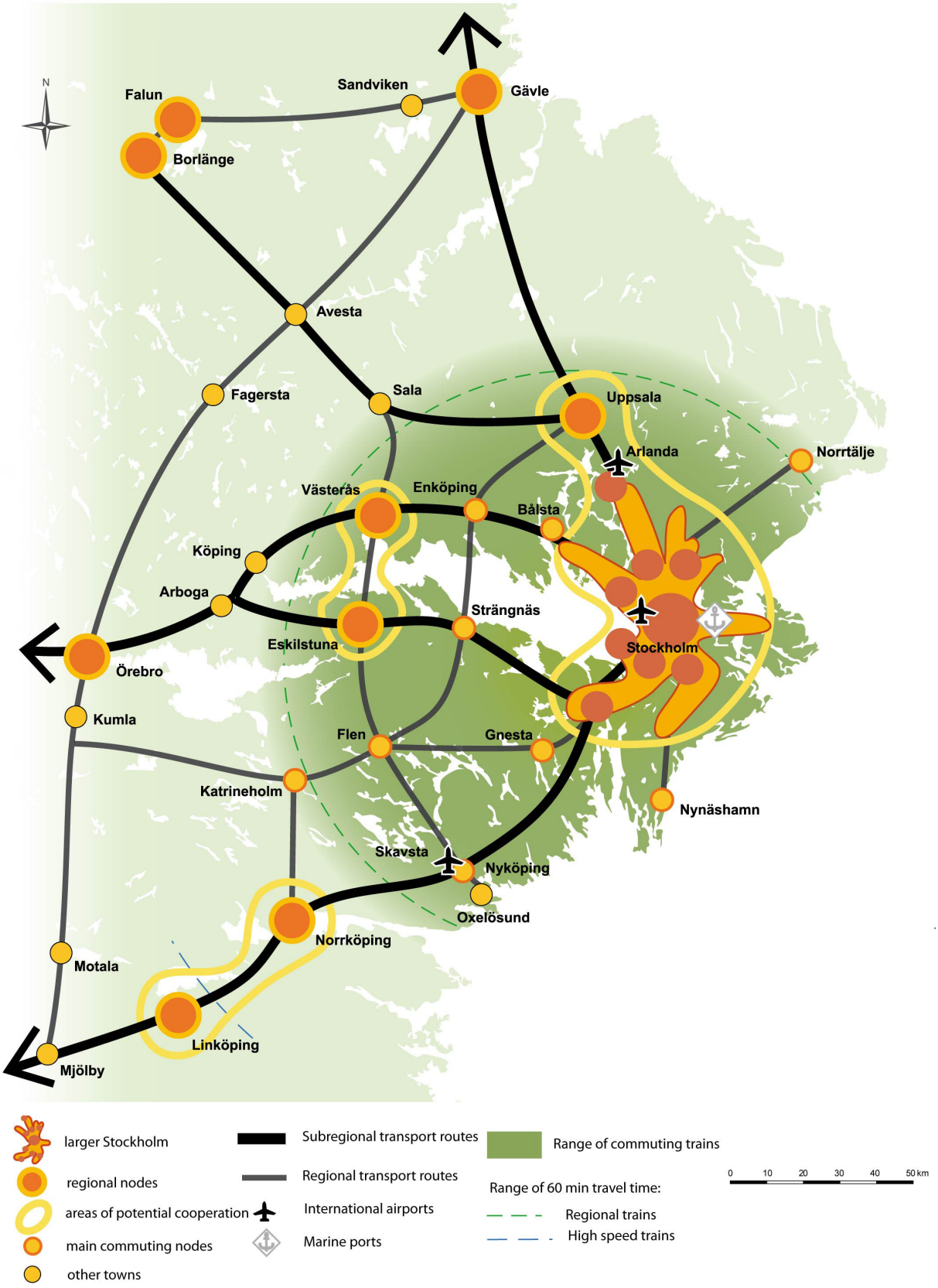


Figure 31. Functional metropolitan Stockholm Mälar region

Source: (Regionplaneämneden, 2010)

Regional migration doesn't seem to be an explanatory factor of the spatial range of the metropolitan region, as the external migration to the city (immigrants from abroad) exceeds the interregional migration. There are visible suburbanization processes motivated by education, jobs and self realization. Suburbanization ranges up to 30 km outside the central city. On the other hand, despite higher real estate prices some people are staying in Stockholm, as the number of households with children has grown in the last 10 years. This can probably explained by: deindustrialization of the inner city and housing developments (larger apartments, as earlier there was a tendency to build only studios).

The least important is the regional identity factor, as it is not as important as local identity vs. national identity. There is no such identity as Stockholm Mälar region identity. An interesting observation however, is the broad range of the "Stockholm" logo accepted as a regional branding strategy by the local administration representatives of municipalities located in Stockholm, Uppsala, Södermanlands, Västmanlands and Örebro counties.

Regardless of the adapted definition, it is acknowledged, that mainly due to the regional labour market demands, the spatial range of the metropolitan region of Stockholm has been constantly and rapidly expanding since the 1970s (Regionplaneämneden, 2010).

The range of the metropolis is usually defined by the administrative boarders of the Stockholm County (both NUTS 3 and NUTS 2 level), however this definition doesn't fully reflect the functional metropolitan area. Therefore there are several alternative definitions of the Stockholm metropolitan area. One of the criteria used for the purpose of planning is the population density which includes the Stockholm city, Solna and Sundbyberg municipalities. Another definition, based on the range of the labour market and commuting intensity includes the Stockholm and Uppsala counties and the northern parts of the Södermanland county (RTK, 2009a).

The most important strength of the Stockholm metropolitan area is its highly competitive, innovative an internationalized economy with a lot of multinational companies, diverse structure of knowledge-based branches, high levels of FDI and acknowledged position in the globalised economy. This is a result of a long period of successful performance in the global competition based on a model of an open, however relatively small, export-based economy which was developed even before these factors became crucial in international competition. Another important strength of Stockholm is the top quality human capital with the highest ratio of population with higher education, strong tradition of life-long-learning and practically bilingual population (English as second language). Moreover, Stockholm is located near to growing markets in the Baltic

region. Finally, the urban structure of the city offers high quality of life with a lot of recreation areas, high quality of air, water and landscape, but also high density of dwellings and excellent public transport system within the metropolitan area, which allows easy access to institutions and retail centres.

Among the weaknesses of Stockholm the most important include high real estate prices and housing shortage due to which the city is loosing its attractiveness. As a consequence there is a growing problem of spatial and social segregation, which is especially problematic in case of immigrants coming from the non-EU countries. Another weakness of the Stockholm metropolitan area is its peripheral location with regard to the Pentagon area. What is more, due to the ongoing globalization and lack of critical mass in terms of population size the city is loosing its importance in the global financial market and trade. Finally, the structure of knowledge economy sector is based on big companies without the expected spin-off effect that would encourage small and medium-sized enterprises to appear.

The strengths of the region surrounding the Stockholm metropolis include high quality of life with lower real-estate prices when compared to more central locations. Another strength is the awareness of the decision makers in terms of using the proximity of Stockholm in advantage to the local development, which is reflected by close cooperation with the city. Furthermore, the workforce is characterized by high working culture and efficiency even in the low-skilled and manufacturing sectors. Finally, the social structure is more homogenous, which causes less social tensions when compared to the metropolis.

Weaknesses of the region surrounding the Stockholm metropolitan area are connected to the economic dependency of the metropolitan economy with typical hinterland economic sectors such as industry, manufacturing, logistics and basic services. Furthermore, local human capital is subject to brain-drain and the most talented people tend to move to the city area leaving less skilled and educated workforce structure. Due to lower population density and underdeveloped transport network only several areas of the region have good access to the inner-city. Finally, the region doesn't fully benefit from its assets, since the functional roles of regional nodes such as Västerås or Eskilstuna aren't fully defined or agreed on.

The relationship between strengths and weaknesses of the metropolitan area and the metropolitan region are of complementary character, especially in term of the economic structure and real-estate market. The main differences include work productivity and human capital, access to specialized services and culture, labour market diversity as well as income level and social structure. The side effect of the complementary structure of strengths and weaknesses is the asymmetrical relation between the metropolis and the

region in which the region is economically and functionally dependent on the city. The current situation is posing new challenges to the region's economy which was to high extent based on manufacturing (automobile, machinery, caterpillars, printing) as this sector has been declining over time due to off-shoring. In order to sustain the competitiveness of the regional economy more focus was put on encouraging subcontractors to cooperate with the companies located in the city and developing the wholesale and logistics sectors (SBR, 2007). Another idea is to encourage spin-off companies in advanced sectors to be started in more remote areas of the region. This however demands more comprehensive solutions. Recent trends show growing awareness among local and regional decision makers in both areas considering the necessity to cooperate. There is a political consensus on a general level that the region's municipalities and Stockholm have to cooperate in order to maintain and strengthen the region's position in the global competition.

3.2. Relationships between the metropolis and the region

The industrial, economic and social links between Stockholm and its surrounding region are of historical character and were determined by the waterfront-like inland formation. The settlement structure of the region was determined by the location of the early medieval church towns such as Sigtuna, Västerås or Eskilstuna. On the other hand the north-west part of the region appeared to be rich in raw materials such as iron ore, which attracted both skilled labour force, craftsmen and capital to develop mining industry. The towns located along the lake Mälaren such as Västerås, Eskilstuna and Örebro took up the role of manufacturing. The development of the manufacturing industry contributed to the social and economic progress of the whole region, became a source of significant shift in regional gross product as well as created industrial, economic and social links between different parts of the region, which became functionally more dependent on each other. The main communication arteries were lakes, rivers and the sea. Stockholm as a separate city was established 200 years later as a result of functional division of branches in the region, to play the role of market, warehousing, trade and other business services. On the other hand, the growing demand for knowledge and sophisticated workers led to foundation of the Uppsala University in 1477. Another significant period which had a big influence on the settlement and functional structure of the Stockholm Mälar region was the industrialization in the late 19th century, that established Stockholm as a macroregional financial market and communication centre (dense telephone network provided by LM Ericsson) (Högberg, 2009).

Commuting to work

The population in the Stockholm County has increased by almost 400 000 during the last 3 decades. The main source of this growth was foreign migration and the internal

migrations were minor in comparison. In the context of housing shortage the commuting became a crucial factor of creating and widening the range of the functional metropolitan region. The map below illustrates trends in increase of commuting in the metropolitan region of Stockholm during the last 20 years. About 80-85% of commuting to Stockholm takes place across the county boarders. The overall number of commuters travelling to Stockholm is about 85 thousand of which 60% are the inhabitants of the Mälar region, that is Uppsala, Västmanland, Södermanland and Örebro counties. During the last decade the number of commuters increased by 50%, especially in case of Uppsala and Södermanland counties (Regionplaneämneden, 2010).

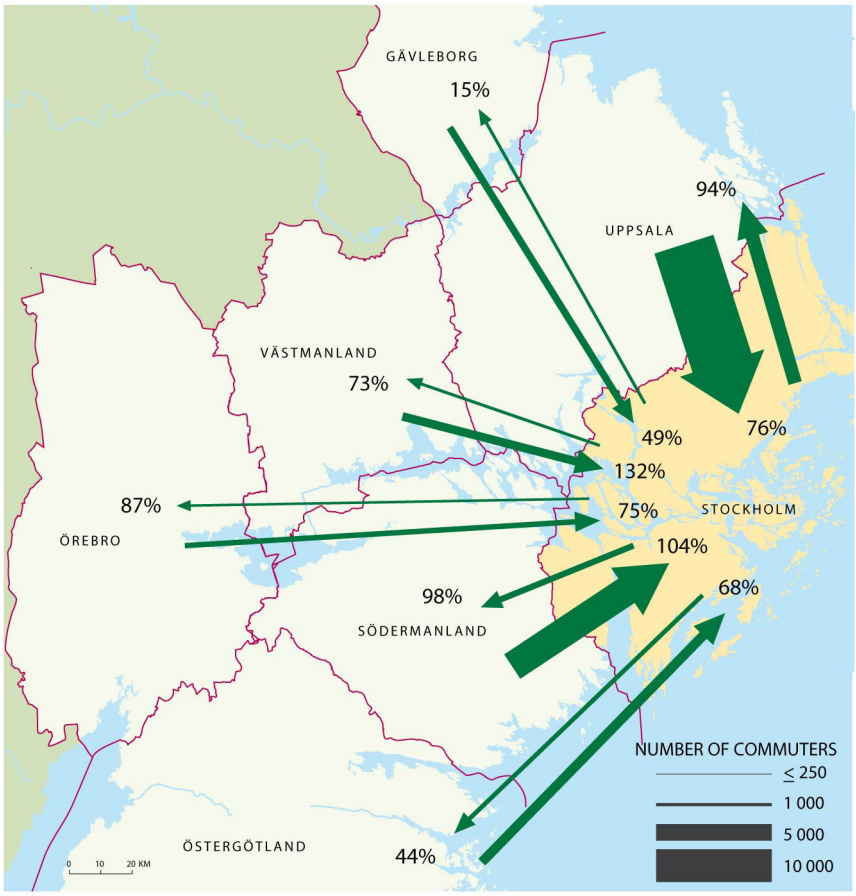


Figure 32. Commuting trends in the Stockholm Mälar region 1985-2006
Source: (Regionplaneämneden, 2010).

The most important factor behind commuting is the broad and diversified labour market of Stockholm. Furthermore, it's also the most important connection transport hub in the national scale. Today the metropolitan labour market comprises of Stockholms and Uppsala Counties, Strängnäs, Gnesta and Trosa in Södermanland County and Västerås and Eskilstuna. The traveling time of 45-60 minutes has been achieved in most of the regional nodes located within the radius of 100 km. The biggest growth in commuting is caused by development of railway connections, however still the biggest share of total traffic capacity in the region (60%) remains within the car journeys (SLL, 2009).

When analyzing the main purposes of commuting within the metropolitan area, the most important include everyday journeys to work and shopping. Due to high quality of education, school-related journeys of pupils are of a lesser importance. When it comes to the whole metropolitan region, the structure is similar with everyday journeys to work and for shopping as main purposes of commuting. Weekly mode of commuting appears to be more typical for the workers who live in the municipalities located outside the radius of 100km away from the central city.

The most important goal concerning commuting in the region is to shorten the travelling time in order to attract potential employees to utilize the commuting network in order to supply the metropolitan labour market. This goal applies mainly to the regional railway network. The most important routes from the Stockholm perspective connect other parts of the region and two biggest airports and these are:

- Stockholm/Arlanda–Malmö/Göteborg, via Nyköping/Skavsta, Norrköping, Linköping
- Stockholm/Arlanda–Oslo, via Strängnäs, Eskilstuna, Örebro
- Stockholm/Arlanda–Oslo, via Enköping, Västerås, Örebro
- Stockholm–Arlanda–Uppsala–Gävle.

Migrations

The most important factor of growth in the Stockholm region is the economic and structural fitting to the challenges posed by the globalization. Therefore the regional economy is highly dependent on skilled and well educated labour force supply. Because of the relatively low level of internal migrations to the region and low fertility rate the labour market has to rely on foreign migration. The share of population of foreign origin has been constantly growing to reach around 25% of the population. A side effect of this situation is caused bu certain problems with integrating immigrants in the labour market, which leads to lower income level among this group. It results in spatial segregation of this population, who tend to be concentrated in the lowest quality neighbourhoods built between the 60s-70s as a part of the so-called "million project" (Stadsledningskontoret, 2005).

Trade exchange between businesses

As in the rest of the country, the economy of the Stockholm Mälar region is highly dependent on export and foreign direct investments. It is especially typical for the metropolitan area in which more than 40% of workforce employed in the private sector is working for export companies involved in commerce, manufacturing and business consulting. The largest of this group of companies are in the branch of finance and communications. In general more than half of the foreign-owed companies in Sweden reside in the Stockholm Mälar region and they are concentrated within the metropolitan

area. In this context the most important role of the regional surrounding is logistics and transport connection between the suppliers of goods and services and customers (Tidestav & Zetterberg, 2008).

Other platform of business links between the metropolis and the region is a result of the functional and spatial localization of economic clusters. Business activities, especially biotech, financial, automobile, ICT and R&D clusters are still concentrated in the Stockholm city, however their functional links are constantly expanding to other parts of the region:

- Biotech cluster: ranges across the whole region with Uppsala, Stockholm as main creative centres and Strägnås and Sigtuna as main industrial basis for the cluster;
- Financial cluster: concentrated in the Stockholm City
- Automobile and robotic cluster: located in the south-western part of the region includes Södertälje, Västerås, Eskilstuna and Örebro;
- ICT industry: located longitudinally between Uppsala, Kista and Stockholm;

Higher-order services for individuals

Academic institutions located in Stockholm have excellent reputation and are recognized for the quality of teaching and R&D activities and are therefore an important factor of commuting. The intensity of commuting to universities has been constantly growing and now ranges across the whole metropolitan region. This situation is a result of binary higher education model in Sweden with visible division to universities and colleges. While universities are targeted at most talented and competitive students, their recruitment area is of national scale, whereas colleges are more accessible, but offer less prestigious education programs (RTK, 2009b).

Cultural and entertainment offer of the Stockholm city together with the creative cluster are also a significant factor of human flows across the region. The intensity of commuting related to cultural and entertainment activities was comparable to the flows motivated by education. In comparison to the metropolis, the regional cultural offer is poor and less diversified. It is necessary to underline, that cultural sector of Stockholm is one of the most innovative and recognized in the European scale and in case of music scene it's the third biggest market in the world (after USA and UK) with the highest number of recording studios per capita in the world.

Other services, such as health care, didn't have any significant impact on regional flows. The reason behind this is probably the welfare state policy which assures every citizen equal access to high quality public services regardless of their residence.

Entertainment and leisure

Quality and availability of leisure and recreation possibilities in the area surrounding the Stockholm metropolis play an important role in raising the quality of life and the attractiveness of the whole region. The main advantages of the leisure and recreation offer result from the seaside location, unique landscape of skerries and qualities of the area where Lake Mälaren merges with the Baltic Sea. The most popular recreational area is therefore coastal area, where a significant number of city inhabitants traditionally have their summer cottages. Another popular area includes the northern parts of the Södermanland County, which is famous for a concentration of castles and other historic buildings. The main tourist and leisure attractions include activities based on the natural heritage of the region such as National Parks, nature reserves but also recreation possibilities such as golf, sailing, cycling, horse riding. Leisure and recreation in the Stockholm Mälaren region is characterized by high quality tourist infrastructure and excellent management of natural heritage (Regionplaneämneden, 2010).

Relationships of public authorities

The most significant feature of relations between different representatives of public authorities in the Stockholm Mälar region is the bottom-up type of cooperation. It is driven by the common conviction that in order to remain competitive globally the local authorities need to cooperate and come up with development –oriented solutions that are to benefit the whole metropolitan region.

The formal range of power on the regional level is relatively limited. The division of competences can be described as an hour-glass model in which the state is powerful, the region is weak and the municipality is powerful. With the lack of powerful authority on the regional level there is a bottom-up initiative concerning the coordination planning and development activities and coordinating these processes between different local authorities representing the formal power structures and various associations of municipalities and counties. This process is facilitated by the fact, that representatives of most of the institutions responsible for local and regional planning are located in the same building (Berggren & Hermansson, 2008).

In this configuration the Regional Planning Office (Regionplanekontoret) is playing the role of a research and development unit that collects, processes, analyses and publishes social and economic data concerning the regional development. The quality of the analytical capacity of this institution is very high and the analytical support is of constant and comprehensive character. The Regional Planning Office is therefore responsible for formulating recommendations, and suggestions concerning the overall area of the region. It also coordinates the cooperation between representatives of the city of Stockholm and 36 municipalities who have formal competences in terms of spatial planning, transport

and infrastructure, housing and labour market policy and support for enterprises (SALAR, 2009).

A good example of such an initiative, which illustrates mutual trust and dominance of cooperation rather than competition between local authorities is the „En Bättre Sits - On the right track" project. The aim of the project is to improve the accessibility, quality and capacity of transport infrastructure in the region. One of the reasons behind the initiative was the fact that the specific demands of the spatial structure and relations of the Mälar region were not incorporated accurately in the plans prepared on the state level. The project is a communication platform uniting local and regional authorities as well as representatives of national institutions and agencies responsible for transport and infrastructure. The main goal of the project was to work out consensus concerning the investment priorities and incorporate interests and demands of all participating actors (local authorities, entrepreneurs, local communities and environment protection) as well as the overall development interest of the whole area (Högberg, 2009).

There are however some examples of competition between the smaller towns around Stockholm. The main subject of competition are the public-funded infrastructural investments, location of knowledge-intensive sectors, universities and the schedule of investments. At the same time leaders on smaller municipalities understand the necessity of investments in Stockholm city. A good example of this initiative is the fact that several municipalities located further away from Stockholm were financially participating in the construction of the city tunnel, which is to improve the communication in the whole metropolitan region.

3.3. Factors shaping the relationships between metropolis and its region

The most important factor affecting the interlinks between the metropolis and the region is the complementarity of the economic structure of the metropolis and subregional centres that results from the traditional and historic division of functions of regional production. The western part of the region, which used to be mining and industrial area, is still characterized by a significant role of the manufacturing sector. Today this sector is based on hi-tech and knowledge intensive production. On the other hand the eastern part of the region was traditionally shaped according to its transport and commerce functions, so the share of specialized services and more diversified economic structure was always the case (SBR, 2007).

Another factor contributing to interlinks between the metropolis and surrounding region is the developed transport network. This is especially crucial in terms of labour market demand and housing shortages in the metropolitan area. However, a significant part of the region is not well connected to the city centre, since the density of population on the most peripheral areas makes infrastructural investments economically inefficient.

Despite the bottom-up cooperation initiatives between various local authorities, the decision making processes are very slow and driven by the consensus culture. Territorial planning on the regional scale is also affected by the procedures considering the competences and logic behind constructing development plans. Unlike in many other countries this process is of a bottom-up character, which means, that initial planning takes place at the local level and only than particular local plans are integrated into a regional development plan. With a negotiated regional development plan, each municipality still has their autonomy not to conform to the compromise solutions made on the regional level (SALAR, 2009).

The most important spillover effect is caused by the improvement in transport network and housing shortages in the inner-city of Stockholm. Dynamic economic growth of the metropolitan area was accompanied by lack of housing and relatively slow tempo of new dwellings delivery when compared to growing demand. This situation has been negatively influenced by formal restrictions concerning the construction of new housing areas as well as real estate regulations that oblige landlords to register the apartments to be rented. The waiting lists for renting an apartment in the city exceed 100 thousand people. As a result of this process, the real estate prices and rental prices have shifted to the level that makes Stockholm one of the most expensive cities to live in and where the share of housing expenses in household budgets is among the highest in the EU (OECD, 2006). To a paradox, this phenomenon decreases the quality and level of life in the metropolis, despite Stockholm being characterized by the highest personal income levels in European cities. This phenomenon is also contributing to the spatial expansion of the metropolitan area and growing suburbanization. With significant improvements in public transport and access to neighbouring municipalities and housing resources in more remote areas became available, which contributed to the suburbanization processes. However central city remained dominant in terms of concentration of workplaces. This contributed to growing financial transfers, especially in the form of local taxes, to the municipalities located conveniently along main transport routes within the radius of 75-100 km away from the city.

On the other hand, municipalities located away from the main transport routes experienced significant backwash effect, which manifested itself mainly in the form of brain drain and outflow of well-educated, highly skilled labour force. The western part of the region was especially affected by these processes, as the adverse net internal migration was typical for all of the age groups of the population. In case of the eastern parts of the region and especially the coastal area, the net migration values varied according to the age group of the population with significant outflows of people between 15-30 and inflows of people aged 30-55. The municipalities experiencing biggest

population outflows are characterized by peripheral localization, low population density and fewer job opportunities (RTK, 2009c).

3.4. Mutual relationships between the metropolis and the region

The metropolis and the region are mutually dependent on each other and this is related to their functional and structural complementarity. There exists however a certain asymmetry in this relation. The main aspects in which the metropolis is to certain extent dependent on its surrounding include supply of the labour force and limited housing capacity of the city. The regional surrounding experienced minor relocation of companies, mainly in logistics and wholesale sector offering only less attractive employment opportunities. The expected appearance of spin-off companies or subcontractors in more advanced sectors, like ICT, R&D, creative sectors was not the case even in regional nodes.

On the other hand, the region is economically and functionally dependent on the metropolis to a much larger extent. The metropolitan area offers high quality jobs and diversified labour market, high order services and cultural activities. This potential and opportunities are however not fully utilized by the municipalities located in the region. The spillover effect is also highly dependent on the accessibility of a particular area and its placement within the regional transport network. What is more, most of the industries and sectors creation the economy of the region are of subordinate role to the high order activities in the centre, which makes them prone to any economic shifts in more advanced sectors. It is reflected by the deindustrialization of some parts of the region, which used to be part of the automobile cluster and are now loosing competitiveness due to the offshoring of manufacturing. Another factor that makes the region dependent on Stockholm is the lack of capacity to attract foreign capital. Because of its excellent reputation, Stockholm is a trademark in itself and therefore attracts companies and investors into the region. The significance of this factor is reflected by the fact, that the whole Mälar region promotes itself under the slogan "Stockholm, the capital of Scandinavia".

3.5. Activities of public authorities in metropolis-region context

In the formal setting of planning in Sweden divides most of competences between the state and the municipality level with little power remaining at the regional level. The state is responsible for setting up the standards and main development priorities, whereas the municipalities have competences of implementing the policies proposed on the state level. Local authorities have significant autonomy concerning the ways, fields and financial resources devoted to implementation of policies (Berggren & Hermansson, 2008; Åkerlund & Legerius, 2009).

Infrastructural investments and polycentric development

One of the main strategies to assure spillover effects and more polycentric development is to constantly improve the transport network quality, speed and capacity. It applies both to improving the connection between the metropolitan area and the rest of the region, but also to improving the connections between various regional nodes such as Norrtälje, Uppsala, Bålsta, Enköping, Västerås, Strägnås, Eskilstuna, Gnesta, Flen, Oxelösund and Nyköping. Furthermore, the tools of polycentric development include strengthening of regional nodes by location of technology parks, logistic centres, and retail centres as well as new housing areas. Finally, certain municipalities such as Eskilstuna and Västerås are encouraged to strengthen their cooperation and become quasi twin-cities.

Education

Sweden is an example of the binary model of higher education which means that there is a coexistence of two types of academic institutions, namely universities and colleges. The universities located in the Stockholm city and Uppsala such as Royal Institute of Technology (KTH), Stockholm School of Economics, Stockholm University, Karolinska Institute and Uppsala University are the most prestigious in the country. The colleges (högskolan) are offering mainly bachelor and masters level of courses and therefore attract a significant number of mature students as part of the life-long-learning policy. In the Stockholm Mälar region there are 26 academic institutions, which employ 40% of all Swedish academic teachers. The most prestigious universities are located centrally and aim at research, development and technology studies and less relatively at teaching and education. On the other hand, the main function of colleges, which are mainly located outside the central city in the metropolitan area and macroregion, is teaching and education. One of the strategies to develop the regional surrounding of Stockholm was to invest in the second type of academic institutions. As a result they have noted the biggest increase in the number of students of which the most significant were Södertörn University located south of Stockholm and Mälardalen University located in the twin city of Eskilstuna-Västerås (OECD, 2006).

3.6. The metropolitan area governance

As previously mentioned regional planning the region is of a bottom-up character and is strongly affected by the consensus culture of decision making processes. Despite fewer competencies on the regional level Swedish legal framework offers a variety of solutions encouraging cooperation between local authorities. These include the ordinary contract, which applies to a very specific object of cooperation; local government federation, which is a form of cooperation between institutions representing various levels of local, regional and national authorities and can be additionally subsidized from the central budget;

joined ownership, which is a tool of rationalizing the supply of public services such as education or health care. In this context a very interesting initiative has emerged in the Stockholm-Mälar Region (OECD, 2006). The main activities concerning strategic regional planning are handled by the The Council for the Mälar Region, which is a non-profit special interest organization for municipalities and county councils in the Stockholm-Mälar Region. It consists of the five counties of Stockholm, Uppsala, Västmanland, Södermanland and Örebro. The activities of this organization are focused on three areas such as infrastructure, benchmarking and education. The objective of the Council for the Mälar Region is to promote the development of the Stockholm-Mälar Region into an attractive, future-oriented region within an integrated Europe (Högberg, 2009).

One of the results of this cooperation is a very comprehensive and broad Regional Development Plan for the Stockholm Region 2010 (RUFS 2010), which unlike previous documents of this sort, includes diagnosis, recommendations and proposals the whole metropolitan region (Regionplaneämneden, 2010).

The main effects of this policy tools are visible especially in terms of the labour market related issues with constantly growing commuting demand and intensity as well as growing suburbanization process and spatial expansion of the metropolitan area. On the other hand the attempts to diversify the structure of regional economy and attract companies from the more advanced sectors into the more remote areas of the region haven't brought any visible results yet.

3.7. Development prospects

The current trends suggest further growth of disproportions between the metropolitan area of Stockholm and its region in economic development. One of the main arguments behind this forecast is based on the differences in economic structure with a significant share of manufacturing and basic services in the region and highly internationalized, innovative and advanced branches in the metropolitan area. Currently the remote parts of the region are faced with competition from the manufacturing sector of developing countries and are undergoing restructuring due to its earlier monofunctional structure. On the other hand the metropolis is constantly strengthening its position in the international context due to its competitive advantages resulting from the metropolitan functions of Stockholm.

There are three possible scenarios that include both the structural conditions of the region and intended strategic approaches and policy tools declared by public authorities and proposed in strategic documents.

The first scenario "Growing monopoly of the city" is based on the assumption, that the ongoing processes will continue and the backwash effects will be dominant and will prevent the integration of the metropolitan region. According to this scenario further development will be monocentric and the economic dependency of the hinterland will grow. The limitations of regional planning procedures will prevent successful cooperation and bloc efficient decision making processes. The depopulation of the remote areas will therefore continue and most of new investments, company start-ups and development of clusters will be concentrated in the metropolitan area. The condition for this argument to take place would be substantial growth in number of dwellings inside the metropolitan area.

The second scenario "Infrastructure – spatial expansion of the city, residential function of suburban areas" also assumes extrapolation of current trends concerning the gap between the regional and metropolitan economic structure. However, according to this alternative, the improvement in transport infrastructure will shorten time of travelling, lead to better communication and interlinks between the region and metropolis and therefore contribute to suburbanization. The assumption here is that due to infrastructural improvements there will be a significant real estate boom in the municipalities located along main transport routes. As a result these municipalities will change their character to typically residential areas and will benefit from the financial transfers of their new residents working in the city.

The third, most optimistic scenario "Polycentric network of regional nodes, endogenous development" assumes that all intended policies and strategies will succeed and lead to diversification of regional economic structure and development of new functions of regional nodes. General improvement in infrastructure, strategic localization of technology parks and better investments in higher education will positively influence income levels, human capital and will therefore enable endogenous development. This will further attract more advanced sectors and contribute to further restructuring and growth.

All of the scenarios are based on the assumption of the economic complementarity between the region and the metropolitan area. Each scenario gradually includes the possibility of positive effects on both economic and policy levels. Taking into consideration recent improvements in communication and cooperation between local and regional authorities the first scenario is least possible. The other two scenarios are dependent on the effectiveness of cooperation, coordination and implementation of actions foreseen in the strategic documents.

4. City-region relationships: Toulouse – Midi Pyrenees case study.

The Midi-Pyrénées region is situated in southern France and borders on Spain along the Pyrénées. This is the largest region in France (8.3% of the country's area), but weakly populated: it has slightly over 2.8 million inhabitants, i.e. ca. 61 inhabitants per 1 km2 (which is much less than the country's average of 113 inhabitants per 1 km2). The urban population accounts for the majority of the region's inhabitants, with the urbanisation rate of 68%. Toulouse is the key urban centre in the region. In 2006, the central municipality of the metropolitan area had 444 000 inhabitants, and the entire metropolitan area had a population of 1 103 000. Other urban centres in the region are markedly smaller: Tarbes (112 000 inhabitants in the urban area, 47 000 in the central municipality); Albi (93 000 and 51 000, respectively); Montauban (82 000 and 56 000); Rodez (69 000 and 26 000); Castres (63 000 and 45 000); Cahors (40 000 and 21 000); Auch (37 000 and 23 000) (INSEE 2009). We can say therefore that the region is strongly polarised and dominated by the centrally situated Toulouse, which is the administrative, economic and cultural capital of Midi-Pyrénées. This dominance is so great that the famous saying coined by Jean-Francois Gravier (1947) to describe the dominant role of Paris in the French space "Paris and the French desert" is frequently invoked. The situation in the region is therefore referred to as: "Toulouse and the desert of Midi-Pyrénées" (Gouardin 2008). Both these bon mots accurately capture the "fractality" of how Toulouse and Midi-Pyrénées function – just as Toulouse prevails over Midi-Pyrénées regionally, both the region and the metropolis are overshadowed by Paris when we look at the entire country. Nevertheless, Toulouse is a major centre in the French space. Its role in the perspective of longue durée processes was emphasised by the famous historian Fernand Braudel (1986). In the early 1960s, Toulouse was selected as one of 8 French equilibrium metropolises. At the time, as part of the French Government programme aimed to balance the country's spatial development (Hautreux, Rochefort 1965), and owing to its long aviation industry traditions started after the First World War, such institutions as a part of the National Centre for Spatial Research (Centre National d'Études Spatiales – CNES) and the National Civil Aviation School (École Nationale de l'Aviation Civile – ENAC) were moved from Paris to Toulouse (Grossetti 1995). In the second half of the 20th century, the city definitely evolved into a metropolis. Nevertheless, it is frequently pointed out that not all metropolitan functions are fully developed here – this refers to the concept of Toulouse as an "incomplete metropolis" proposed by Guy Jalabert, one of the major researchers of Toulouse, in a book published under the same title (Jalabert 1995).

4.1. The metropolitan region and its component parts

The Midi-Pyrénées region is made up of 3 020 communes [communes] (organised into 8 departments [départements]: Ariège, Aveyron, Haute-Garonne, Gers, Lot, Hautes-Pyrénées, Tarn, Tarn-et-Garonne (cf. Map 1). Toulouse is located in the Haute-Garonne department, and its metropolitan area occupies the whole of the region's northern part, which in some places moves into the adjoining departments (Ariège, Gers, Tarn, Tarn-et-Garonne and Aude, which belongs to the Languedoc-Roussillon region).

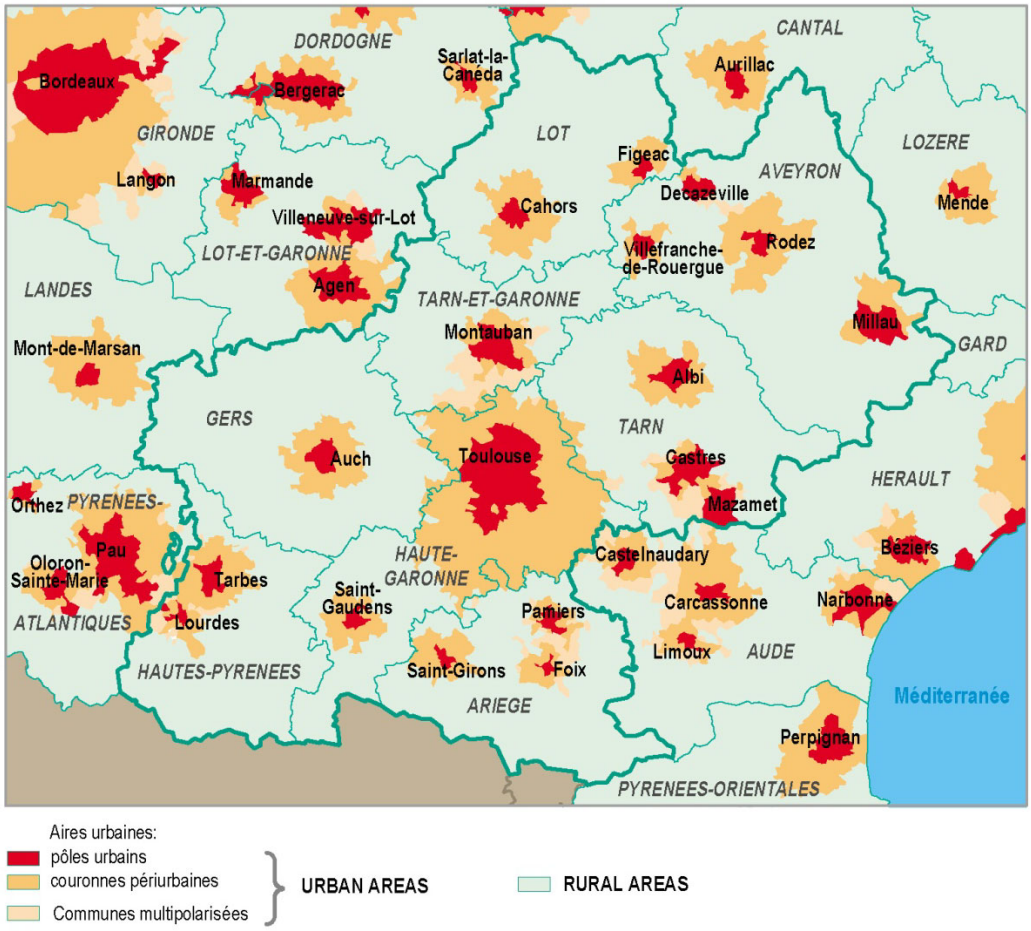


Figure 33. Midi-Pyrénées region, departments, major cities and urban areas
Source: Projetti 2001.

The region is not a structure which is important for regional identity nor which is well rooted in history – in its present boundaries, it is a relatively new entity, established in the 1960s (Poumarede 1991), and did not become an administrative entity until the 1980s (Dugot, Laborderie, Taulelle 2008). For the inhabitants of Midi-Pyrénées, their local identifications matter more than regional, although Toulouse, as a city which enjoys international recognition, plays a considerable role in the building of supra-local identity.

In France, metropolitan areas (Aire Urbaine) are established by Institut National de la Statistique et des Études Économiques – INSEE based on functional analyses. According to the methodology used, a metropolitan area is a compact group of communes (without

enclaves) composed of the communes making up the central urban centre and the communes surrounding the centre, where at least 40% of inhabitants work in the central urban district or the surrounding communes . With such delimitation criteria adopted in 1999, the Toulouse metropolitan area had 342 communes with an area over 4 000 km2 (cf. Map 1). A new delimitation is planned for 2010 – in view of the rapid development of Toulouse, it can be expected that its metropolitan region will be significantly increased.

Nonetheless, the officially delimited metropolitan area is primarily a statistical and analytical entity, not transposed into administrative structures. The fragmentation of communes (basic units of territorial division) is typical of France; communes are here frequently very small in terms of their area, and the number of the population makes cooperation within the metropolitan region complicated. Nevertheless, the law provides for the possibility to set up special-purpose and general-purpose associations of communes (depending on the character of the area, these include: communauté d'agglomération, communauté Urbaine, communauté de communes). Such general-purpose associations take over a broad range of competences from communes (cf. e.g. Kerrouche 2008), but there is a great deal of latitude in this regard. One pertinent aspect in particular is that several general-purpose associations of communes may exist within one metropolitan area. For instance, in the case of the metropolitan region of Toulouse, in 2010 there existed one communauté Urbaine (Communauté urbaine du Grand Toulouse – 25 communes, with a total population of 666 000), 2 communautés d'agglomération (Communauté d'agglomération du Muretain – 14 communes, 71 000 inhabitants, and Communauté d'agglomération du Sicoval – 36 communes, 66 500 inhabitants) as well as 30 small communautés de communes (cf. Map 6). However, this is not an uncommon situation in France. In 2008, only one in 10 metropolitan areas in France (Air Urbaine) had a uniform mode of management, i.e. based on one association of communes which comprised most of the communes of the area (Estèbe 2008).

The entire Midi-Pyrénées region unquestionably remains under a strong influence of Toulouse, which results both from its sheer size as well as the lack of other major city centres. The impact of Toulouse is also visible in the western part of the Languedoc-Roussillon region which borders on Midi-Pyrénées from the east, particularly the Aude department, the western boundaries of which run 40 km from the centre of Toulouse. Moreover, some communes from this department are included in the metropolitan region of Toulouse in the official delimitation. However, its immediate surroundings, defined as an area lying 30-60 minutes by car from Toulouse have the strongest functional ties with the metropolitan area. This mostly includes smaller cities, as a rule capitals of the departments: Albi, Auch, Castres, Castelnaudary, Foix, Mazamet, Montauban, Pamiers, Saint-Gaudens **(Figure 33).** These cities make up an urban network with Toulouse as its obvious hub. The area of influence defined in this way (referred to as the Aire

Métropolitaine de Toulouse) is important because it is used in analytical and strategic studies (cf. AUAT 2008).

Toulouse is the headquarters of Airbus, the aerospace industry giant. The role of this company for the city is so great that Toulouse has been dubbed as "Airbus-ville". The modern aerospace industry is definitely the strongest asset of the city. Aviation industry includes not only Airbus, but also ATR, Latécoere, EADS, Cimpa and a large number of cooperating companies. Other dynamic industries include space, aircraft flight controls systems, aerospace security, electronics, mechanics, as well as chemical, pharmaceutical and medical industries (Pierre Fabre, Sanofi-Aventis, the Pôle de compétitivité Cancer-Bio-Santé initiative). These sectors are characterised by a great degree of innovation and international competitiveness, which is transposed into a significant role of exports for the city and its capacity to attract foreign capital – which are the city's other assets. Toulouse is also an important national academic and research centre , with unique courses and specialisations of study (primarily those connected with aerospace industry). One proof of the attractiveness of the metropolitan region is that in the past decade its population constantly increased, at a rate of ca. 1.9% in the years 1999-2006, both as a result of natural increase and migrations (Tornéro 2010).

The significant role of the aerospace industry (which is e.g. expressed by the 70% share in the value of the region's exports, according to 2007 data) at the same time poses a potential threat to the sustainability of the city's development – in a situation of a potential downturn in this market or loss of its competitive advantage by Airbus and its cooperators. It should be emphasised at this point, however, that the economic structure of the metropolis is quite diverse and has a modern sectoral make-up (with over 70% of jobs in services). In addition to that, diversification attempts are being made (e.g. development of activities in the pharmaceutical sector). The dynamic spatial and demographic development of the city creates a strong demand pressure in regard to technical infrastructure, particularly in transport, the main problems being the "bottlenecks" in public transport: the lack of a speedy connection (metro, railway) with the industrial zone in SICOVAL and with the airport. The complex structure of the administrative units is another important weakness, because it makes necessary elaborate cooperation networks, and this undoubtedly makes the decision-making process unduly long. Another threat to the city's development, also in the context of technical and social infrastructure, is posed by suburbanisation processes, which are difficult to control also because of the complex structure of spatial units.

The main strength of the regional hinterland of the Toulouse metropolitan region is primarily a high quality of life: the scenic landscape, easily accessible basic social services and an extensive transport network which ensures speedy cooperation with the

metropolis. Other assets include the relatively well-developed subregional centres which are the capitals of the departments (with branches of higher education institutions, business environment institutions, modern industries such as for example pharmaceutical industry in Castres, aerospace industry in Tarbes, Figeac and others, La Mecanic Vallée with its heart in Figeac and Decazeville). The region also has a modern, specialised and profitable agriculture (with 6% employment, it generates 5% of the region's exports) and the food industry with some 100 000 jobs (that is, more than the aerospace industry, directly and indirectly) – the competitiveness of these activities receives supports from the public authorities as part of the Agrimp-Innovation scheme. Another strength of the region is its potential for tourism, particularly significant in the southern part of the region: the Pyrénées, with its well-developed mountain tourism (summer and winter) and Lourdes – a pilgrimage tourism centre. Altogether, tourists spend ca. 80 million nights per year in the region, and the tourism sector generates some 45 000 jobs (of which some are seasonal, and 29 000 permanent).

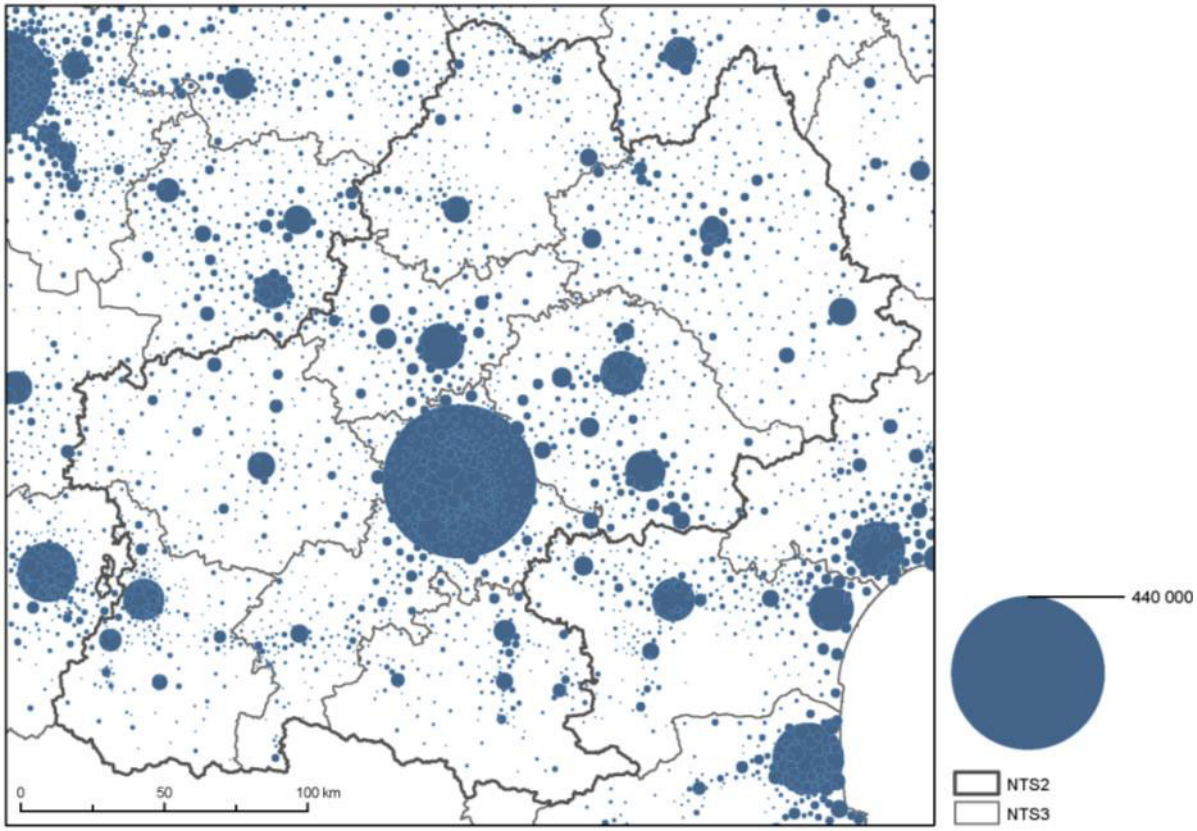


Figure 34. Midi-Pyrénées – population 2006
Source: prepared by the author based on INSEE data.

Among the weaknesses of the region is the structure of the transport network, built around connections with Toulouse, at the expense of inferior-quality connections between the subregional centres (this refers to public and railway transport in particular). Also, the small size of cities other than Toulouse can be considered as a weakness, although not as significant (**Figure 34**). Due to the relatively limited demographic potential of

these cities, the evolution of a polycentric network of cities to balance the influence of the metropolis is not very likely in the foreseeable future.

In the case of the analysed region, the differences between the metropolitan area and its regional hinterland are in a way natural, arising from the characteristics of these areas. The metropolis is a big modern city, whereas its hinterland is rural, with small or medium-sized subregional centres. The aerospace industry, however, is present both in the metropolis and outside its area (see below), so as the chemical and pharmaceutical industries (e.g. Pierre Fabre in Castres). Agricultural activity is naturally present outside the metropolis, although food processing is located both in the metropolitan area and elsewhere in the region. Moreover, despite the concentration of higher education, research institutions and innovative enterprises in Toulouse, they are also present in other cities of the region (albeit obviously on a relatively smaller scale). The living standards of the population are regarded as high both in the metropolitan area and in the regional hinterland. Even though some disparities are visible in the level of education, or the age or income structure (the inhabitants of the metropolis being better educated, younger and wealthier), these are only relative disparities which do not justify any statements on significant structural differences between the two.

4.2. Relationships between the metropolis and the region

Commuting to work

Commuting to work is a factor that connects the region with the metropolis. It can be analysed from two perspectives: flows as part of the metropolitan area and flows between the metropolitan area and its hinterland. The majority of work-home commuting covers travels to work in Toulouse from outside the city. About 110 000 people, i.e. 40% of those working in the city (AUAT 2009), commute daily to work in Toulouse from its metropolitan region. The reverse direction of such flows is also visible, although on a smaller scale: some 35 000 inhabitants of the central city work outside the city, but live in the metropolitan area (the total employment in the metropolitan area but excluding the central city is some 250 000, mostly residents of this area).

Another dimension of these types of linkages are flows of employees in the region, between the major cities. In this case, flows are significant, but on a much lesser scale. For instance, slightly over 8 000 inhabitants of the subregional centres surrounding Toulouse commute to work to the city and its metropolitan area. Castelnaudary is the city with the strongest ties with the metropolis – 10% of economically active population living in this city (and its area of influence – Air Urbaine) commute to work in the Toulouse metropolitan area. This is a particularly interesting example because Castelnaudary is situated outside the Midi-Pyrénées region. This shows the artificiality of administrative boundaries on the one hand and on the other – the power of attraction of

Toulouse. Commuting to work to the Toulouse metropolitan region is also popular in the case of Pamiers and Saint-Gaudens (9% of people in work in each), Montauban (8%), Foix, Saint-Girons, Albi (each 4.5%), Castres (slightly over 4%). The distance within which Toulouse is attractive for incoming employees is about 100 km. Movement in the opposite direction is also visible. Slightly over 5 000 inhabitants of Toulouse and its metropolitan area commute to work to the subregional centres, most of them to Montauban (about 1 800), Albi (800), Pamiers and Castres (500) (INSEE, AUAT 2009).

Aerospace valley – cooperation links

In Midi-Pyrénées, about 55 000 jobs are connected with the aerospace industry (40% directly, 30% indirectly, while the remaining 30% represents employment generated by other types of activity), of which 10 000 are provided by Airbus. Employees in the aerospace industry account for slightly over 5% of all people working in the region (Ruhlmann 2007). The aerospace industry is concentrated in the Toulouse metropolitan area, which offers 3/4 of jobs associated with the aerospace industry in the region. Important aerospace industry centres are also located in other parts of the region. These include in particular: Pamiers, Villefranche-de-Rouergue, Figeac, Tarbes, Louey (cf. Map 3). The aerospace industry is also well-developed in Aquitaine, a region west of Midi-Pyrénées. Both these regions are in fact one functional area of the aerospace industry (and related activities), with over 1 000 companies having strong cooperation links. Its development is stimulated by a dynamic organisation called the "Aerospace Valley", which brings together some 550 enterprises and institutions associated with the aerospace industry situated in both regions (Aerospace Valley, INSEE 2008). This is an aerospace cluster with extensive internal cooperation structures and strong international links, robust R&D facilities and specialised higher education, which is promoted by both regional and national authorities (cf. e.g. Jalabert, Zuliani 2009; Dugot, Laborderie, Taulelle 2008). Toulouse is unquestionably the hub of the cluster, which proves that the metropolis' control functions play a significant role not only in the regional, but also supra-regional context.

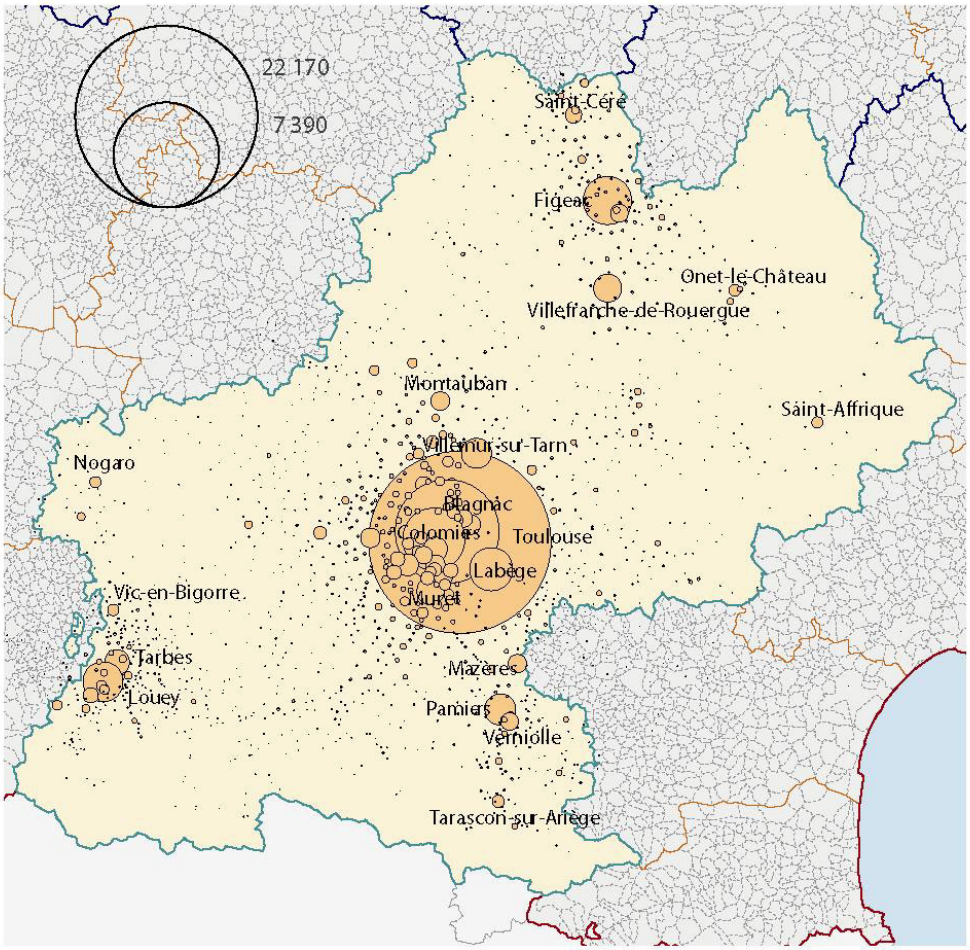


Figure 35. Jobs related to the aerospace sector in 2006.
Source: Ruhlmann 2007.

Higher-order services

Toulouse concentrates many functions which do not occur elsewhere in the region. First and foremost, its is the main academic centre which attracts students from all over the region – higher education institutions in subregional centres offer a small range of specialisations, most of them at the undergraduate level. A similar situation – although on a much smaller scale – can be observed in secondary education; in this case, the range of impact is much smaller than in case of tertiary education (AUAT 2008).

Toulouse is the major centre of specialised medical care in the region – subregional centres have limited specialisations, whereas the metropolis offers a broad range of high-quality medical services and access to specialist medical equipment. The metropolis can also offer consumer goods which are not attainable elsewhere in the region. In addition, the metropolis is the main culture centre which caters to the entire region; this is true in particular for high-culture institutions (theatres, opera, concert halls, museums and art

galleries). Toulouse is also the main transport hub in the region – primarily its international airport, but also long-distance train connections.

Migrations

Significant migration flows can be observed within the region both from the metropolis to the region and in the opposite direction. In 1990-1999, about 55 000 people moved from the region to the metropolitan area, and nearly 40 000 people emigrated from the metropolitan area to other parts of the region. As we can see, the dominant direction was towards the metropolis, which attracted new residents (it should be noted that this trend was visible not only in the movement between the metropolis and the region, but also in general terms: in the period in question, Toulouse attracted over 230 000 new residents, and lost only 130 000 inhabitants). The largest age group migrating to the metropolis are people aged 15-24 (which means that many of them are students; thereby the city's academic function is strongly manifested). On the other hand, most people moving out of Toulouse are in their thirties. Those who migrate from the metropolitan area usually settle somewhere in its vicinity or in the subregional centres. This trend was also noticeable post 2000 (AUAT 2006).

Entertainment and leisure

The region is attractive for tourists and serves as a natural recreational base for the residents of the metropolitan area, both with regard to longer typically tourist travels (especially the Pyrénées), weekend stays (interesting historical small and medium-sized cities), spa tourism, and second homes, as the region's rural areas are attractive leisure and recreation locations. The well-developed infrastructure (which e.g. includes hiking trails, navigable canals, bicycle lanes, skiing facilities in the Pyrénées, and the south-western edge of the Massif Central) fosters the development of tourism. On the other hand, Toulouse is also an attractive leisure destination for the inhabitants of the region, mainly because of its major cultural and entertainment functions.

Relationships of public authorities

Despite extensive centralisation and a complicated, multi-tier system of territorial administration, France has elaborate and efficient mechanisms for coordinating activities and cooperation between different territorial units, especially in the case of urban areas (cf. e.g.: Kaczmarek, Mikuła 2007; Kerrouche 2008). Nevertheless, the system of cooperation between the communes as part of the metropolitan area is characterised by a great deal of freedom (that is, the top-down identification of areas for cooperation is limited). For this reason, there are three large general-purpose associations of communes (see above) in the Toulouse metropolitan area, although it is difficult to find a substantive explanation for this. In this case, the local interests and competitions are the

decisive factors (cf. also Nevers 2002, Nicholls 2005). In spite of these difficulties, and the frequently open competition at the local level, coordination of activities in the metropolitan area is effective and efficient. In the regional dimension, cooperation of public authorities is largely coordinated by the regional authorities, especially with respect to spatial planning.

4.3. Factors shaping the relationships between metropolis and its region

The metropolis and the region are complementary vis-à-vis each other. This complementarity is facilitated by the lack any marked socio-economic disparities with negative consequences. Midi-Pyrénées can serve as an example of a strongly polarised region, with a significant concentration of the population, business activity and services in Toulouse, but at the same time with a considerable attractiveness of the regional hinterland as a place to live, rest and conduct business activity – all this is fostered by a well-developed transport infrastructure, good availability of basic social services, available land for development, as well as modern agriculture.

Diffusion is manifested most distinctly through migration flows. On the one hand, they take place within the metropolitan area (usually in the direction from the central city to the metropolitan area), but on the other, they are also common from the metropolitan area to the region. In 1990-1999, nearly 40 000 people left the metropolitan area and settled down in the region. The destinations of such migrations were as a rule areas located in the vinicity of the metropolitan area as well as the subregional centres and transport corridors connecting them with the metropolis (cf. Map 4). Migrants very frequently maintain strong ties with the metropolis, both with regard to employment in the metropolitan area, and services offered by the metropolis.

The considerable role of migration does not only refer to movements from the metropolitan area to the region. The Midi-Pyrénées region attracts new residents also from other regions, which, coupled with positive natural increase, produces an overall increase in the number of the population in many areas of the region. However, the highest positive dynamics can be observed in the Toulouse metropolitan area and its direct environs, as well as the subregional centres and their suburbs; the demographic development in the corridors connecting Toulouse with the subregional centres, mentioned above, is also well visible. However, an increase in the number of the population is not only limited to urban areas – it can also be clearly observed in some rural areas, e.g. the rural areas of the Lot department, lying at a distance from Toulouse. It should be emphasised at this point that in the case of rural areas we can observe a reversal of the depopulation trend, observable in the second half of the 20th century (AUAT, INSEE 2009).

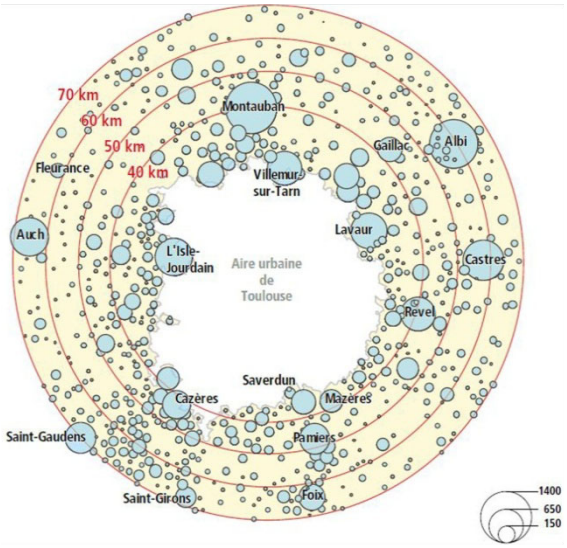


Figure 36. Destination of migrations from the metropolitan area (2000-2006)
Source: AUAT 2006.

An increase in the number of the population is transposed into an increased demand for flats, houses and development sites, and consequently implies price rises. This is particularly well visible in the metropolitan area and its immediate hinterland. During the past decades, the development of transport infrastructure – especially expressways– increased the range of commuting to work in the metropolitan area, and thereby extended the range of impact of the diffusion of development.

Another aspect of diffusion refers to cooperation links of companies from the metropolitan area with companies from other parts of the region. This is most readily visible in activities associated with the aerospace industry (see above), but also other industries such as the pharmaceutical and cosmetics industry. Laboratoires Pierre Fabre, a large corporation operating globally, with EUR 1.8 billion turnover in 2009, can serve as an example of the latter. It has its main seat located in a relatively small (ca. 50 000 inhabitants) city of Castres (in the Tarn department), situated east of Toulouse. The corporation has operated from Castres since 1961 and does not intend to move its headquarters. Still, it has very strong cooperation linkages with Toulouse, particularly concerning R&D aspects, including for example the European Centre of Skin Research, founded and run together with the Paul Sabatier University and the city hospital, or participation in the new project for a centre for cancer research (Cancéropôle) (cf. e.g. Abbot 2005), which is being developed on the site of the AZF plant, the explosion of which in 2001 was one of the gravest industrial catastrophes in contemporary Europe (CIEU 2002; Dechy et al. 2004).

Diffusion is also visible in the stepping up of economic activity outside the metropolitan area. This mainly applies to the growth in retail and office space. In 1999-2004, new trade and office facilities outside the metropolitan area were mostly opened in THE subregional centres and in the transport corridors going out of Toulouse; with a particularly intense development observable in the Toulouse-Montauban and Toulouse-Albi corridors (cf. AUAT 2008).

An important manifestation of diffusion has also been the development of higher education in the subregional centres, promoted by the public authorities. Currently, all the major subregional centres have higher education institutions within their bounDaries. Most of these are branches of colleges and universities from Toulouse, with two notable exceptions, Albi and Tarbes, which have independent technical universities.

In addition to that, the development of the business environment infrastructure is visible in the subregional centres. These facilities can take different forms (such as innovation centres, technology transfer centres, technological platforms, competence centres, etc.), and their activities frequently involve developing cooperation networks between institutions from the metropolis and its hinterland. These efforts have been moderately successful, which is proved by the fact that out of 32 companies which left the regional business incubator, as many as 9 chose their locations outside the metropolitan area, mostly in the subregional centres (AUAT 2008).

The phenomenon of backwashing is much weaker in the region than the diffusion of development. Migrations are probably the most important aspect of backwashing. The metropolitan area is an attractive place to work, live and study, and therefore attracts considerably large numbers of people. In 1990-1990, migration flows between the metropolitan and the region were distinctly favourable for the metropolitan area, whose population increased by over 15 000 inhabitants net (40 000 emigrated to the region, but 55 000 moved from the region to the metropolitan area) (AUAT 2006). Such a tendency has been maintained in the recent years. People who migrate from the region to the metropolis include mainly students and people in working age who take up employment in Toulouse or the metropolitan area (Le Boëtté, Ruhlmann, Laurin 2008).

Migrations and the natural increase result in the growth of the population across the region. However, there can be wide disparities in this regard between the region's individual areas. In the years 1990-2006, a considerable population increase was recorded primarily in the metropolitan area of Toulouse and its direct vicinity, as well as – to varying degrees – in the subregional centres and their suburban zones (here, we can see some analogy with the distribution of jobs associated with the aerospace industry – see Map 3). On the other hand, there was a population decrease in a large part of the region's rural areas (cf. Map 5).

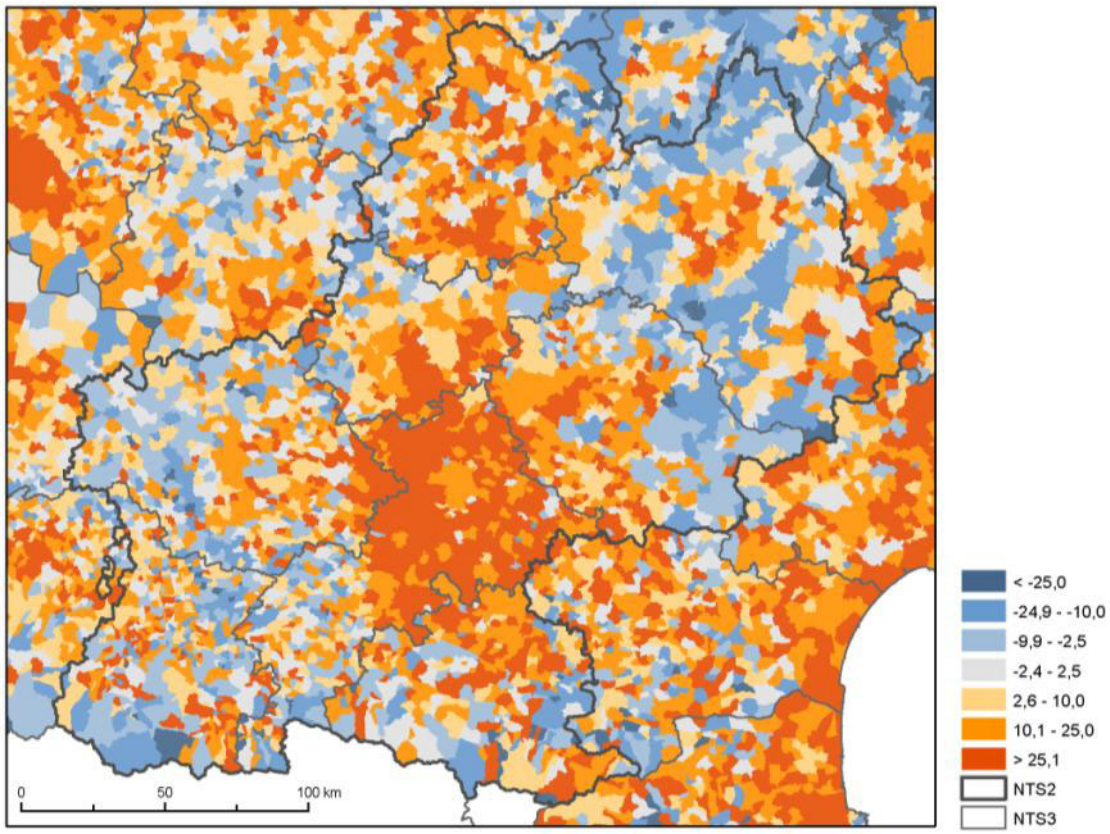


Figure 37. Midi-Pyrénées – population change in % (1990-2006)
Source: prepared by the author based on INSEE data.

A considerable difference in scale between the metropolis and the region undoubtedly fosters the concentration of economic activity in the metropolitan area. However, it is difficult to assess the scale of this phenomenon, especially in view of the clearly visible development of the entire region, both the metropolitan area and its hinterland.

4.4. Mutual relationships between the metropolis and the region

Despite the various aspects of ties between the metropolis and the region discussed above, it can be said that, for Toulouse, the linkages going beyond the region are far more important. This is particularly well visible in the case of modern industries (aerospace, electronics, pharmaceutics), in which the metropolis has a global presence, participates in international cooperation networks (e.g. Airbus parts are manufactured in several European countries) and is subject to global competition. Owing to its relatively small scale, the regional hinterland does not influence the functioning of the metropolis in any significant way. Still, some elements of complementarity could be noticed. The regional hinterland, which provides good opportunities for leisure and recreation, is also an attractive housing location and has plenty of available land for development (a factor which can gain in importance in view of the dynamic development of the metropolis). In

addition to that, a well-developed food sector ensures balance (diversification) to the region's economy.

On the other hand, the region seems to be strongly dependent on Toulouse. This is primarily due to the fact that Toulouse represents an unquestionable centre, whereas other cities in the region cannot offer services available in the metropolis due to their small demographic scale. This dependence, however, is not excessive – the region has endogenous resources which enable it to function – at least to some extent – in isolation of the metropolis (agriculture and food industry, tourism, pharmaceuticals in Castres, textile industry in the departments of Tarn and Ariège, etc.) (cf. Dugot, Laborderie, Taulelle 2008).

Positive results of developmental diffusion prevail in the relationships between the metropolis and the region. To a certain extent, this is a natural phenomenon, but activities of the public authorities which promote such diffusion also play an important part.

4.5. Activities of public authorities in metropolis-region context

Activities of the public authorities are multifaceted and tackle many different spheres. This is possible owing to an elaborate institutional system. However, the activity of its individual players is well coordinated by extensive cooperation structures.

Competition poles

The competition poles policy (Pôles de compétitivité) (cf. e.g. Weil, Fen Chong 2008), pursued since 2004 at the national level, has been an important factor promoting economic development. These are clusters developed at the regional level with financial and organisational supports, aimed to promote regional specialisations while ensuring coordination and complementarity of actions at the national level. Midi-Pyrénées has identified three such poles: the Aerospace Valley (www.aerospace-valley.com), agriculture and food (Agrimp-Innovation: www.agrimipinnovation.com), and cancer research (Cancer-Bio-Santé www.cancerbiosante.fr). These initiatives refer to the regional level and, as such, develop competitiveness both of the metropolis (as a first priority) and of the region. Activities inspired by the central authorities are launched are coordinated by the regional and local authorities, with considerable commitment on the part of enterprises and R&D institutions.

Strategic and spatial planning

The system of development planning is well-developed in the region. The majority of plans are devised at the regional level: Schéma Régional d'Aménagement et de Développement du Territoire – current version from 2009 . Another planning section which is important for the analysed topic is planning for the broad metropolitan area,

comprised of Toulouse, its metropolitan area (Aire Urbaine) and the surrounding areas along with the nearest subregional centres (Aire Métropolitain) (cf. AUAT 2008). At both these levels, the polarisation and diffusion approach. Toulouse is perceived as a growth engine for the region; on the one hand, the planning activity aims to foster the development of the metropolis and facilitate diffusion mainly through reinforcing the potential of subregional centres and on the other to ensure the best possible connections between them and the metropolis.

Higher education

In the past 20 years we have seen a consistent policy aimed to develop higher education in the subregional centres. This has been possible owing to cooperation of the national, regional and local authorities. Currently, academic centres operate in all the major cities of the region, usually as branches of higher education institutions from Toulouse. These initiatives are mostly local in character. The number of students in subregional centres is not large, similarly to the number of courses and specialisations offered. As a rule, the subregional centres offer undergraduate courses (see above).

Economic activity zones and business environment institutions

Economic activity zones (areas furnished with complete infrastructure) are established outside the metropolitan area on the initiative of the regional authorities. Currently, about 30 such zones are either in operation or at the planning stage (Région… 2009). Business environment institutions are also being developed, similarly to specialised institutions focused on innovation (AUAT 2008).

Transport infrastructure

The road infrastructure connecting the metropolis with the regional centres is sufficiently well developed. Currently, initiatives aimed to streamline communication between the subregional centres are under way. However, activities in the sphere of transport infrastructure focus on the modernisation of rail connections between Toulouse and the subregional centres. In this case, the scale of neglect is quite considerable, with obsolete infrastructure and some single-track railway routes. At present, a comprehensive plan for the modernisation and extension of the railway network is under way (Région… 2009).

4.6. The metropolitan area governance

The management system in the Toulouse metropolitan area (Aire Urbaine) is both complicated and not uniform. First and foremost, there is no single authority in charge of the entire area. The metropolitan area is composed of many communes, which may set up general-purpose associations (furnished with broad powers taken over from their constituent communes, but with ensuring the superior and control role of the communes). However, a great deal of freedom in establishing such associations has

resulted in their clearly excessive number (cf. Map 6), and the spatial ranges of the associations hardly correspond to the functional areas (cf. e.g. Lanusse 2006). In the very core of the metropolitan area, there operate 3 associations of communes (see above: PART 1. The Metropolian Region and Its Component Parts). However, spatial planning is currently conducted for a different, more functional division. At present, 4 supra-municipal spatial development plans (SCOT – Schéma de Cohérence Territoriale) are being prepared for the metropolitan area (cf. Map 7), which have been synchronised in the planning document entitled: "InterSCOT de l'Aire Urbaine de Toulouse" (AUAT 2005).

Coordination of activities in such a fragmented institutional structure requires efficient cooperation mechanisms. It should be emphasised that, in this case, these mechanisms work quite well. The planning and coordination of activities in the metropolitan area rests with the Agency for Urbanisation and Spatial Development of the Toulouse metropolitan area (AUAT – Agence d'Urbanisme et d'Aménagement du Territoire Toulouse Aire Urbaine, www.auat-toulouse.org), made up of several public institutions representing different administration levels (both state authorities and local governments).

4.7. Development prospects

In the coming few years, economic development and continued population increase will represent major factors determining the relationships between the metropolis and the region . The demographic and economic development will mainly be concentrated in the Toulouse metropolitan area and the subregional centres, and to some extent in rural areas (in the latter case, some depopulation trends may also be expected in certain areas). The development of the metropolis will increase the extent of its direct influence, which may have some negative consequences in the form of suburbanisation pressure and overburdened infrastructure. Activities initiated by the authorities to strengthen the subregional centres many however prevent such negative phenomena and create conducive conditions for a more polycentric development. Nevertheless, taking into account the wide differences in the scale of the metropolitan area and the surrounding cities, no evolution of a fully polycentric system should be expected in the foreseeable future. Toulouse will remain an indisputable growth engine for the region. This will be fostered by the diversification of economic activity, primarily in hi-tech industries (space, electronics, pharmaceuticals, biotechnology, etc.) and launching a high-speed railway connection (by 2020, a journey to Paris will take about 3 hours). In this way, conditions will be created for a further metropolisation of Toulouse and the enhancing of its status in the European network of cities.

The biggest threat for the city and the region may be posed by a crisis in the aviation industry (but such a risk in the coming years is regarded as minimal). The fall of large

enterprises would entail problems in companies cooperating with them and qould lead to a severe crisis in the labour market in activities directly and indirectly associated with aviation. Such a scenario, however, is neutralised by activities aimed to maintain the competitive edge of the aerospace industry on the one hand, and on the other – to diversify the region's economic structure.

5. City-region relationships: Warsaw – Mazovia case study

Mazowieckie voivodship (province) situated in central Poland occupies an area of 35 600 km^2 and has 5 200 000 inhabitants. There are 85 cities within the voivodship, of which Poland's capital, Warsaw, is the largest. It has a population of 1 700 000, and its metropolitan area has some 2,600,000 inhabitants. Mazowieckie is structured as a hub, being distinctly divided into the metropolitan area of Warsaw and its regional hinterland, which in many cases is rural in character. In the remaining parts of the region, there are a number of medium-sized cities such as: Radom (224 000), Płock (127 000), Siedlce (77 000), Ostrołęka (54 000) and Ciechanów (45 000). Generally speaking, however, the region's rate of urbanisation outside the Warsaw metropolis is low not only in comparison with the highly-developed Western European countries but also with the national average (61.2%).

From the very beginning of economic transition, Mazowieckie voivodship has been a driver of change and a leader of the transformation, and currently is the fastest-developing region of the country. Its privileged position is primarily due to the capital city, which has become the leading centre of the transformation (including privatisation) and has attracted the bulk of USD 125 billion of inward capital invested in Poland (until 2008). In Warsaw, being a seat of transnational corporations, the sector of higher-order services (mostly related to finance and information) has developed to cater to their needs. In contrast, the remaining part of the region trails far behind the capital city and its direct hinterland in terms of the level and dynamics of growth. Low-productivity agricultural sector still dominates in the economy of these areas, and the restructuring of the industrial sector there has been longer, frequently leading to the closing down of enterprises, which has severely affected many local labour markets.

As a result of the 1998 administrative reform, 16 voivodships with mixed system of administrative authority (shared by government-appointed voivode and an elected regional assembly) were formed, Mazowieckie being one of them. The elected regional authorities are responsible inter alia for drawing up development strategies, and since recently (2007) – also for the preparation of the Regional Operational Programme (ROP) which provides the basis for using structural funding assistance from the ERDF.

5.1. The metropolitan region and its component parts

Warsaw, as any big city, has a broad zone of influence owing to its capital city and metropolitan functions. The public administration sector in Warsaw employs 64 000 staff, which accounts for ca. 8% of its entire working population; this does not make it substantially exceptional when compared to other large Polish cities, but the figure is over twice as high as the national average. It is metropolitan functions that are of cardinal importance for the city's economy. This is associated e.g. with Warsaw being a seat of enterprises, including branch offices of transnational corporations which operate across Poland. Their needs are catered to by the well-developed B2B services sector employing 110 000 staff and the financial intermediation sector (58 000 employees) with the highest location rate values in Poland. In addition, Warsaw is the country's leading academic centre (280 000 students) and a city with the greatest concentration of R&D potential. Cultural functions are also well developed, even though other large Polish urban centres are worthy competitors in this sphere. Warsaw is also an important location on the national map of tourist traffic (the largest airport in Poland, handling ca. 9 000 000 passengers per year, but with a growing significance of regional airports), mostly business in character, but with poorly developed facilities for congress tourism.

The Warsaw labour market is both attractive (high salaries) and open (a high degree of diversity). The majority of those who settle down in Warsaw explain their decision to do so by job opportunities offered here. Daily commuting to work is also popular, and its extent goes beyond the administrative boundaries of the voivodship. Two types of commuting can be distinguished: daily travels (which prevail in the belt up to 80 km from the city centre) and weekly travels, with distances in many cases exceeding 200 km.

Although Mazowsze (Masovia) is a region with a long history, its regional identity is not strong. The historical region covered only the northern and central part of what now makes the voivodship, and its boundaries have changed during the ages. In the past, the southern part of Mazowsze belonged to Małopolskie (Lesser Poland) voivodship, and its border running along the River Pilica can still be easily noticed inter alia on the map of gminas' (municipalities) own incomes. Another reason for this deficiency of regional identity is the fact that since it became a capital city in the 16th century, Warsaw has always had relatively weak ties with its direct surroundings. This situation slightly changed towards the end of the 19th century as cooperation linkages grew within the industrial economy.

Mazowieckie voivodship in its present shape came into being as a result of the administrative reform of 1998. The boundaries of all the 16 new regions reflect the spheres of influence of the respective voivodship seats relatively well; this is also the

case of Warsaw. Only small fragments of the neighbouring voivodships belong to the sphere of influence of the national capital (Figure 38).

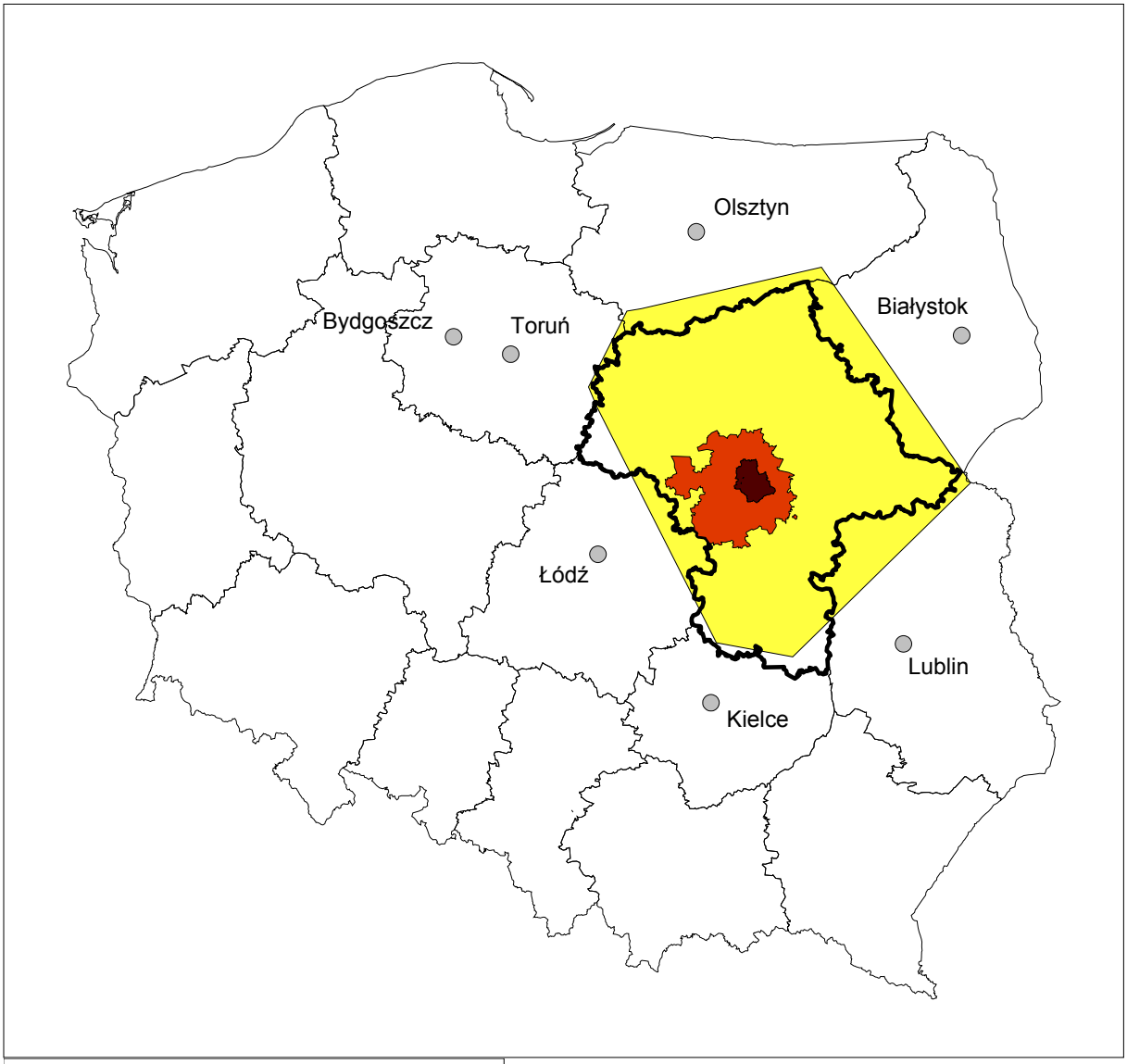


Figure 38. Warsaw and its spheres of influence in the context of Poland's administrative division

Source: M. Smętkowski (2005a).

There are 314 gminas (NUTS5) in Mazowieckie voivodship, which are concentrated in 42 districts - powiats (NUTS4). The majority of analyses delineating the metropolitan area of Warsaw use gminas as the basic delimitation units **(Figure 38)**. Despite some differences between the individual approaches, a metropolitan area is usually enclosed within a 50 km distance from the central city, and its actual shape is determined by the routes of the major transport corridors. This area stretches most visibly westwards and southwards (directions of the main economic linkages), and less so in the eastern direction, which is partly associated with the communication barrier posed by an insufficient number of bridges on the Vistula. In addition to that, the boundaries of the metropolitan area largely overlap with the borders of the former capital city voivodship existing in the years 1976-1998. Unlike the present Mazowieckie voivodship, this administrative unit was not a self-governing one, and its scope of competences was relatively narrow.

The strengths of the Warsaw metropolitan region include a high-quality human capital, expressed for example by the share of people with tertiary education, which is the highest in the country. Secondly, Warsaw has strongly developed nation-wide control functions, which is proved by its being a seat of major enterprises, including transnational corporations. Thirdly, the B2B sector has a considerable share in the metropolitan economy, including e.g. financial intermediation and information services: accounting, IT, advisory services, advertising or public relations. For these reasons, the Warsaw market for office space is booming, and the capital can offer over 3 million square metres of modern office space.

In contrast, Warsaw's weaknesses are the poorly developed external transport links (the city is not included in the trans-European motorway network) and a standard of living which is relatively low when compared to other European metropolises. The latter is compounded by a low quality of the public space and the growing spatial chaos in the suburban zone, propelled by uncontrolled suburbanisation processes. Furthermore, despite the robust R&D potential, linkages between science and business have so far been weak in Warsaw and failed to produce any synergy effects.

When compared with Warsaw, its regional hinterland hardly shows any strengths. Instead, certain and as yet unutilised development opportunities may be indicated: firstly, those associated with the existence of large subregional centres, which in the future (e.g. following the development of transport links) could serve as supra-local growth poles. Secondly, some of the region's areas have favourable conditions for specialised market-oriented agriculture. In addition to that, some potential for tourism

can be observed in several locations, also based on agri-tourism farms and associated tourist products.

The weaknesses of the regional hinterland of the Warsaw metropolis include a considerable role of subsistence agriculture. Also, due to excessive employment in this sector, the voivodship is struggling with a high hidden unemployment rate. On top of that, the non-metropolitan part of the region is not very attractive for investors from Poland and abroad, which can be attributed to low-quality human capital and poor transport accessibility. The resources needed for endogenous growth are rather limited and in effect the SMEs sector outside the Warsaw metropolis is not very well developed.

The above review of the strengths and weaknesses points to a distinct dichotomy of socio-economic structures existing between the metropolis and the region. As a result, Mazowieckie is one of Poland's regions characterised by widest internal disparities. Apart from development disparities (GDP per capita 2 to 1), this dichotomy between the metropolis and region is well visible in the economic structure, mostly the divergent shares of farming activity in the labour market. Furthermore, it should be observed that Warsaw's economic structure has been coherent regardless of the indicator applied, i.e. the number of employees or gross value added. On the other hand, the remaining part of Mazowieckie voivodship is characterised by a large share of agriculture (excluding hidden unemployment in agriculture) with lower productivity (53% share in the employment structure and 9% share in gross added value). In addition to that, in comparison to Warsaw, the region shows a relatively higher significance of industry – mostly in traditional industrial sectors. Other major differences included the quality of human capital: whilst in Warsaw the percentage of people with higher education represented ca. 30%, it did not exceed 1% in some rural gminas of Mazowieckie voivodship.

5.2. Relationships between the metropolis and the region

Commuting to work

Commuting to work belongs to basic linkages between the Warsaw metropolis and its regional hinterland. The scale of daily commuting to Warsaw is high, and estimated at some 170 000 people (about 20% of the city's employees), while only 12 000 employees move in the opposite direction. It should be pointed out that the rate of daily commuting to work has a strong negative correlation with the physical and temporal distance from the centre of Warsaw. The distance beyond which weekly commuting begins to prevail over daily commuting (which involves renting accommodation in Warsaw) may be set at ca. 80 km from the centre of Warsaw, with the time of travelling by passenger car of 95 minutes. Daily commuters usually travel from gminas situated in the close vicinity to Warsaw. Such commuting involves transfer of incomes, which may lead to the

development of the endogenous sector in a given gmina. In addition to that, commuting increases budgetary revenues of gminas through personal income tax. On the other hand, less developed and more distant gminas serve as providers of cheap labour for Warsaw, with most such travels done at weekly intervals.

Migrations

Migration flows are partly correlated with commuting to work, discussed above. Migrations in Mazowieckie comprise two segments. The first segment refers to the outflow of inhabitants from the central city which began in the early 1990s and involves suburbanisation processes in the suburban zone. Its larger part is directed to gminas surrounding the city; in 1988-2002, they received ca. 70% of 114 000 former Warsaw residents. As a rule, these people maintain close links with Warsaw, starting from work to education, culture, leisure and daily shopping. A mere 10% of people who had earlier had permanent residence in Warsaw moved to other parts of the region. On the other hand, the majority (63%) of the population incoming to Warsaw (151 000) came from peripheral areas of Mazowieckie voivodship. This particularly applies to people with tertiary education aged 24-30 (29 000), whereas gminas of the remaining part of the metropolitan region accounted for 76% of the inflow to Warsaw.

Trade exchange between businesses

Warsaw's metropolitan area played a considerable role in Poland's foreign trade turnover, which accounted for ca. 30% share in the imports of goods and services and ca. 16% share in exports. Imports which are twice as high as exports distinctly point to the intermediary function of Warsaw enterprises in foreign trade, which to some extent was a corollary to the location of foreign trade enterprises supplying the nation-wide market in Warsaw. At the same time, the 2002 survey of companies with locations within the Warsaw metropolitan area showed that the metropolis' regional linkages were poorly developed. The remaining part of Mazowieckie voivodship had a marginal (less than 10%) share in the supply and sales of enterprises outside the local market – usually lower in the case of more processed goods or specialised services (Gorzelak, Smętkowski 2008).

Higher-order services for individuals

Warsaw's higher education institutions were very popular with secondary school leavers from Mazowieckie voivodship. The rate of this type of commuting to Warsaw was the highest within a 60 km radius from the city centre. The role of this type of commuting increased in nearly all gminas of the region as compared to the period prior to 1989. This

can be viewed as a proof of the growing educational aspirations in the society, coupled with a significant role of Warsaw as the leading academic centre.

Warsaw's institutions of culture were also popular with the residents of other gminas of the metropolitan region. Nevertheless, the intensity of commuting for cultural purposes was not as strong as in the case of student commuting. It was clearly visible within a radius of 30 km from the city; less so at a greater distance, and beyond the threshold of 60 km this type of commuting was only episodic.

The role of Warsaw as a centre of medical services was smaller in comparison with the above types of commuting, and applied only to some of the region's areas.

Entertainment and leisure

Journeys of Warsaw residents outside the city for entertainment and leisure purposes can serve as an example of movement in the opposite direction. This type of commuting as a rule involved the construction of holiday homes, which in many cases represented densely built-up enclaves in places with outstanding natural assets – most frequently in river valleys. The intensity of such travels decreased visibly as the distance from the city increased; this phenomenon did not occur at all in gminas situated at the north-western, southern and eastern borders of Mazowieckie voivodship. The rate of commuting was the highest within a 90 km radius from the centre of Warsaw, particularly in the gminas bordering on the metropolitan area. At the same time, competition from more distant areas of the country should be emphasised, especially from Warmińsko-Mazurskie voivodship.

Relationships of public authorities

Mazowieckie voivodship provides a good example of how national policies affect the relationships between various actors responsible for the region's development. The capital's decision-makers are seriously involved in national-level politics, and the office of the mayor (or commissioner) as a rule is held by politicians with careers in the government, presidential election runners or leaders of major political parties. On the other hand, since 1998 the position of the marshal who is responsible for regional government has been held by a politician affiliated with the Polish People's Party (PSL), which is a farmers' party. This leads to political rivalry, manifested inter alia during the process whereby the principles for allocating the Regional Operational Programme funds are agreed. Quite frequently, the exercise is biased in favour of entities operating in the non-metropolitan parts of the voivodship. Apart from very few examples such as a joint ticket for city public transport (Warsaw's authorities) and regional railways (the region's authorities) for journeys within the agglomeration and the Mazowsze Loan Guarantee Fund (*Mazowiecki Fundusz Poręczeń Kredytowych*), there are no initiatives of projects to be implemented jointly by the city and regional authorities. The relationships between

public authorities and enterprises are similar in character; it is difficult to indicate effective communication channels between them or joint public and private initiatives.

By contrast, more examples can be found to illustrate the well functioning cooperation networks between gminas in different areas of activity, starting from access to public services to joint infrastructure projects to development planning (Zegar, 2003). Inter-municipal cooperation is relatively the least developed between Warsaw and the neighbouring gminas. This is an area fraught with most serious conflicts of interests. Nevertheless, successes are possible, e.g. the recently introduced joint public transport ticket for the Warsaw agglomeration, co-financed by the gminas from the metropolitan area – but based on bilateral agreements with Warsaw, and not negotiated as an initiative of a coalition of gminas formed for this purpose.

5.3. Factors shaping the relationships between metropolis and its region

The key factor affecting the linkages between the metropolis and the region involves the structural mismatches described above, which relate to the social and economic spheres. The Warsaw metropolis operates in a global network of information economy, which is also its source of major development resources. In this regard, the attractiveness of endogenous resources in the other parts of Mazowieckie voivodship is rather small. In addition, owing to inefficient agriculture in the vicinity of the city, even the traditional food-producing zone is poorly developed in the region. Its role is decreased even further by the development of large-format retail trade facilities in Warsaw, which considerably expands the range of services to the city in terms of food provision. In addition to that, barriers related to an insufficient capacity of the existing transport network obstruct the development of strong linkages between the metropolis and the region. In effect, the accessibility of the region's peripheral areas is limited, which further reduces their attractiveness for private investors.

In these circumstances, it is difficult to maintain the region's cohesion politically as the huge differences in the electoral make-up hamper the consensus between the different local government levels. This situation also makes it difficult to implement a pro-development policy for the entire region despite the fact that the marshal's office is furnished with all the requisite competences.

As all these factors are closely interrelated, the traditional central functions play a minor role in Warsaw's economy on the one hand, and on the other – the region so far has not been able to make use of potential benefits associated with the development of the country's key metropolis.

Manifestations of the spreading of Warsaw's development processes are rather limited spatially and usually take place within its metropolitan area. The major indications of

such processes included the relocation of enterprises or the opening of branch offices in the gminas situated near Warsaw. For instance, the range of foreign investments has been restricted to the area within a 30 km radius from the city. **(Figure 39a)**. Certain structural differences are also well visible in this area: while service sector investments prevail in the central zone, manufacturing, logistics and storage activity is developing in the region's peripheries. This specialisation is also manifested by the fact that some service enterprises operating in the environs of Warsaw move their head offices to the capital. In addition to that, investors interested in conducting business activity outside Warsaw very frequently register their company in Warsaw and in many cases (also for marketing purposes) also locate the company's seat in Warsaw.

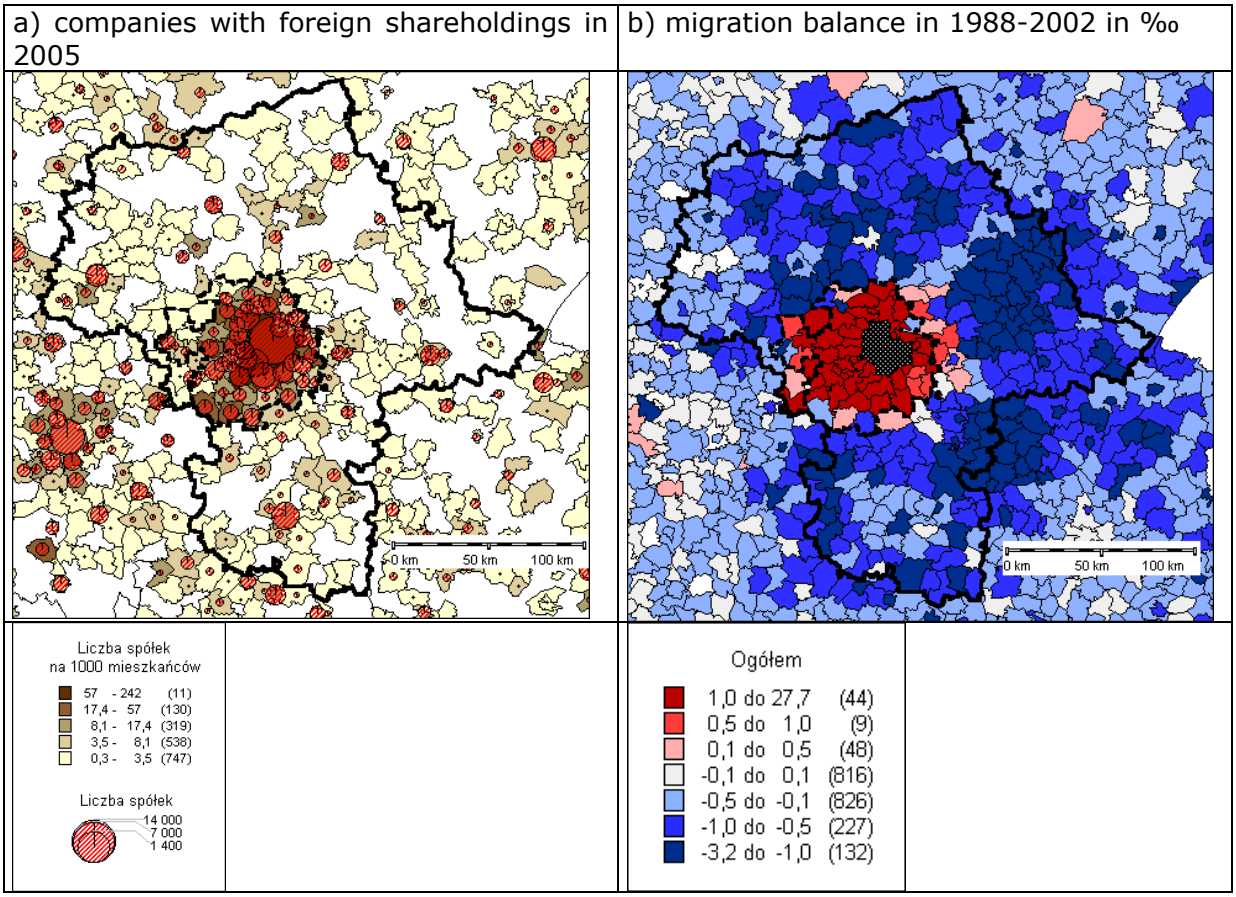


Figure 39. Development dynamics of the gminas in Mazowieckie voivodship
Source: M. Smętkowski (2005b).

Another symptom of diffusion processes is the outflow of residents from Warsaw in search of better housing conditions. Gminas situated in the immediate vicinity of Warsaw are usually chosen by people in working age who maintain close ties with the city, mostly in the form of commuting to work. On the other hand, areas situated further from the city centre are selected by people in post-working age, which is partly due to their earlier family ties with a given area. Nevertheless, it should be pointed out that the gminas situated in the close vicinity to Warsaw played a major role in the population outflow

from the capital (mostly with higher education), followed by other Polish metropolises or the capitals of the neighbouring voivodships. In this respect, the role of the main subregional centres of Mazowieckie voivodship was only marginal.
Furthermore, daily commuting to work in Warsaw played a certain role in capital transfers from Warsaw to peripheral areas, but their greatest intensity was basically limited to the metropolitan area.

Based on the map showing the migration balance between Warsaw and the remaining gminas (Figure 39b), we can say, with respect to the number of the population in these gminas (net rate of migration), that the negative balance could mainly be observed in the gminas lying within the radius of 150 km from Warsaw. In this area, gminas situated near the subregional centres had a relatively low net balance of migration: north-west of Płock and south of Radom, and along route no. 8 north-east, towards Białystok. On the other hand, two compact areas with a considerable outflow of population to Warsaw were clearly visible in the east of the region, and two less compact ones in the north and the south of the voivodship. Isolating the group with higher education (including those aged 24-30) from migratory outflows did not have any significant influence on this picture.

The gminas characterised by a high negative balance of migration with Warsaw are as a rule less developed. As a result, they function as sources of cheap labour for Warsaw, mostly commuting at weekly intervals. In this case, the relationship between commuting and the level of development is bilateral in character. A low level of gmina development and a weak local labour market prompts the local residents to emigrate in search of work. The barriers that hinder a steady migration outflow include high costs of housing and living in Warsaw. For this reason, some migrants rents flats (rooms) in Warsaw and return to their families on days off work. However, such migratory outflows may have negative consequences related to spending a large part of their income in Warsaw, and – in the long term – it may lead to a steady outflow of some residents to Warsaw and the resultant capital transfers for real property purchases.

5.4. Mutual relationships between the metropolis and the region

From the perspective of the metropolis, the linkages between the metropolis and the region were weak and irrelevant. Regional concentration processes dominated in Mazowieckie voivodship both in absolute and in relative terms, expressed by the concentration of jobs outside agriculture mostly in the metropolitan service sector. In contrast, deindustrialisation processes more strongly affected Warsaw's metropolitan area, which led to a relative increase of production functions elsewhere in the metropolitan region. Nevertheless, the role of the regional hinterland in providing supplies for Warsaw's enterprises was rather marginal and largely limited to simple products, with little added value. Similarly, labour force from the regional hinterland in

many cases lacked necessary qualifications to be able to participate in the mainstream of development associated with the increasing role of specialised services. In addition, deconcentration of business activity and locating branch offices of Warsaw's enterprises as a rule did not reach beyond the borders of the Warsaw metropolitan area. On the other hand, the region's non-metropolitan areas most frequently provided locations for traditional and most noxious types of activity, e.g. cement industry.

The development of the Warsaw metropolis opened a window of opportunity for its regional hinterland, but it was not fully utilised. For instance, in the case of the population with higher education, processes of a relative regional deconcentration could be observed, which however was mostly due to the development of subregional academic centres. At the same time, development diffusion processes associated with shuttle migrations of the population (including daily commuting to work) were limited in scope to the gminas neighbouring with the metropolitan area, mostly those situated in transport corridors. Their positive impact was largely reduced by commuting to work on a weekly basis, which was mainly the case in gminas situated in the region's periphery. The capital balance of the remaining types of commuting suggested their centripetal character, which in turn increased the trade exchange deficit and was only partially offset by entertainment and leisure travels of Warsaw residents and the resultant development of construction activity. This was associated by the deficit of the metropolitan region in trade exchange with the metropolis, both with regard to simple and processed resources.

To sum up, the economy of Warsaw was characterised by a considerable degree of diversity, with a growing significance of specialised B2B and financial intermediation services, and the diminishing production activity. The role of the service sector was much smaller in the case of Mazowieckie voivodship, which however did not entail any clear sectoral specialisation in manufacturing. In effect, the development paths of the metropolis and the region were not significantly intercorrelated, although the region could to some extent benefit from the development of the capital city.

5.5. Activities of public authorities in metropolis-region context

In the recent years, the regional government of Mazowieckie voivodship prepared a number of strategic and operational documents outlining key policy directions for the region's development. These documents correctly identified the voivodship's strengths and weaknesses while clearly indicating the dichotomy between Warsaw's metropolitan area and the remaining part of the region. The planned projects are expected to gradually close development gaps between the metropolis and the region. The planned activities may be divided into financial instruments addressed to enterprises and local governments, and investment tools related to the development of "hard" infrastructure, intended inter alia to boost Warsaw's positive impact, as well as "soft" initiatives" aimed

to foster the development of human resources, which can help reduce the results of the backwashing of development resources from the regional hinterland to the metropolis.

Financial instruments

At the national level, a map of regional assistance was drawn up to limit public support for enterprises. In the case of the Warsaw metropolis, this cap is set at 30%, as compared to 50% in other parts of Mazowieckie voivodship. In addition to that, the Regional Operational Programme adopted by the regional government allocated 23.5% of its EUR 1.8 billion budget to the development of enterprise and innovation. The disbursement of these funds depends to some extent on the terms of calls for tenders, which in many cases include provisions giving preference to projects and beneficiaries located in peripheral or rural parts of the region. Nevertheless, the effectiveness of these activities has not been staggering so far, and most active are companies operating in the Warsaw metropolitan area.

Moreover, the national system for the financing of territorial self-governments uses an equalising mechanism whereby some of the wealthiest gminas' own revenues are transferred to the poorest gminas. This severely affects Warsaw which in effect loses some EUR 250 million every year, with the city budget totalling ca. EUR 3.5 billion.

Infrastructural projects

The development of transport infrastructure largely rests with the national authorities. The network of modern roads and railways in Mazowieckie region is rather poorly developed. Some progress could be observed in this regard in the recent years as several sections of dual carriageways were opened for use. However, an effectively functioning transport network is still a far cry. The rail transport has also been neglected, which is due not only to tardiness in the implementation of infrastructure investments (despite EU co-financing, which allowed for repairing some major rail lines in the east-west direction), but also to deficient organisation skills, manifested by poorly matching the railway offer with the needs of passengers. This, coupled with the obsolete rolling stock and depreciated railway stations, makes competing against public transport providers difficult. Furthermore, several public carriers use the railway infrastructure, including the Mazowieckie Railways (*Koleje Mazowieckie*) run by the regional government, and this – with a small degree of coordination in these activities – does not serve to improve the quality of the offered transport opportunities.

Education

Activities planned nation-wide in education (Human Capital Operational Programme) include inter alia the strengthening of the education system in rural areas, also by extending the pre-school experience to include children aged 3-5. The ROP allocated ca.

9% of the budget (EUR 164 million) to human resources development, and the main anticipated areas of activity include: increasing social cohesion, equalising development opportunities and supporting structural changes in rural areas.

It should also be observed that the recent years have seen a rapid development of public higher education institutions in the subregional centres of Mazowieckie voivodship (considerable increase in the number of students). This was supported by private investments and led to the establishment of a number of non-public higher education institutions, which serves to broaden the educational offer but at the standard of teaching that is frequently questioned.

Summary

The results of activities discussed above have so far been modest, and their coordination may be summarised as mildly satisfactory. In effect, they have not made any significant contribution to the development of linkages between the metropolitan centre and the remaining part of the metropolitan region. It should be remembered however that a large part of the plans and projects have not been launched or completed yet. The disbursement of cohesion policy funds in the years 2007-2013 may considerably change this picture. However, the short period set for the implementation of operational programmes in this financial perspective does not allow for their comprehensive evaluation.

5.6. The metropolitan area governance

The discussion on the creation of metropolitan areas in Poland has been going on in Poland since 2001, when the amendment to the Spatial Planning and Management Act was enacted, pursuant to which such areas should be delineated as part of the National Spatial Arrangement Policy (KPZK). Irrespective of the still ongoing work on the KPZK and work on the draft bill on metropolitan areas, the crucial issue on whether metropolitan areas should be instruments of regional policy or exclusively elements of spatial policy still remains unresolved. The debates so far have primarily focused on identifying the number of metropolitan centres, rules for delineating their boundaries, as well as the scope of competences and governance. Currently, it is difficult to predict what general and specific decisions will ultimately be made in this matter.

Regardless of the lack of central solutions, in the light of the legislation in force, gminas in Poland may set up special-purpose associations of their own accord for addressing specific issues or making use of development opportunities. In the vicinity of Warsaw, however, propensity to cooperate is not particularly great, particularly in comparison to the environs of other cities e.g. Wrocław or cooperation of cities making up the Silesian conurbation.

As shown above, in the recent years a number of concepts concerning the delimitation of the Warsaw metropolitan area have been prepared. None of them, however, is legally binding. Work on this issues is currently under way i.e. at the Mazowsze Bureau for Regional Development, which reports to the regional self-government authorities.

As a result of bilateral agreements between Warsaw and individual gminas in its direct vicinity, a joint public transport ticket has been introduced for a large part of Warsaw's metropolitan zone. The agreements inter alia laid down the rules governing participation of gminas in the operational costs of the system, which are covered from ticket sales only in 40%. In this particular project, it was possible to reconcile the interests of the city authorities (buses servicing the areas outside Warsaw's administrative boundaries) and the regional self-government (regional railways) in the metropolitan area. Work on continued integration of the transport system is now under way.

The regional self-government authorities are also responsible for the adoption of the spatial development plan for the Warsaw metropolitan area. However, many different problems are associated with planning at the local level. So far, only a very small area of the gminas making up Warsaw's metropolitan area (ca. 3%) have valid local spatial development plans, and work to prepare such plans in the remaining gminas is proceeding slowly. In Warsaw alone, less than 20% of the city's area have valid local spatial development plans. In this situation, it can hardly be expected that the spatial development plan for the metropolitan area, if adopted (at the moment, no guidelines for this have been issued as yet), could change this picture in any significant way.

5.7. Development prospects

In the coming years, further increase in the development disparities between the Warsaw metropolis and the surrounding region can be expected. In many cases, the scale of disparities between the metropolis and the region is so huge that it hampers any potential opportunities to make use of the complementarity of their socio-economic structures. In other words – Warsaw and its surroundings increasingly operate in a modern information economy, while the region as such – in traditional agriculture and industrial economy. In effect, it seems that only large-scale migration flows could, in the long term, partly reduce the scale of the present disparities in the level of economic development. As regards Warsaw itself, it can be expected that its internationalisation will be further increased and its position in the European and global network of cities will be strengthened even more. This will have a specific impact on the situation of the surrounding region which – considering the development mechanisms outlined above – may develop according to three general scenarios described below,

According to the first scenario, the regional hinterland will be depopulated owing to the migratory outflow to Warsaw, coupled with population ageing processes. The speed of

this process will largely depend on the development of residential housing in Warsaw and the speed at which the polycentric structure of the metropolitan area will evolve as it affects better accessibility of cheap housing. In the long term, the decreasing population and the growing quality of human capital may lead to a relative increase in the wealth of the population living in other parts of the metropolitan region.

The second scenario envisages the development of transport infrastructure, leading to enhanced internal cohesion of the metropolitan region. Together with the development of the polycentric structure of the metropolitan region in terms of jobs, this could foster the increase of daily commuting to work and eliminate commuting on a weekly basis. In addition to that, increased accessibility may encourage investors to establish new companies in locations outside the metropolis, mainly in the largest subregional centres.

The third scenario involves a transformation of the social and economic structure of non-metropolitan areas through human capital investments and increased availability of modern technologies. This in turn could trigger endogenous development processes, especially in subregional centres provided with the requisite infrastructure, and could halt the widening of developmental disparities between the metropolis and the rest of the region.

All the above scenarios are based on contemporarily observable development mechanisms, which suggests adopting the polarisation and diffusion model as the basis for considerations about the region's future. In the event there is no intervention of the public authorities, the first scenario is the most plausible. The remaining two depend on giving a specific direction to the public intervention and its coordination with the activities of the local authorities, particularly within the metropolitan area, and with the policies pursued by the authorities of the region's major urban centres.

6. Comparison of case studies: towards synthesis

6.1. General characteristics of the analysed metropolitan macroregions

The analysed macroregions operate within dissimilar administrative structures. Two of the cities covered by analysis, Stockholm and Warsaw, were state capitals, while the remaining cities were regional centres. To some extent, this affected their functions: as a rule, the capital city status was associated with a greater diversification of the economy, while the regional centres were more specialised. The surveyed metropolitan macroregions corresponded to NUTS2 units or aggregated NUTS3 subregions, and reflected the range of the central city's dominant influence relatively well. The relatively widest mismatches in this regard could be observed in the Glasgow region, in the case of which the functional linkages were both complex and historically varied, which was mostly due to the close proximity of Edinburgh, and also to the diversity of the

geographical environment (differences between the northern and southern parts of the region). Except Catalonia, the close correspondence between the administrative division and the functional ties did not imply the existence of a strong regional identity; for this reason, regional identity did not play any key role in the linkages between the metropolis and the region.

The disparities in the development level between the metropolis and the region were the widest in the case of Mazowsze, in which there was a clear "divide" between the metropolitan region and the more distant regional hinterland of Warsaw, manifested inter alia by the different economic structures (services in the metropolis vs. agriculture and traditional industry in the regional hinterland) and the quality of human capital. A similar situation could be observed in Scotland where the Glasgow metropolitan region was historically strongly industrialised (metallurgy, ship-building, engineering, and earlier hard coal mining), whereas the regional hinterland of the metropolis was much less industrialised. On the one hand, this implied a need for a thorough restructuring of the metropolis, but on the other hand the level of education and qualifications of people, also due to the presence of higher education institutions, was much higher in the centre of the macroregion. Similarly, in the Stockholm macroregion, intraregional disparities were on the increase, which was a result of the industrialisation of the non-metropolitan part of the region and necessitated the restructuring of traditional sectors, as opposed to the economy of the metropolis with a robust service sector, including well-developed IT and financial services. On the other hand, there was a visible social polarisation of the metropolitan area itself regarding the class and ethnic dimensions. In the case of Midi-Pyrénées, the disparities between the metropolis and the region were also wide, which was primarily due to the concentration of higher-order services in Toulouse. At the same time, social differences associated with the quality of life were relatively small. The most interesting situation could be observed in Catalonia, where – despite the disparities in the economic structure – the development level was similar throughout the entire metropolitan macroregion, and in some non-metropolitan local systems it was even higher than in the metropolis itself. The reason for this uncommon situation is widely believed to be the (now completed) process of depopulation of the remaining parts of the region due to the dynamic industrialisation and urbanisation of the core of Catalonia. In effect, the population decrease, coupled with the modernisation of the non-metropolitan economy, not only resulted in a statistical increase of per capita income but also in the real improvement of the quality of life.

The strengths of the analysed metropolitan areas were primarily connected with their international significance. In case of Stockholm, the R&D and hi-tech sector was such a strength, in particular the ICT, biotechnological and the technologically advanced automotive sectors, associated with the presence of large transnational corporations of

domestic origin. In Toulouse, it was the well-developed aviation industry and the developing space industry, supported by the R&D and academic potential. By contrast, as early as the 19th century, Barcelona was one the major industrial centres in Europe which, coupled with its role as an important trade and transport centre in the western part of the Mediterranean Sea, accorded it a crucial position in Spain. Currently, Barcelona is also a major culture and tourism centre. Both these sectors are believed to supersede traditional industrial sectors, which, however – despite the serious initiatives undertaken to this end for a number of years now - to date have not been replaced by hi-tech sectors. The role of Glasgow was determined by the gradual reworking of the city's image associated with the overcoming of the negative consequences of the collapse of traditional branches of industry. At present, efforts are aimed to foster development in 8 strategic sectors (natural sciences, energy, financial services, tourism, creative industries, food industry and electronics), which is hoped to foster transformation towards a knowledge-based metropolis. On the other hand, in case of Warsaw, the high development dynamics accompanying the influx of foreign capital was of crucial importance, so as the control and management functions performed nation-wide by the capital city owing to well-developed human resources.

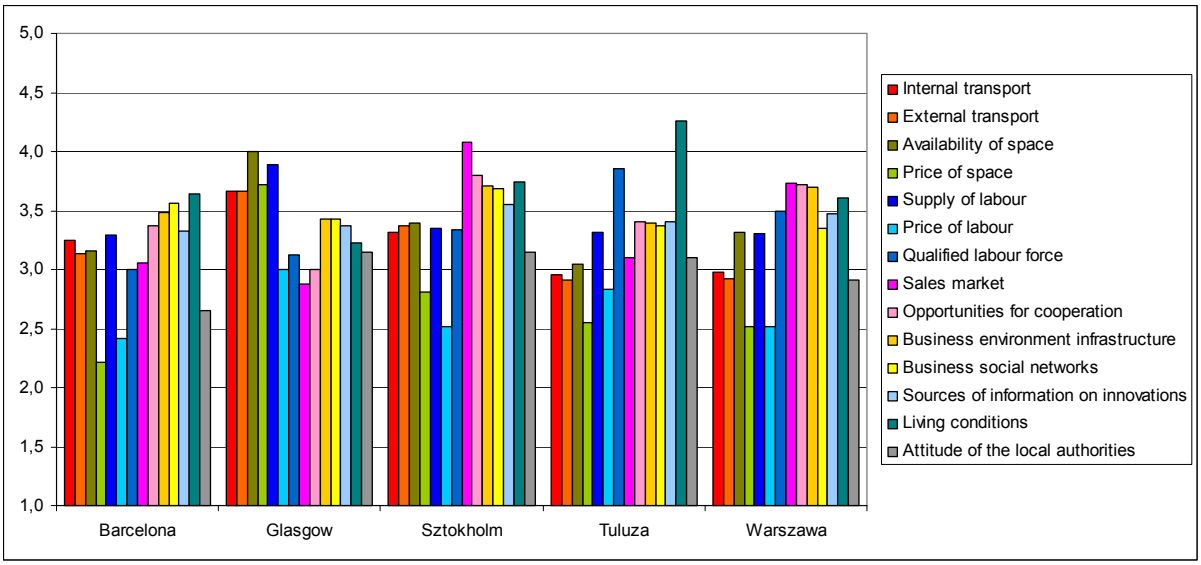
In most cases, the weaknesses of the metropolis were associated with difficulties and limitations in using the international potential. The weaknesses of Warsaw included the poorly-developed external transport links (the city is not included in the trans-European motorway network), and also the relatively low standard of living when compared to other European metropolises. The latter aspect was aggravated by the low quality of public space and the growing spatial chaos in the suburban zone, caused by uncontrolled suburbanisation processes. In addition, despite its significant R&D potential, the linkages between science and the business sector were weak in Warsaw and did not produce any synergy effects. In contrast, Glasgow was still struggling with its industrial past and the negative effects of the restructuring process (for more information see Box 1). On the other hand, the problems experienced by Stockholm were side-effects of the fast and stable growth of the city in the last two decades and the position achieved in the process, manifested by an excess of demand over supply in the housing market, which in effect led to increases in purchase prices of the real estate and rent rates. Paradoxically, this in consequence resulted in lowering the standards of living because in spite of the highest salaries in Sweden, the metropolitan region of Stockholm is characterised by one of the highest shares of housing expenses in the salaries of the population. Furthermore, this fuels the ongoing social polarisation which also has a spatial dimension, and causes difficulties in the labour market integration of immigrants. In Toulouse, inferior transport accessibility (by comparison with the neighbouring metropolises of Bordeaux and Montpellier) is a certain drawback, especially the lack of high-speed railways connecting

the city with Paris and Spain (which is offset to some extent by a well-developed network of airline connections). On the other hand, Barcelona has not been able so far to develop the hi-tech sector so as to replace traditional industrial branches. The problem of Barcelona also affects the city; here, for some years now, efforts have been made to bring in domestic and foreign services and hi-tech companies to the old industrial district (eastern Barcelona), but so far it has mostly attracted office blocks and some hotels. For reasons which are not clearly understood, modern companies and foreign investors are definitely more willing to locate their business in Madrid. The local experts emphasise that not only new, significant investors omit Barcelona, but also major companies, once located here, are moving elsewhere. On the other hand, the traditional industry centres (deconcentrated many years ago) from the so-called Arc surrounding Barcelona are now undergoing an accelerated process of deindustrialisation and unemployment increase.

Box 1. Restructuring of the Glasgow metropolitan area

The economic restructuring of the Glasgow metropolitan area not only brought about adverse social consequences in the form of structural and long-term unemployment (poverty, break-up of families, health problems), but also made it necessary to remove the remnants of industrial past associated with environmental degradation (contaminated soil, post-industrial areas). Until the 1970s, new investments were located in areas with a considerable availability of "greenfield" sites, in particular in the so-called "New Towns" (East Kilbride, Cumbernauld and Irvine). However, from the 1980s onwards, efforts have been made to develop degraded, "brownfield" areas for both housing and industrial purposes. These weaknesses of the Glasgow metropolitan area associated with restructuring negatively affect the city's image, which is undoubtedly one of the factors hampering the location of large international companies in the metropolis.

Regarding attractiveness of the metropolitan area for new investment we can conclude, based on the questionnaire surveys of enterprises **(Figure 40)**, that in all the metropolises (including Warsaw), the costs of labour and costs related to the purchase or lease of space needed to conduct business activity were evaluated the most negatively. In addition, entrepreneurs were rather sceptical about the positive attitude of the public authorities regarding the creation of conditions conducive for new investments (this aspect was ranked the lowest in Barcelona and Warsaw). On the other hand, the conditions and standard of living in all the metropolitan areas belonged to the most highly evaluated aspects of their competitiveness (particularly in the case of Toulouse).



* From: 1 – very poor, to 5 – very good / results for Glasgow for a small sample (N=10)
Figure 40. Evaluation of the attractiveness of the metropolis for new investment*
Source: prepared by the author.

There existed certain differences between the surveyed metropolises in the evaluation of some of the remaining location factors. In Barcelona, the quality of life was viewed by the respondents as the most important of "soft" factors, and transport infrastructure as the most crucial among "hard factors". In Stockholm, entrepreneurs paid special attention to the size of the sales market, coupled with a well-developed transport infrastructure (both external and internal) and extensive social networks in business. Toulouse – the smallest of the analysed metropolises – was most highly evaluated in terms of the quality of life, and the quality of labour (the greatest difference in comparison to labour supply). On the other hand, in case of Toulouse, the size of the local sales market and the development level of the transport infrastructure were evaluated as the weakest. In Warsaw, the sales market played an important role, whereas the development level of the transport infrastructure was regarded as weak. In addition, among soft location factors, accessibility to information on innovation and the development level social networks in business were evaluated as weak.

In some macroregions, the regional hinterlands of cities had few advantages when compared to the metropolis (Warsaw, Glasgow). In these cases, certain development opportunities could be indicated, most of them connected with the strengthening of the subregional centres through investments in transport and telecommunication and IT infrastructure. Secondly, some opportunities could be seen in the utilisation of their endogenous potential: agriculture, tourism and renewable energy. In case of the remaining macroregions, the strengths of the regional hinterland included in particular a high quality of life associated with high-quality infrastructure. Among more specific

strengths, we can indicate high work culture in the case of the Mälar region, which attracts foreign capital and generates high productivity in traditional business activities. By contrast, in Toulouse and Barcelona, the strengths of the regional hinterland include highly productive, modern agriculture and the accompanying food industry (particularly in western Catalonia), associated with a significant attractiveness of many areas (coastal and mountain) for tourism.

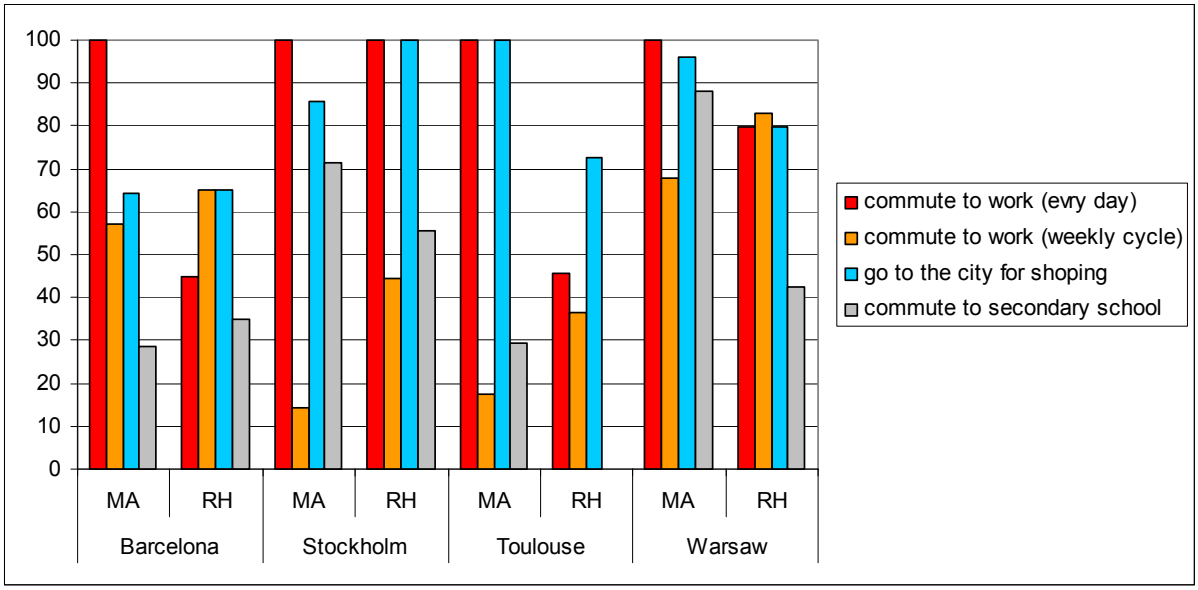
The weaknesses of the regional hinterland of the metropolis were mostly associated with low productivity of labour in traditional sectors, such as: agriculture (Warsaw) or industry (Glasgow), with a simultaneous low level of economic activity. Another important problem was the lack of sufficient human capital resources, which inter alia was connected with the outflow of the most enterprising individuals to the central cities (also in Toulouse, Stockholm and Glasgow) or the influx of unqualified foreign immigrants to the regional hinterlands which remain dependent on traditional industries and agriculture (Barcelona). In effect, the regional hinterland of the metropolis as a rule lost in the competition for investment capital with the central city's metropolitan area.

6.2. The relationships between the city and the region

In all the analysed metropolitan areas (broadly speaking, municipalities situated within 50 km from the centre of the metropolitan centre were classified as ones belonging to the metropolitan area), the local government authorities identified the following linkages with the central city **(Figure 41a)**:

- Daily commuting to work (with relatively the smallest intensity in Barcelona and the greatest in Stockholm and Warsaw);
- Commuting for shopping (save for the Barcelona metropolitan area);
- Commuting of students to universities;
- Commuting for cultural and medical services.

a) labour and simple services [% of responses]



b) higher services and emigration [%of responses]

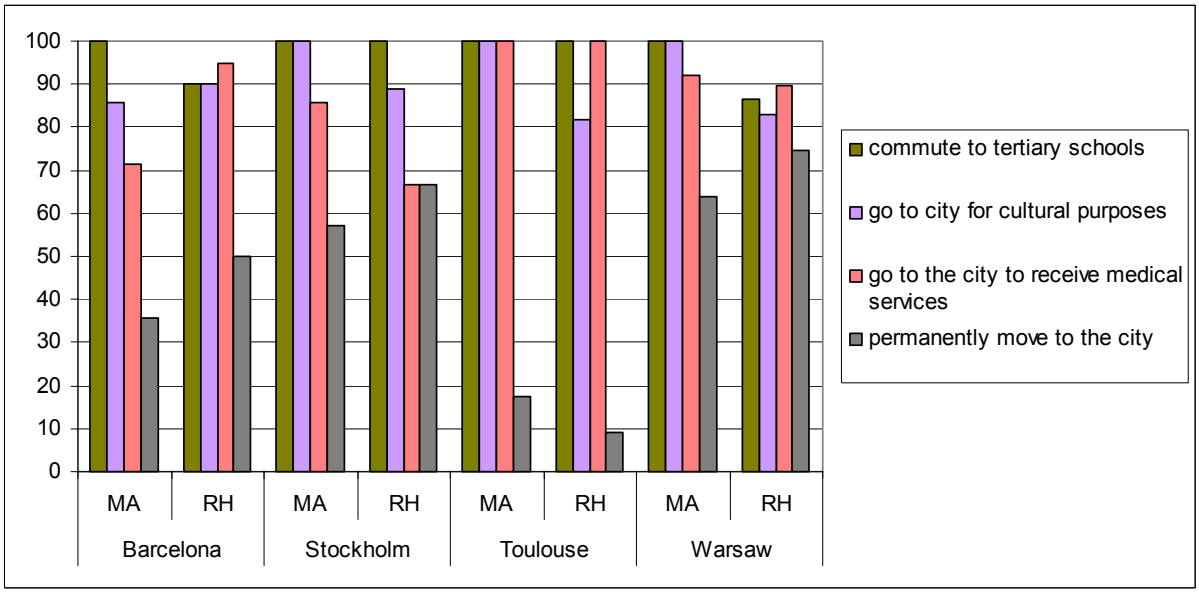


Figure 41. Linkages of municipalities in the macroregion with the metropolitan centre [% of surveyed municipalities]
Source: prepared by the author based on research findings.

Some differences in the organisation of secondary education could be observed between individual metropolitan areas: commuting to school was easily visible in Stockholm and Warsaw, and much weaker in Toulouse and Barcelona. On the other hand, commuting home for the weekend of those who worked in the city during the week were characteristic for Warsaw and Barcelona. In contrast, permanent emigration of residents from the suburban zone to the city could mainly be observed in Warsaw and Stockholm (but with a relatively small intensity and a weakening of this trend observable in the recent years). In most spheres, there was an increasing tendency concerning the intensity of commuting (save for Stockholm) or maintaining its existing levels, which

could be viewed as a proof of a small increase in the degree of polycentricity of metropolitan areas, manifested by the deconcentration of jobs and certain services.

In case of the external zone of the metropolitan macroregions **(Figure 41b)**, commuting in order to participate in higher-order services (e.g. higher education, institutions of culture and health care) played the most important role. Daily commuting to work was also important in the case of Stockholm and Warsaw (over 80% of the surveyed municipalities), which could indicate a greater range of the functional influence of the city. In Barcelona and Toulouse, this affected less than a half of the municipalities, and the role of such commuting was viewed as insignificant. In all these cases, we could observe commuting to work at weekly intervals, which was done on the greatest scale in the Warsaw and Barcelona macroregions. Commuting for shopping was also quite popular, but the scale of this phenomenon was not extensive (particularly in the case of Barcelona), but even in Stockholm – where such commuting was very popular – it did not have any significant intensity. In this context, commuting to secondary schools was done on a minimal scale. At the same time, metropolitan centres represented attractive locations for migration, which was particularly noticeable in Warsaw (growing tendency) and Stockholm (falling tendency).

Commuting to work was also an important factor identifying the functional metropolitan macroregion in all the analysed cases. As a rule, such commuting had the form of daily travels, although in some macroregions (Warsaw, Barcelona) it was also done a weekly basis (which implied renting accommodation and returning home for the weekend). Such travels were of a clearly centripetal character. As a result, no processes concerning the evolution of the polycentric structure of functional ties, characteristic e.g. for Randstad Holland could be observed in the analysed macroregions. In case of Barcelona, this was partly due to the region's geographical features, where mountain ranges separate many settlements (districts, municipalities) of the metropolitan area, and the main valleys host strategic transport routes connecting these areas with their surroundings. As a result, centripetal connections definitely prevail, and there is a shortage of ring roads to integrate the peripheral centres of the metropolitan area. In addition, in some cases the metropolitan region was rather enclosed as regards commuting to work; for example, in Glasgow travels to work did not exceed the distance of 50-70 km. Unlike Glasgow, in Stockholm, the number of commuters to work from region to the metropolitan area was some 85 000 people, of whom nearly 60% were residents of the remaining part of the Mälar metropolitan region. Moreover, the increase dynamics of such commuting was very high, and in some areas exceeded 50% over a decade. These processes may be explained by an improved transport accessibility of Stockholm owing to the extension and enhancing the quality and speed of the transport infrastructure.

Box 2. Commuting to work in the Midi-Pyrénées region and the administrative boundaries

Commuting to work within the metropolitan macroregion can be analysed from two perspectives: flows within the metropolitan area and flows between the metropolitan area and its hinterland. The majority of work-home commuting covers travels to work in Toulouse from the metropolitan area - about 110 000 people, i.e. 40% of those working in the city. The reverse direction of such flows is also visible, although on a smaller scale: some 35 000 inhabitants of the central city work outside the city, but live in the metropolitan area which provides some 250 000 jobs).

Another dimension of these types of linkages are (much smaller) flows of employees between the major cities of the macroregion. Slightly over 8 000 inhabitants of the subregional centres surrounding Toulouse commute to work to the city and its metropolitan area. Castelnaudary is the city with the strongest ties with the metropolis – 10% of economically active population living in this city commute to work in the metropolitan area. This is a particularly interesting example because Castelnaudary is situated outside the Midi-Pyrénées region, which shows certain artificiality of the existing administrative boundaries. Generally speaking, the distance within which Toulouse is attractive for incoming employees is about 100 km. Movement in the opposite direction is also visible. Slightly over 5 000 inhabitants of the Toulouse metropolitan area commute to work to the subregional centres

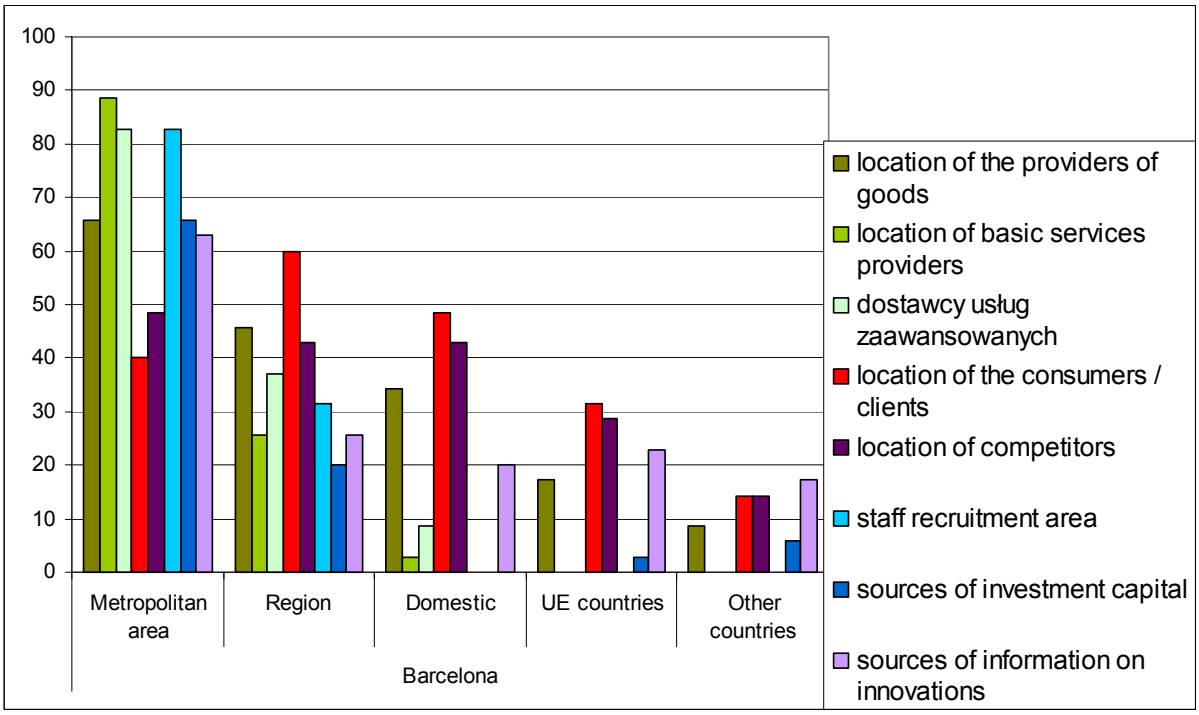
In many cases, metropolitan centres were monopolists in the provision of higher-order services. Practically all municipalities of the metropolitan macroregions generated commuting of their residents with the aim of using such services, but this was usually done on a minimal scale. Health services and cultural services were relatively the most deconcentrated services in the macroregions, while higher education was the least deconcentrated (mainly in the regions of Barcelona and Warsaw, as well as branches of higher education institutions in the region of Toulouse, and Uppsala in the region of Stockholm). At the same time, it should be pointed out that the potential of metropolitan centres in terms of higher-order services would as a rule reach beyond the boundaries of the analysed macroregions. Furthermore, in some regions, there were no other urban centres which could compete in this regard with the metropolis (Glasgow, but with a tangible impact of the rival Edinburgh).

Migration flows within the metropolitan macroregions were varied in character. One significant dimension of such differences was the division into domestic and international migration. The latter was particularly pertinent in the regions of Stockholm and Barcelona, the only difference being that, in the case of the Mälar region, immigrants were mostly attracted by the metropolitan region, and in the case of Catalonia both the

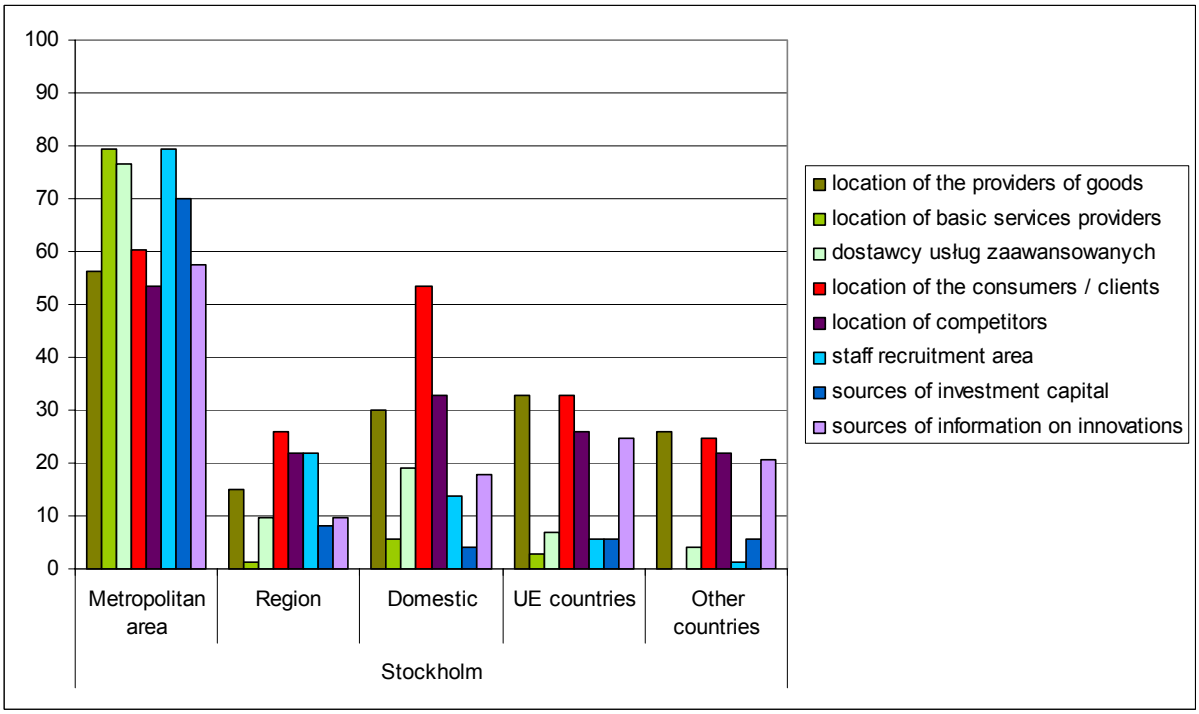
core of the macroregion and its peripheries were attractive for immigrants. Segmentation of migration flows was visible between the metropolis and the region. On the one hand, suburbanisation processes which were taking place in the metropolitan area involved middle-aged population, especially families with children. On the other hand, people in post-working age were those who migrated to most distant locations, frequently their places of origin. As a rule, this outflow was compensated by the inflow of young people with higher education to the metropolitan centres (for example in Warsaw and Glasgow). An important source of such migrations was the regional hinterland of the metropolis, and in the case of the Barcelona metropolitan area in the last decade, migration also originated from other provinces of Spain and, particularly recently (just as in Glasgow), other EU Member States (primarily the new MS).

In the analysed regional macroregions, production systems were developed to varying degrees (Figure 42). Based on the questionnaire surveys of enterprises concerning the role of the individual market ranges e.g. for supply chains and sales, we could observe that economic processes were largely enclosed within the metropolitan areas, particularly regarding the use of services (both simple and specialised), personnel recruitment and sources of investment capital. The role of the regional hinterlands of the metropolises was extremely varied. In case of Barcelona, the considerable role of the metropolis' regional hinterland was clearly visible, mainly as the location of both recipients and clients of enterprises from the metropolitan area (the region played a greater role than the national market). To a lesser extent, this applied to providers of goods and services (primarily advanced services). Moreover, the regional competition did not fall much behind the competition on the national scale. Interestingly, the region was also a source of information about innovations implemented by enterprises operating in the city's metropolitan area. Toulouse also had quite strong linkages with its regional hinterland (providers, recipients and employees), yet the regional ties were on the whole significantly smaller than those with other regions of the country (primarily with regard to the sources of investment capital and sources of information about innovations). In this context, the marginal significance of foreign markets was striking; this could be due to the fact that only a narrow group of major enterprises was operating on such markets (cf. Box 3). In case of Stockholm and Warsaw, the role of the regional hinterland was marginal. The Stockholm metropolis was the most strongly internalised one in terms of suppliers' locations (but also in terms of recipients and sources of information about innovations) – both in the national and European dimension. In case of Warsaw, the degree of internationalisation was not uniform, i.e. foreign provisions and supplies (including information about innovations) were more important than sales of goods, which were primarily sold on the domestic market.

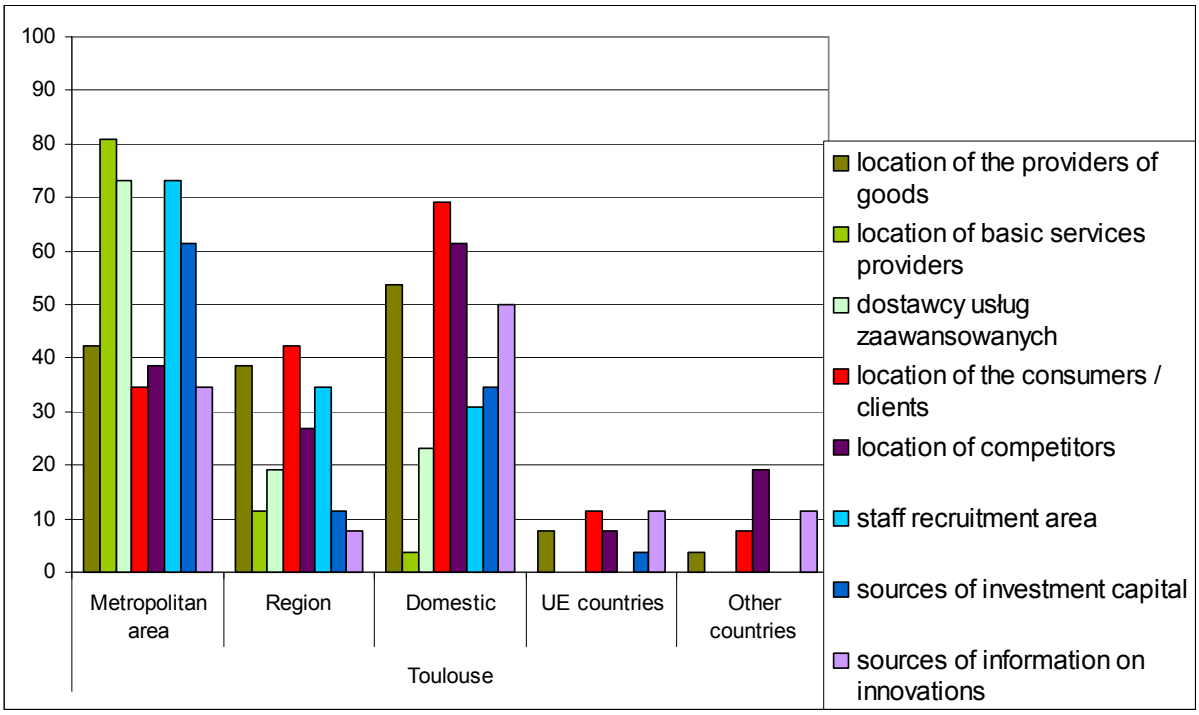
a) Barcelona



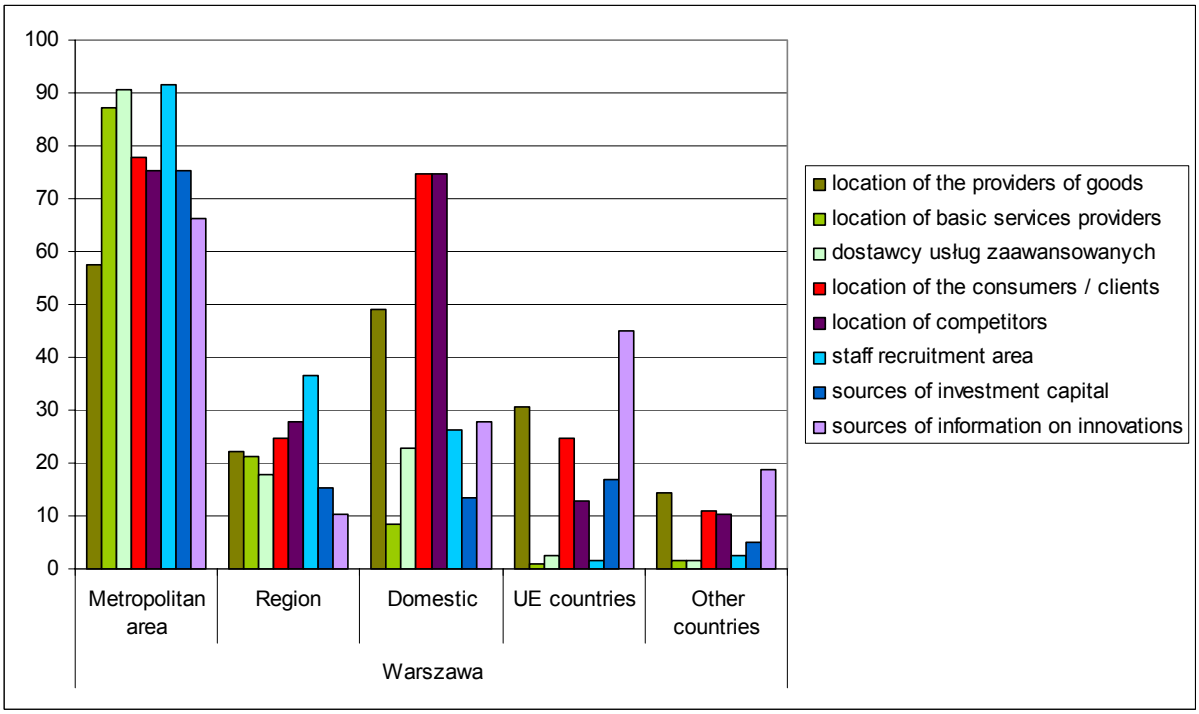
b) Stockholm



c) Toulouse



d) Warsaw



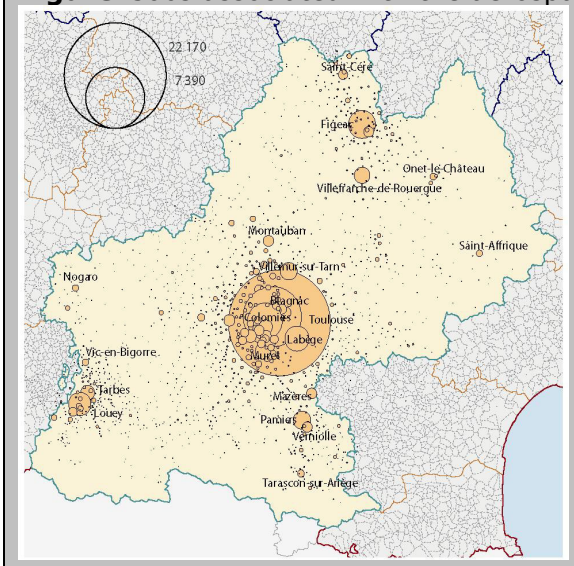
Two key markets / spatial ranges could be indicated in the answer.

Figure 42. Spatial linkages of enterprises located in the metropolitan areas*
Source prepared by the author.

Box 3. The Aerospace Valley in the Toulouse macroregion – cooperation links

In Midi-Pyrénées, some 55 000 jobs are connected with the aerospace industry (40% directly, 30% indirectly, while the remaining 30% represents employment generated by other types of activity), of which 10 000 are provided by Airbus. Employees in the aerospace industry account for slightly over 5% of all people working in the region (Ruhlmann 2007). The aerospace industry is concentrated in the Toulouse metropolitan area, which hosts 3/4 of jobs associated with the aerospace industry. Important aerospace industry centres are also located in other parts of the region (Pamiers, Villefranche-de-Rouergue, Figeac, Tarbes, Louey). The aerospace industry is also well-developed in Aquitaine, a region west of Midi-Pyrénées. Both these regions are in fact one functional area of the aerospace industry (and related activities), with over 1 000 companies having strong cooperation links. Its development is stimulated by a dynamic organisation called the "Aerospace Valley", which brings together some 550 enterprises and institutions associated with the aerospace industry situated in both regions (Aerospace Valley, INSEE 2008). This is an aerospace cluster with extensive internal cooperation structures and strong international links, robust R&D facilities and specialised higher education, which is promoted by both regional and national authorities (cf. e.g. Jalabert, Zuliani 2009). Toulouse is unquestionably the hub of the cluster, which proves that the metropolis' control functions play a significant role not only in the regional, but also supra-regional context.

Figure: Jobs associated with the aerospace industry in 2006.



Source: Ruhlmann 2007.

In all the regions, the regional hinterlands of the metropolis performed recreation and leisure functions. However, their role in the regional development was significantly varied

and largely depended on their supra-regional attractiveness (e.g. Catalonia – the coastal and mountain areas). Recreation and leisure functions were insignificant only in case of the regional hinterland of Warsaw, which can partly be explained by the competition of other regions of the country in this respect. By contrast, tourist functions played a considerable role in case of certain local systems in Scotland, which supplemented the offer of Glasgow as a cultural, conference and retail centre. As a rule, recreation and leisure assets of the regional hinterland were important factors in improving the quality of life and the attractiveness of the entire area (e.g. the region of Stockholm - nature and sports tourism, with a very high quality of the recreation infrastructure and intensive management of the natural assets). In the Midi-Pyrénées region, the regional hinterland also provided a recreation base for the inhabitants of Toulouse (diverse landscape, well-developed mountain tourism, spas, attractive rural areas, historic small and medium-sized cities).

6.3. Determinants of linkages and processes of polarisation and diffusion

As the analysed case studies revealed, considerable differences in socio-economic structures, which suggested potential complementarity between the metropolis and its regional hinterland, were not a sufficient factor fostering the development of linkages between these territorial systems. This was most clearly visible in Mazowsze, where the Warsaw metropolitan region basically functioned within a framework of the global information economy whilst the rest of region – in a traditional agricultural and industrial development paradigm **(Box 4)**. On the other hand, despite the dissimilarities existing between the socio-economic structures, the functional ties in the Barcelona region were strong, mostly due to the well-developed endogenous potential for growth in both these territorial systems. The situation in the Mälar region to some extent resembled that in Mazowsze, but the regional hinterland of the former region was able to make an effective use of the endogenous development potential associated with the processing activity and logistic services catering to the metropolis. Nevertheless, the historical division of economic activity between the subregional centres could still be visible in the region. In the western part, traditionally based on industry and mining, manufacturing (which today has a relatively high technological level) still represented a significant part of the economic structure. On the other hand, the eastern part of the region which traditionally evolved on the basis of trade and transport functions, performed higher-order functions and had a more diversified economic structure. By contrast, in the Toulouse region, the existing linkages were determined on the one hand by the functions provided by the metropolitan centre to its hinterland, and on the other by the high quality of life in the regional hinterland. In the region of Glasgow, the role of the hinterland was limited to providing the recreation and leisure base for the inhabitants of the metropolis, the alimentary zone, as well as a source of compensating the shortages in the metropolitan

labour market. On the other hand, Scotland provides a different example of structural complementarity in the financial sector between Glasgow and Edinburgh – in the former, back office and contact functions prevailed, and in the latter – high quality functions.

Box 4. Mazowieckie voivodship – an example of intraregional civilisational disparities
In case of the Warsaw metropolitan macroregion, there existed a clear dichotomy in the socio-economic structures between the metropolis and the region, expressed by the level of internal disparities in the voivodship, which was the highest in the country. In addition to the above disparities, the dichotomy between the metropolis and the region (GDP per capita ratio of 2 to 1) was also manifested in the economic structure – the well-developed sector of higher-order services with nation-wide significance in the deindustrialised metropolis and low-productivity agriculture with a primarily social function prevailing in the remaining parts of the region except the industrial subregional centres (with traditional industry branches). Another key disparity was related to the quality of human capital – while in Warsaw the share of the population with higher education was about 40%, it did not exceed 1% in some rural areas of Mazowieckie region. Also, despite certain deficiencies in the capital city and its environs, the level of infrastructure was low mostly in the peripheral rural areas. In addition, the level of the region's internal integration associated with the existing transport networks was very low due to a huge scale of neglect and very small traffic capacity of the road and railway infrastructure.

The similarity between the socio-economic structures - whether observable for the entire region or only in the major subregional centres - fostered the development of intraregional linkages. In the latter case, it was associated with a specific hierarchy of linkages (metropolitan centre – subregional centres – regional hinterland). In particular, the similarity between the metropolis and the region in terms of the quality of human capital and degree of innovation was a significant factor which promoted the development of linkages between the two. This was particularly well visible in the case of Barcelona, where such linkages were very strong also because of a high level of civilisational development both in the metropolitan area and in the remaining parts of the region, and due to a strong sense of ethnic (according to the Spanish authorities) or national (according to Catalonians) identity.

The development of the regional hinterland largely depended on the quality of life offered there, as this could prevent the outflow of top professionals from the region to the metropolis. In effect, this facilitated the development of activities with high added value, which required hiring high-quality specialists. On the one hand, they could be recruited

from the region's inhabitants; on the other, this posed an opportunity for hiring relevant specialists from outside the metropolitan labour market. The example of Barcelona corroborates this thesis, although it should be taken into account that, particularly in the case of migrants (and in the period 2002-2006 alone, the population of the Barcelona metropolitan area increased by 10%), the choice of the place to live was largely determined by the costs of living, which were the highest in Barcelona.

In the development of linkages between the metropolis and the region, well-developed transport networks could play an important role, which inter alia was proved by research carried out by the local government authorities in metropolitan macroregions **(Figure 43)**. In particular, the transport infrastructure was of cardinal importance at a distance from 80 to 160 km from the metropolitan centre. Within this distance, the ties were strong or moderate[44] in the case of municipalities which declared that the travelling time was shorter than 90 minutes. At the same time, a longer travelling time would imply much weaker linkages. On the other hand, in case of shorter distances from the centre of the metropolis, the travelling time under 60 minutes was less important than the location with regard to the centre of the region.

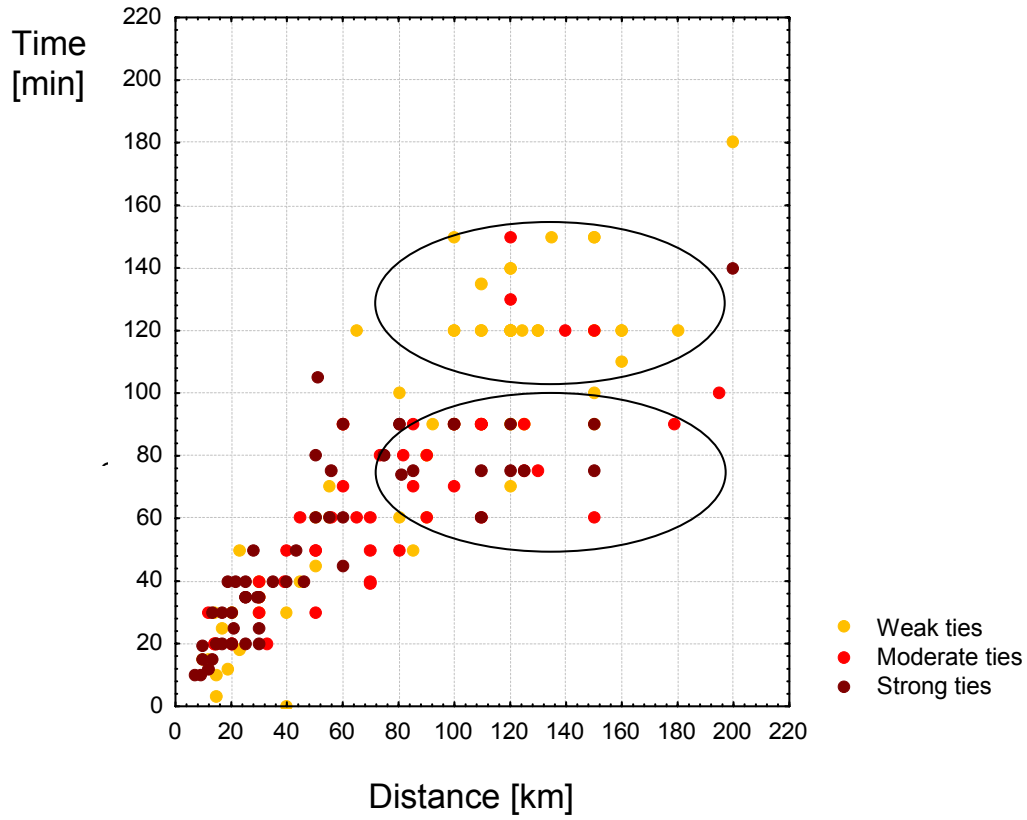


Figure 43. Relationships between accessibility and impact on development
Source prepared by the author.

[44] Strength of ties between municipality and metropolitan centre was calculated as a sum of indications in question 6-8 (scoring: weak - 1, average - 2, strong - 3) in questionnaire to local governments (Annex 9). In the next stage municipalities were classified into three ranges based on natural break method.

Moreover, it should be observed that in the local governments' opinion, transport accessibility of the central city affected the development of the municipality (from 50% in the case of the Toulouse region to 80% in the case of the Warsaw region). At the same time, the majority of municipalities which had efficient transport connections with the metropolitan centre believed that this had a positive impact on their development, and that poor transport accessibility had a negative influence. On the other hand, in most cases, the most weakly developed areas of the macroregions were those which had the weakest transport connections with the metropolitan centre – that is those situated between transport corridors or in the region's periphery.

The centrifugal movements observable in the metropolitan areas were mostly related to suburbanisation processes, the intensity of which visibly increased in the recent years (excluding Stockholm). The development process of a polycentric structure of metropolitan areas was the most advanced in Barcelona and Stockholm, as the majority of municipalities situated within 50 km from the city centres looked at daily commuting to work in the same way as they did on the residents' settling down in those municipalities (Figure 44). However, using the example of Barcelona, we could see certain changes in this process. The increasing costs of living in Barcelona itself, coupled with well-developed transport links with the non-metropolitan areas, fostered suburbanisation. On the other hand, the dynamic development of the Barcelona metropolitan area stimulated immigration which covered different zones of the metropolitan area. To some extent, these processes cancelled each other out in the last decade, but overall they generated a rapid growth of the Barcelona metropolis.

In the Warsaw metropolitan area, over a half of the municipalities acknowledged commuting to work of Warsaw inhabitants, but both their intensity and rate of increase was moderate. In the case of Toulouse, only 25% municipalities made a similar declaration, but this was associated with a much greater intensity and rate of increase of commuting than in the case of Warsaw. There was a similar situation in terms of commuting for shopping to the central city, which was occasional in Toulouse and Warsaw and quite popular in Barcelona and Stockholm. In the metropolitan areas of Warsaw and Barcelona, commuting for recreation purposes were relatively the most important, whereas in Toulouse this was acknowledged by less than a half of the municipalities, and in Stockholm only by 1/3.

Similarly, the majority of municipalities in the regional hinterland performed recreation and leisure functions for the residents of the metropolis. In comparison with the municipalities of the metropolitan area, this was particularly well visible in the regions of Stockholm and Barcelona. Only in Warsaw, the role of this function significantly decreased with the distance from the centre. There is good reason to conclude that this

kind of linkages most significantly affected later migration decisions. This is corroborated by the fact that residents of the central city moved out to live in the regional hinterland on the largest scale in the Barcelona and Stockholm regions, while in the regions of Warsaw and Toulouse the scale of this phenomenon was rather limited. In the case of Stockholm and Toulouse, commuting to work played a certain role in the development of municipalities in the regional hinterland – on a daily basis in the former case, and on a weekly basis in the latter. In case of Barcelona, this type of commuting was indicated by 30% of municipalities, and in Warsaw – only by 15% municipalities situated further than 50 km from the city centre.

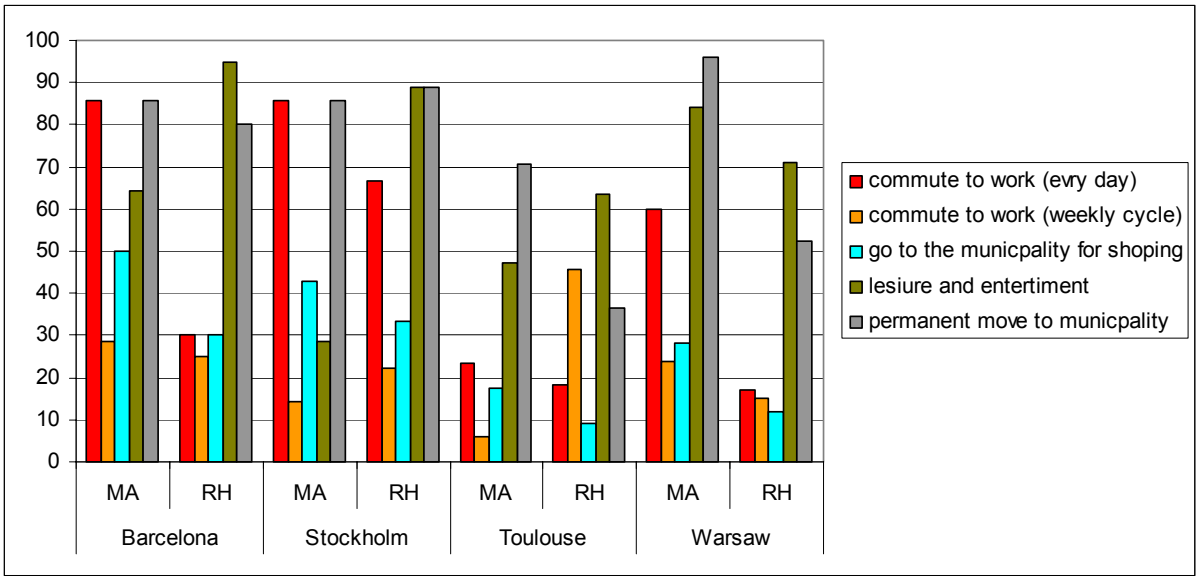


Figure 44. Ties of the macroregion's municipalities with the metropolitan centre – commuting or movement of the metropolitan centre residents [% of municipalities surveyed]
Source: prepared by the author.

In all the metropolitan areas except Toulouse, about a half of municipalities declared that enterprises which have their headquarters in the central city locate their branches in those municipalities (Figure 45)[45]. Relatively most often, these were facilities associated with logistic functions, but other types of activity such as production, trade or services were nearly as popular. In the metropolitan areas of Barcelona and Stockholm, the role of branches of trade companies was significant, in case of Toulouse the majority of such locations were production companies, while Barcelona showed the greatest degree of stagnation in this respect. At the same time, it should be observed that the accelerated development activity of the metropolitan area has led to the emergence of pockets of

45. The results obtained for Toulouse could be affected by the structure of the spatial units: the municipality of Toulouse (the central city) is relatively small, and is surrounded by many municipalities urban in character, where a very large number of enterprises are located. For his reason, the respondents, when answering the question on linkages between the central city, might not indicate connections with the municipalities surrounding Toulouse, which represented a coherent urban functional region.

prosperity and also of poverty. As a rule, this was caused by classical segregation and succession processes described by social ecology, which are currently taking place on a larger spatial scale in metropolitan areas.

Based on the questionnaire surveys, it can also be observed that, as a rule, the regional hinterlands save for Catalonia did not matter considerably as locations for the branches of companies operating in the central city. Metropolitan enterprises would most frequently launch storage and warehousing activity in the regional hinterland, although in the case of Warsaw this also applied to the company headquarters, a situation which was not observed at all in the case of the Mälar region.

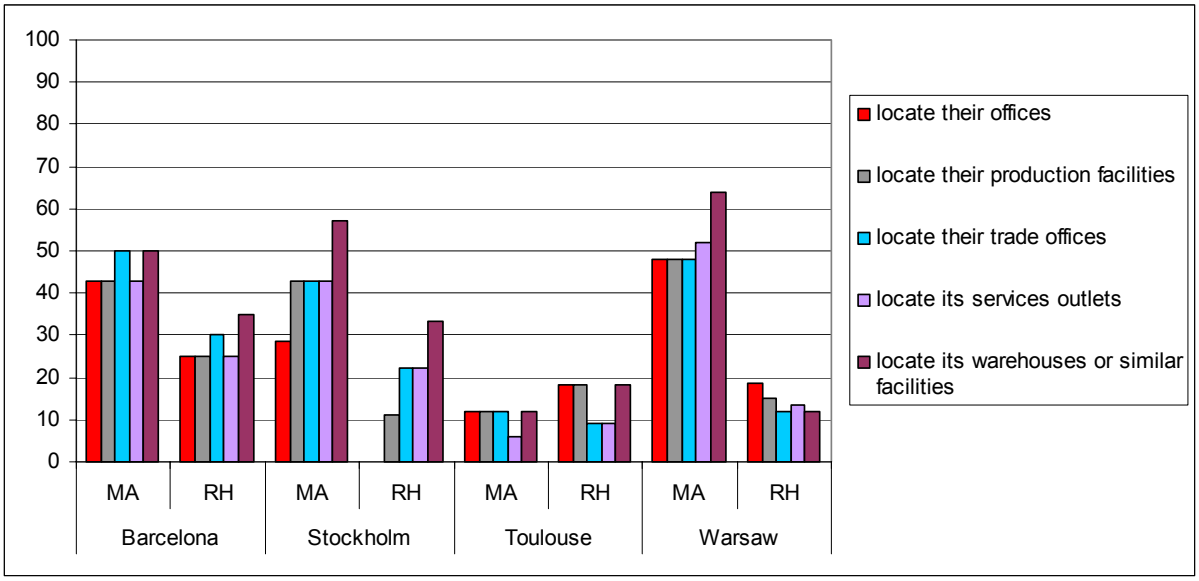


Figure 45. Location of businesses from metropolitan centres
Source: prepared by the author.

Definitely, the process of the "backwashing" of employees with the highest qualifications and young people in education or training from the regional hinterland to the metropolis could be observed in all the regions (the migration balance of the surveyed municipalities in the metropolitan macroregions is shown in Annex 11). The main reason for this was the concentration of the best paid jobs in the metropolitan centre and its direct hinterland. It was also associated with the technological advancement of activities in the centre of the region, the level of innovation of new projects and ventures, and with the well-developed sector of information services. Development opportunities offered by the regional hinterland, including a high quality of life, as a rule did not offset the attractiveness of the labour market in the metropolitan area. This was one of the basic reasons for an increase of disparities in the development level between the metropolis and the region. The exception here was the macroregion of Toulouse, where the backwashing and spreading of developmental processes remained in a relative balance. On the one hand, young people went to study in Toulouse, where as a rule they would

start employment. On the other hand, middle-aged people who started a family would go to live outside the city, most frequently in a location within the metropolitan area, but also further away (including the subregional centres), which is facilitated by a well-developed road network connecting Toulouse with the subregional centres.

6.4. Activities of public authorities in metropolis-region context

Cooperation networks in the analysed metropolitan macroregions were rather varied. The case studies revealed that one factor which impeded the development of cooperation was the region's dependence on the current political situation (e.g. Mazowsze and Catalonia), while the ability for working out an institutionalised model of cooperation was a factor conducive to development. The current administrative division was also an important factor in the creation of such networks. In the case of Warsaw and Barcelona regions, the existence of authorities in charge of regional development in a situation of overly politicised relationships did not make the development of cooperation easier. On the other hand, the absence of such authorities forced certain bottom-up activities which in many cases were more effective than solutions imposed from above. The most important examples of such cooperation at the macroregional level included spatial planning (Glasgow, Toulouse) and development of transport networks (Barcelona, Stockholm).

Box 5. Transport integration – the example of Stockholm

In case of Stockholm, the authorities of five subregions and their municipalities proposed an initiative entitled "*En Bättre Sits* - On the right track", which was aimed to improve the accessibility, quality and speed of the transport infrastructure. One of the reasons for this was neglecting the specific needs of the Mälar region in the central-level planning. The initiative operates as a forum for dialogue between the regional and local public authorities and representatives of specialised central institutions dealing with transport. Its aim is to arrive at a consensus concerning the investment priorities, and addressing the interests of individual actors, the entire metropolitan region, entrepreneurs, inhabitants as well as environmental protection issues.

The authorities of the metropolitan centre were as a rule the dominant entity determining mutual relations between the metropolis and the region. In some case, however, the city authorities had greater, nation-wide ambitions (Warsaw), whereas elsewhere the regional and city authorities showed no interest in the establishment of an additional – metropolitan - tier of administration (Barcelona). The latter case, in which usually conflicts are sought in relation to the Autonomous Community of Catalonia, shows how difficult this issue is, and proves that in the case of Catalonia the significance of intraregional interests is usually underestimated. The establishment of the metropolitan authorities in 1974 immediately met with a negative response both from the city of

Barcelona, and the regional authorities, as a result of which, 13 years later (in 1987), the metropolitan authorities were abolished by a decision of the regional authorities.

Competition in the metropolitan macroregions was manifested in a variety of ways, primarily by efforts to ensure the location of strategic inward investments, which to a smaller or greater degree could be observed in all the macroregions. In this regard, competition was particularly severe in the metropolitan areas, which also included plans to attract the wealthiest residents.

Another symptom of competition was fighting for political influence and voters' support, which was most visible in those regions which had regional authorities. It was also manifested by the ambitions of the subregional centres which strived to attract some of the higher-order services from the metropolitan centre (the region of Toulouse – higher education; the region of Warsaw – academic and cultural functions).

The coordination level of activities regionally was varied. The paradox is that such coordination was relatively weak in those regions where self-government authorities were furnished with broad competences (Mazowsze: e.g. railways run by the regional government, regional roads, specialised health care, spatial planning; Catalonia – own treasury, police, numerous companies, e.g. General Roads Directorate, Catalonian Railway Infrastructure, Audiovisual Media Corporation). For instance, in Catalonia intensive spatial planning work is carried out for the region; however, due to the lack of the required funds, the effects of this are meagre. It is because the municipalities have most powers and funds, and they engage in territorial cooperation networks very cautiously, only in justified situations and specific spheres (transport, environmental protection, etc.). The situation is similar in Mazowsze, where – despite the existence of a regional spatial development plan - the decision-making power in this regard rests with the local governments, which pursue their own policy.

In contrast, in case of the Midi-Pyrénées region, the coordination of activities is quite extensive. This is possible owing to efficient forms of cooperation between different administration levels (both horizontally and vertically). Coordination is also facilitated by the fact that the regional authorities have been furnished with broad powers and investment budgets: the region is inter alia responsible for secondary and vocational education, spatial planning, economic development, and transport (road and railway infrastructure, financing and organisation of public road and railway transport).

In many cases, the analysed regions lacked institutions furnished with relevant powers at the regional level. The non-governmental Mälar region in Sweden was in charge of the coordination of bottom-up activities, including promotional ones, in order to increase the competitiveness of the metropolis and its regional hinterland. Sweden is an exceptional example here because the division of competences can be described using the hourglass

metaphor, which means that considerable powers related to planning, setting standards and decision-making processes are vested in the central level, whereas the implementation of programmes and policies takes place at the level of municipalities, which have both extensive competences related to making decision on the ways of executing specific tasks, as well as far-reaching fiscal autonomy and freedom in the expenditure of funds.

Similarly, in the case of Western Scotland, the key competencies are concentrated at the local level. In consequence, the local networks of cooperation between municipalities are well developed, but there is a deficiency of coordination at the macroregional level. To some extent, this gap is filled at the governmental level (Scottish Government) as the powers vested in it include inter alia: railways, environmental protection, flood protection. Another example of national-level activities is the Government Relocation Programme, which aims to transfer some public services outside London and the south-eastern region. The results of its activity include inter alia the location of a computerised government register and statistical data centre in Western Scotland (Dumfries).

In addition, in many cases individual areas of the macroregions seek ways to release the endogenous potential on their own. For example, Dumfries and Galloway, the largest agricultural area in Western Scotland, undertakes joint activities together with the Scottish Borders region located in the zone of Edinburgh's influence, relating e.g. to applications of modern design in the traditional textile industry.

The relationships between the city and the surrounding region were ascribed varying roles in the strategies of public authorities at different levels. In some cases, efforts to equalise development disparities by favouring peripheral areas could be observed (Mazowsze – equalising instruments addressed to enterprises and local governments; United Kingdom – government-level relocation programme to peripheral regions; the strategic goal in Scotland is to reduce the intraregional development gap). In other macroregions, a clear domination of the metropolitan area could be noticed. For example, the Barcelona metropolitan region, depending on the mode of its delimitation, has from 3.7 to 4.9 million inhabitants – i.e. hosts the definite majority of Catalonia's population. In addition, the bulk of economic activity with regional and supra-national significance, including international, is concentrated there. In contrast, activities have been undertaken in Sweden to create functional links throughout the macroregion by strengthening second- and third-order subregional centres, primarily by the establishment of technological parks, logistics and retail centres and new housing estates. Technological parks are developed via branches of higher education institutions with a view to attracting companies operating in the ICT and biotechnology sectors (Kista and Flemingsberg) and reinforcing the region's R&D potential.

In the majority of macroregions, the undertaken activities focused on attempts to utilise the endogenous potential of individual areas, on the assumption that the development of the metropolitan area has a positive impact on its regional hinterland.

Box 6. The concept of polarisation and diffusion in the Midi-Pyrénées region

In Midi-Pyrénées, the development policy is based on the polarisation and diffusion concept. It is believed that development opportunities for the region should be sought primarily in the development of Toulouse (modern technologies, R&D in aerospace industry, pharmaceuticals and medicine, chemistry and food processing) and in creating conditions for the diffusion of development – mainly through the development of high-quality transport network, promoting the building of human capital (development of higher education in the subregional centres) and zones of industrial activity outside the metropolitan area. Modern specialised agriculture is also supported (including ecological, traditional agriculture, also combined with agri-tourism); it is regarded (together with food industry) as a significant endogenous resource of the region's rural areas.

The extension of the transport infrastructure was one of the major tasks undertaken to disseminate development from the metropolis to more peripheral areas of the region. However, key decisions in this regard as a rule rested with the central authorities. In some situations, in view of the passivity of the central-level authorities, such activities were initiated "on the ground", as for example in the case of Stockholm, where the initiative "*En Bättre Sits* - On the right track" was aimed to integrate and coordinate decision processes at different levels (see above). This was associated with placing special emphasis on the development of the transport infrastructure in the Stockholm-Mälar region as it was believed to be of crucial importance for maintaining the region's competitiveness and good performance of the labour market. This is particularly important when we take into account limited accessibility of housing in the area of the metropolis. Transport accessibility was also regarded as crucial in Western Scotland, which is corroborated by activities at the level of the Scottish Government concerning the development of the railway network. In the Midi-Pyrénées region, efforts were concentrated on the strengthening of the subregional centres (development of business activity centres and branches of higher education institutions) and upgrading the railway infrastructure (key road investments have already been completed), while the major investment in this regard – the construction of a TGV route (Bordeaux – the Mediterranean Sea) rests with the central authorities.

Most frequently, activities related to the development of the transport infrastructure helped build supra-regional linkages of the metropolises, which catered to their regional hinterlands only incidentally, with a simultaneous existence of gaps in the transport networks and "tunnelling" effects. These activities are supplemented by efforts to ensure conducive conditions for the creation of new jobs around smaller urban centres.

Some of the activities were associated with attempts to build a polycentric structure of the metropolitan areas. For instance, efforts were made in Barcelona (in its eastern part) to create a centre of hi-tech sectors, but these attempts have not been particularly successful. The metropolitan region of Barcelona is relatively polycentric, owing to the purposeful deconcentration of industry many years ago (although the centripetal arrangement of the transport system strengthens the role of Barcelona). Problems experienced today are mostly related to difficulties with finding an alternative for the last declining zones of traditional industry (also as a result of their off-shoring to Eastern Europe and Asia). In case of Western Scotland, we can list the location of regional airports as an example of actions building the polycentricity of the metropolitan area. The two international airports are situated outside the boundaries of the city of (Glasgow Airport in Renfrewshire and Prestwick in South Ayshire). Moreover, measures are implemented to improve the external image of the individual parts of the metropolis, which inter alia include the regeneration project of the River Clyde waterfront (with a shipbuilding past), the redevelopment of the former steelworks in Ravenscraig (North Lancashire), restructuring of Motherwell and Wishaw (metallurgy), building new housing estates and the Building Society in Glasgow, urban renewal of downtown Glasgow and regional cities or regeneration of free urban space.

Box 7. Polycentric development of the Stockholm metropolitan area

RUFS 2010, the Regional Development Plan for the metropolitan of Stockholm, stipulates the consolidation of the area' polycentric structure inter alia by the strengthening of the role of second- and third-order regional urban centres. Activities, which are implemented at several levels, involve e.g. strengthening cooperation between the local authorities particularly with regard to taking account of the local development plans and spatial development plans, developing a networked structure of transport connections (concentrically around Stockholm), cooperation in the field of education and higher education, development of housing and adaptation of infrastructure to the needs of the regional labour market. In addition to that, the development plan identifies areas which call for closer cooperation and integration. One such area is the central area which comprises Stockholm, the Arlanda Airport, Uppsala and Södertälje. Another is the planned bi-city of Västerås-Eskilstuna. The third area for integration is the research centre and the technological park of Linköping, the environs of the Nyköping Airport and the city of Norrköping. Ultimately, the entire area (except the third component) is to have transport connections with the travelling times of one hour at the most to Stockholm and to the Arlanda Airport.

Source: RUFS 2010.

Activities related to the development of education were the major instruments to counteract the backwashing of developmental resources. In Mazowsze, there were plans related to the development of education at the lowest (pre-school) level, but this was a nation-wide initiative. Furthermore, non-public higher education institutions spontaneously developed in the subregional centres of the Warsaw region. In Midi-Pyrénées, attempts were made to develop academic functions in the subregional centres, but such activities are done on a limited scale (small number of courses offered, only undergraduate programmes), as a result of which Toulouse remains an unquestionable academic centre of the region. In Catalonia, the attempts to deconcentrate higher education institutions (e.g. *Universidad Autonoma Barcelona*) have been only partly satisfactory and have led to creating additional burdens for the transport system of the metropolitan area. In view of a high level of the concentration of the population in the Barcelona metropolitan area, such extensive deconcentration does not make much sense. Similarly, efforts are made in Western Scotland to develop modern vocational education centres outside the metropolis (a branch of the University of Glasgow in Dumfries). By contrast, Sweden operates a binary higher education model, which means that elite universities such as the Royal Institute of Technology (KTH), Stockholm School of Economics, Stockholm University, Karolinska Institute and Uppsala University function side by side with smaller higher education institutions, the so-called *högskolan*, which mainly offer undergraduate and graduate courses. Altogether, there are 26 higher education institutions in the Stockholm-Mälar macroregion, which give employment to 40% of the country's academic staff. The most prestigious higher education institutions are located in Stockholm and focus on research activity and technology rather than on teaching. This function is partly discharged by the *högskolan*, which are frequently located outside the city, both in the metropolitan area and in the macroregion itself. The highest expenditure on education, including adult education, and increase in the number of students was made by the Södertörn University and the Mälardalen University, located in Eskilstuna-Västerås, a bi-city that is now being established.

6.5. The metropolitan areas governance

Many European cities have tried to create a comprehensive model for the management of metropolises, understood as functional entities comprised of the centre and the metropolitan area. The following models for managing metropolitan areas can be distinguished (cf. METREX, 2004):

- Comprehensive: the authorities are elected and have extensive powers in the running of social, economic, infrastructure and environmental policies, which allow them to devise and implement integrated development strategies for the metropolis (e.g. Hanover);

- Key tasks: the authorities are elected or appointed but have limited powers, as a result of which they can only solve specific problems related to metropolitan development (e.g. Stuttgart, Helsinki, Paris, Athens, Thessaloniki, Lisbon, Porto);
- Advisory: there is no separate tier of authority at the level of the metropolis, and the tasks related to the strategic planning of metropolitan development and providing advisory functions in their implementation are executed by development agencies or joint advisory committees appointed by the current public authorities (e.g. Glasgow, Berlin, Munich, Copenhagen-Malmö, Zurich).

Table 44. Management model for metropolitan areas and tasks performed

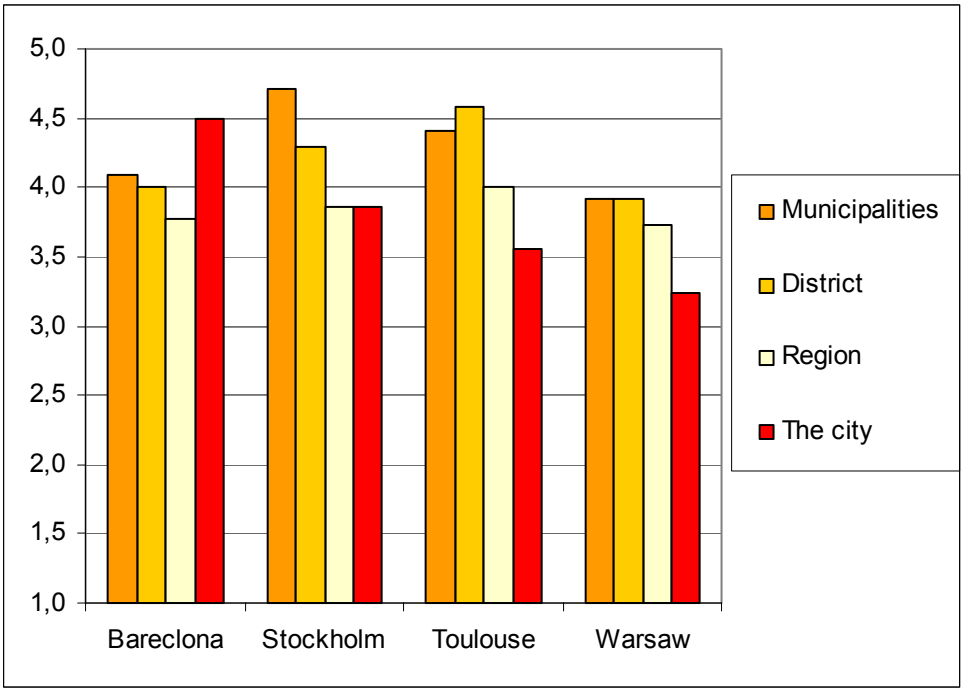
Model	Spatial planning	Infrastructure	Environment	Economy	Society
Comprehensive	**Metropolitan planning**	**Roads** **Public transport** **Water management** **Waste management**	**Natural protection and conservation administration**	**Development agencies** **Training agencies**	**Healthcare** **Education** **Higher education** **Social assistance** **Social housing**
Selected tasks	**Metropolitan planning**	**Roads** **Public transport**	**Environmental protection agencies**	**Development agencies**	
Advisory	**Metropolitan planning**				

Source: prepared on the basis of (METREX 2004).

In order to establish a level of elected authorities responsible for strategic planning on the metropolitan scale, and which will into account all the basic aspects of its development, the existing territorial self-government structures at the local level as a rule need to redesigned. This is undoubtedly a challenging task and has rarely been attempted so far. More frequently used forms of managing metropolitan development are based on voluntary cooperation of the existing territorial self-government units in solving specific problems, primarily those related to transport and economic development. The

growing pressure from the global and local environments is a stimulus for creating various institutionalised forms of such cooperation to facilitate more effective performance. Arguably, if regional and national strategies dealing with these issues function properly, with the involvement of major local and regional actors and the existence of efficient cooperation networks at the metropolitan level, the establishment of institutionalised forms is not as necessary (METREX 2004).

In all the analysed metropolitan macroregions except Barcelona, cooperation between the central city and the municipalities situated in its closest vicinity was not as good as between inter-municipal cooperation networks (Figure 46). Cooperation of municipalities with the metropolitan area was most negatively evaluated in Warsaw and Toulouse (in the latter case this was the consequence of the adopted model of extensive horizontal cooperation networks). In Stockholm, this cooperation was evaluated as good, but still not as good as cooperation with the neighbouring municipalities. In Barcelona, the very good cooperation between the city and the municipalities in the metropolitan area could to some extent be a consequence of poor cooperation between the municipalities and the regional authorities.



* 1 – very bad, 5 – very good

Figure 46. Evaluation of cooperation with the central city by municipalities of the metropolitan area*
Source: prepared by the author.

Box 8. Incoherence of administrative and planning divisions in Catalonia

In case of Catalonia, there was a discrepancy between the traditional administrative division established in the early 19th c. and the planning division, certainly better suited to the actual structure of economic activity and employment in the period after Catalonia's industrialisation. Admittedly, the duality of this division (administrative and planning) has a political context (related to the dissimilarity of interests, which also divide the Catalonian community). The appointment of the authorities of the Catalonian metropolitan area and their subsequent abolishment may serve as an example here. The strong metropolitan authorities, representing the majority of the region's population, were not welcome by the political elites of Barcelona, much less by the autonomous region of Catalonia.

In the analysed cities, as a rule there were no regulations imposed by the central authorities governing the cooperation within the entire metropolitan area. We should not, however, be oblivious of the attempts at their implementation in Poland (with no effect so far), and their functioning in the case of Glasgow (Box 8) and Catalonia, where they were ultimately abolished, mostly due to political conflicts.

Box 9. Liquidation of the Glasgow metropolitan area

In 1975-1996, Scotland had a two-tier system of local administration. In this period, the city of Glasgow operated as part of the Strathclyde Regional Council, which was the most populated and largest region in Scotland. The Council was inter alia responsible for education, transport and strategic planning. The reasons for its abolishment included e.g. blurred powers and mismatches concerning the spatial range of the provided services. However, regional experts emphasise that political interests played an important role in this process, and that the 1996 reform was a mistake as far as Western Scotland is concerned. At present, there is no political nor social willingness to return to the earlier organisation of the regional government.

In case of Barcelona, difficulties in this regard are multifaceted, associated with engaging the national authorities in this process, in addition to the regional and urban authorities. As mentioned above, intraregional interests also played a role; in consequence, the metropolitan corporation (authority) was dismantled after only 13 years of operation.

In Sweden, no attempts have been made so far to implement the arrangements imposed by the central authorities. However, legal forms of establishing bottom-up associations of the local authorities are quite popular, e.g. on the basis of the so-called "ordinary contract" used for specific objects of cooperation; "local government federation" – a form of cooperation between various levels of local government authorities (Sweden has over 60 such authorities), and the broadest form, subsidised from the central government – the "Regional Co-operation Council", which groups representatives of municipalities from across the region, with the possibility for inviting representatives of subregions.

In the existing situation, bottom-up initiatives seem to be the key to the effective and efficient management of metropolitan areas. However, they encounter many barriers, mostly associated with the lack of trust between the authorities of the metropolitan centre and the surrounding municipalities (e.g. Warsaw where, despite the legal arrangements regulating the functioning of special-purpose associations of municipalities, cooperation is poorly developed). In case of Toulouse, there are 3 rival general-purpose associations of municipalities in the core of the metropolis, the establishment of which was driven by a desire to gratify the local ambitions; this hampers cooperation and makes coordination of activities much more complicated. It should be emphasised, however, that extensive cooperation networks between different administrative units (and their associations) facilitate an efficient management of metropolitan areas. On the other hand, in the metropolitan area of Stockholm, activities are hindered by lengthy decision-making processes (the consensus culture), but cooperation is well developed

and covers many areas, being supervised by the County Administrative Board which is appointed by the central authorities. Additionally, regional planning is made more difficult by the fact that municipalities have broad powers in the sphere of spatial planning, and the County Administrative Board draws the regional plan (which is however not compulsory for the municipalities) on the basis of the plans prepared by municipalities. On the other hand, in the metropolitan area of Glasgow, cooperation "on the ground" does not encounter any considerable obstacles, which is an effect of continuing the earlier traditions in this regard as well as strong functional linkages. Nevertheless, it is pointed out that some harmonisation concerning the territorial scope of local agreements and special-task organisations would be useful. The most important example of cooperation at the level of the metropolis is the Clyde Valley Community Planning Partnership, established in 2003 by the political leaders of 8 local governments in order to initiate joint strategic actions for the regeneration of the Glasgow metropolitan area.

Similarly, in Barcelona, the actual metropolitan region (understood as an area where activities are coordinated and decisions are made jointly) is determined by municipal cooperation in three areas. The first covers 31 municipalities (with Barcelona) furnished with powers in the sphere of environmental protection; the second covers 18 municipalities (with Barcelona, in the sphere of transport), and the third includes 36 municipalities which cooperate in the preparation of the strategic metropolitan development plan. Even though there are no integrating elements here, it is believed that the municipalities, acting jointly, express the interests of the metropolis.

The scope of activities undertaken by the metropolitan areas most frequently included transport and spatial planning. All the analysed metropolitan areas had some achievements in this respect: they were relatively the smallest in the case of Warsaw, and fully operable in the case of Stockholm, and in Toulouse (while taking account of the coordination of activities between different administrative units as part of the *Communauté Urbaine du Grand Toulouse*, which had quite extensive powers: municipal housing, culture, public transport, spatial planning, municipal services (water, sewerage), environmental protection, social services, economic development). Activities also cover more specific areas, e.g. tourist traffic services and environmental protection in Barcelona (which is connected with managing the deficit water resources) or development projects in Glasgow (Advanced Research Centre, Science Technology Diamond).

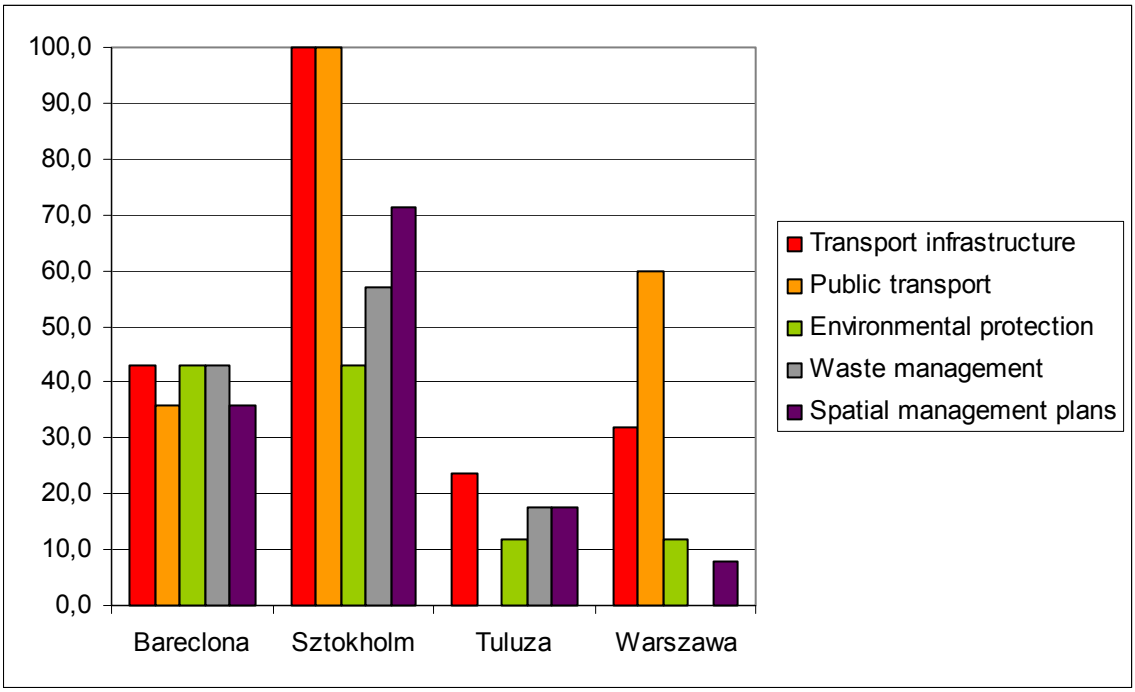
In case of Barcelona, also environmental protection issues (including water and sewage management) are covered by inter-municipal cooperation in the core of the metropolitan area. Likewise, cooperation efforts between the industrial cities surrounding Barcelona (from Villanova through Martorell and Terrasa to Mataro) initiated to address the threat

of marginalisation and costs of deindustrialisation have been interesting. For these cities, the goal of their efforts is the construction of a road connecting them with Barcelona.

In the metropolitan area of Stockholm, state and local government administration function in parallel. The government administration (County Administrative Board) is in charge of:

- Coordination of government policies at the regional level;
- Natural environment protection;
- Monitoring and inspections of local and subregional governments.

The tasks of the subregional local government (County Council) include administration of the health care system, public transport (including transport of people with disabilities), regional planning, and to some extent higher education, while the sphere of regional planning and public transport rests with the Office for Regional Planning and Transport.



* In case of Toulouse, we should bear in mind the specific structure of the metropolitan area, where the central city occupies a relatively small area. For the respondents, a more pertinent point of reference could be the key association of municipalities operating in the metropolitan area of the *Communauté urbaine du Grand Toulouse* – 25 municipalities, including the central city, and furnished with extensive powers.

Figure 47. Scope of cooperation with the central city by municipalities of the metropolitan area*
Source: prepared by the author.

Based on the questionnaires distributed among the municipalities, the key areas of cooperation in the metropolitan areas were the following (Figure 47):

- Public transport (Stockholm, Barcelona (lesser extent), some indications in Warsaw);
- Environmental protection and waste management (Barcelona and Stockholm, some indications in Toulouse);
- Spatial planning (Stockholm, certain indications in Barcelona, marginally in Toulouse and Warsaw).

It should also be pointed out that in the case of the Stockholm region, cooperation networks also covered municipalities situated further than 50 km away from the city.

The majority of municipalities which have not as yet been engaged in cooperation see a need for it. In the case of the Barcelona metropolitan area, this pertained to cooperation in the sphere of transport (including public transport), environmental protection and planning (in various groups of municipalities), while in Toulouse and Stockholm – to environmental protection and spatial planning. In contrast, the respondents in the metropolitan area of Warsaw saw a need for developing cooperation in all of the aforementioned spheres.

6.6. Development prospects

Practically in all the regions except Catalonia and Midi-Pyrénées, we can expect an increase in developmental disparities between the metropolis and the surrounding region. In most cases, this is associated with the polarisation and diffusion development model, which stipulates that the range of the spreading of development processes is usually small, with a simultaneous backwashing of resources from the more distant parts of the metropolitan macroregion. Warsaw can be viewed as a classical example of this model, even though some of its elements can also be found in Glasgow. In the case of Stockholm, the complementary model associated with the functioning of modern industry outside the metropolitan areas is also partly applicable. In Barcelona, so far there are no indications of polarisation, although the consequences of an accelerated deindustrialisation of the cities of the so-called Arc surrounding Barcelona may generate faster polarisation within the metropolitan area. This is partly a consequence of globalisation since the hinterland of the metropolis (including rural areas) probably will not be directly affected by these processes.

The scenarios concerning further anticipated developments vary, and largely depend on the regional context. In the first model, a growing depopulation of peripheral rural areas is the most likely. This trend can be reversed based on the local resources (more likely in case of Glasgow) or investments to disseminate the scale of the metropolis' development

(more likely in case of Warsaw). In case of Stockholm, one of the probable scenarios envisages emergence of a polycentric metropolitan area which will foster development processes across the region. In contrast, the future of the Toulouse region relies most heavily on the diversification of the economy in the metropolitan area, which can lead to the expansion of the present cooperation links and a better integration of the metropolitan hinterland. On the other hand, the future of Barcelona and Catalonia will significantly depend on their ability to meet the challenges posed by globalisation and international competition, which can hardly be expected to be manifested on the regional scale. Undoubtedly, however, some local systems in the metropolitan area of Barcelona are seriously threatened by the diminishing significance of the industrial sector, which the region has so far been unable to offset by creating alternative jobs.

CONCLUSIONS

In the analysed European metropolitan macroregions, trends for the increase of development disparities between the metropolis and the surrounding region could be observed in the period 1995-2004. This can be viewed as a consequence of metropolisation processes, which lead to a faster development of large urban centres which pool the resources indispensable for the development of information economy than that of their regional hinterlands, which in many cases function in the previous, industrial and agricultural development paradigm. Similarly, middle-sized cities "eclipsed" by the large metropolis are developing more slowly. Nevertheless, opposite processes were taking place in some of the macroregions, but this was usually either a consequence of enormous intraregional disparities or of a lower rate of economic growth in the countries in which they were located.

The national context plays an important role in analysing the development dynamics of metropolises as the nation-wide rate of growth is as a rule strongly correlated with the rate of development of metropolitan areas. Furthermore, by comparing the rates of growth in the component parts of the metropolitan macroregions with the national average, we were able to identify the four basic types of regions. Consequently, we indicated macroregions where a fast development of the metropolitan area was accompanied by a speedy development of its surroundings. This could be viewed as a proof of the lack of barriers to the diffusion of developmental processes. On the other hand, an inverse situation could point to structural differences or low accessibility which hampered the diffusion processes or, alternately, to the backwashing of developmental resources from the periphery into the regional centre. In a situation of a slower development of the centre, its surroundings as a rule coped slightly better than the mean value. This could either indicate relatively weak intraregional linkages or point to a competent use of endogenous resources by the regional hinterland (e.g. related to the development of tourism or modern industries). Nevertheless, there also existed macroregions where both the metropolis and the remaining part of the macroregion were developing tangibly more slowly than the national average; this could be seen as a proof either of their strong intraregional ties or of their structural affinities.

Metropolitan macroregions were strongly divergent in terms of the correspondence of demographic processes, structural changes and labour market fluctuations taking place in the analysed component parts of metropolitan macroregions (i.e. in metropolitan areas and their regional hinterlands). This, however, makes generalisation difficult and points to a significant role of the national and regional contexts, which prove a clear *differentia specifica* of each of the surveyed macroregions.

However, in the majority of metropolitan macroregions an increase in the number of the population could be observed; it was primarily caused by migration inflows both to the metropolitan areas and their regional hinterlands. This was probably connected with the segmentation of migration – young people in working age would immigrate to metropolitan areas to seek employment or to study, whereas middle-aged or retired people would move to areas situated further from the centre, seeking a higher quality of life and better living conditions.

On the contrary it is difficult to identify linkages between structural changes occurring in metropolises and in their regional hinterlands. In some regions, similar processes take place (e.g. an increasing role of services), whereas opposing trends can be observed in other macroregions (e.g. increasing share of services in the metropolitan area's economy, accompanied by a simultaneous industrialisation of the metropolitan regional hinterland). The role of services in metropolitan services usually results from a growing role of specialised services, whereas the service "advancement" of the metropolis is usually accompanied by an increased role of services in the regional hinterland.

On the other hand, there were marked linkages between the labour market situation in metropolises and in their regional hinterlands, but this applied to the dynamics rather than the situation on the macroregional labour market – and was largely a consequence of changes in the nation-wide labour market. Simultaneously the situation in macroregional labour markets was rather stable despite a period of good economic performance, and economic growth was mostly produced by an increase in productivity. The disparities in productivity between the metropolis and the region were still relatively wide, both in case of the industrial and services sectors.

One of the major factors differentiating both metropolises and their regional hinterlands was the modern character of the economic structure, expressed by a large share of services, including specialised services, which was associated with a high level of economic development. In addition, the disparities in the demographic potential of the macroregions also played an important role as they signalled the size of the local labour pool and sales markets, which in turn would usually foster the development of the service sector. In case of metropolitan areas, their place in the respective national settlement structures was important, with an additional differentiating factor being the degree of integration of the suburban zone with the metropolitan centre, expressed by the disparities in the economic structure and labour productivity. On the other hand, for regional hinterlands of metropolises, the labour market situation was more important; in many cases it was linked to the level of industrialisation of the regional economy. Furthermore, the level of the duality of the economy, expressed by the disparities in the

labour productivity between agriculture and non-agricultural activity, was another significant factor.

Taking into account the above dimensions of disparities, we identified several main types of conditions determining the economic relationships between the metropolis and the region observable in Europe. Most of the types of such conditions could be encountered across Europe and were spatially dispersed. Nonetheless, there were also groups of macroregions with similar conditions which could be found in one or several neighbouring countries, e.g. southern Germany, northern Italy, Austria and Slovenia, as well as the remaining macroregions of large German cities. On the other hand, the capital city macroregions of Central and Eastern European countries were the most conspicuous of metropolitan macroregions. In this group, it could be clearly observed how metropolises break the ties with their regional hinterlands. This was probably caused by the rapid pace at which the capital city metropolises joined the mainstream of an open networked economy, with a dominance of traditional functions such as low-productivity agriculture and declining traditional industries in the economies of their regional hinterlands. To some extent, this type was imitated by other, usually smaller cities with peripheral locations, where similar processes took place but with a lower degree of macroregional divergence. At the same time, highly industrialised regions ("industrial" or "problem" regions) were relatively the most internally coherent. However, during the process of adapting their economic structures to the conditions of global information economy, their intraregional convergence would as a rule decrease. The remaining types of regions were quite varied despite a similar scale of intraregional disparities in the economic development level. Divergence could be observed both in highly-developed monocentric and in polycentric regions. Nevertheless, in the former type of regions, this process took place in the conditions of an extensive and complex network of flows both regarding migration and local labour market linkages, whereas in monocentric regions the degree of complexity of these relationships was much smaller. In contrast, metropolitan regions situated in Germany, Austria and Slovenia manifested the greatest stability in terms of development disparities between the metropolis and the region, which was largely a result of a similar situation in the macroregional labour markets and could be seen as a proof of considerable integration of regional production systems. However, capital city macroregions yielded the least to such attempts at generalisation – particularly those in smaller countries, where the relationships between the metropolis and the region were uniquely distinctive.

The key factor affecting the disparities in the economic development level and their change was the similarity of the economic structures of the component parts of the metropolitan macroregion. A similar economic structure could point to the existence of direct or indirect linkages between metropolitan areas and their regional hinterlands

which lessened the disparities in the development level. Wider structural differences were manifested in dissimilar development paths for the metropolises and their regions and led to macroregional divergence. Nonetheless, the increasing level of similarity between the economic structures of the metropolis and the region was not the key factor underlying macroregional convergence.

Similarity of the labour market situation was a manifestation of minor intraregional disparities in the level of economic development, which could be seen as a proof of linkages within the macroregional labour market. Furthermore, an improved situation in the metropolitan labour market with its simultaneous deterioration in the regional hinterland was the main reason (or consequence) for the macroregional divergence in the development level. Seen together with the migratory outflow from the regional hinterland to the metropolis, this could testify to the backwashing of development resources (mostly human capital), from the periphery to the core.

Labour productivity was very strongly correlated with the development level that to some extent was a result of the structural disparities. This was manifested *inter alia* by the differences in labour productivity in industry reflected by varied degree of capital intensity of the sector, and thereby probably to the level of its technological advancement.

It should also be pointed out that both the scale of intraregional disparities and their changes were quite strongly dependent on the national and regional contexts, and the indicators used as well the regression models applied revealed only some of the factors that determine them. It is quite likely that incorporation of indicators related to the quality of human capital and innovation of the enterprise sector into these models would have allowed for a better explanation of the observable intraregional disparities and their changes. Furthermore, the capital city macroregions would most often evade such generalisation, particularly in smaller countries whose very nature added specific qualities to the relationships between the metropolis and the region.

The case studies selected for analysis (Barcelona-Catalonia, Glasgow-Western Scotland, Stockholm-Mälar Region, Toulouse-Midi-Pyrénées, Warsaw-Mazowsze) represented extreme situations regarding both the scale and the dynamics of intraregional disparities. Such a selection made it possible to present a broad spectrum of mechanisms underlying the relationships between the metropolis and the region. These studies showed those factors for which no comparable statistical data at the European level could be compiled, and which were pertinent for the relations between the metropolis and the region, while simultaneously taking into account the opinions of both regional and local authorities.

In the analysed cases (except Catalonia), the regional hinterland did not play a significant role in metropolitan development. This proved inter alia that the strengths and

weaknesses of the cities concerned were primarily related to their functioning in an international dimension. Moreover, economic processes were as a rule enclosed within the metropolitan areas, and the regional linkages of enterprises were poorly developed when compared to their linkages with the rest of the country or internationally. At the same time, the regional hinterlands in many cases were not able to take advantage of the opportunities created by the metropolitan centre, which typically led to the excess of the backwashing of developmental resources over diffusion processes.

The key factors which foster strong linkages between the metropolis and the region included intraregional similarities between the socio-economic structures (notably the quality of the human capital and degree of innovation). In this context, the quality of life in the metropolitan hinterland played a crucial role in retaining or attracting top professionals. Another major factor of intraregional integration was transport accessibility, which was particularly important at a distance of 80-160 km from the centre (with the special significance of the isochron of 90 minutes' travelling time for the intensity of linkages with the metropolitan centre). In addition to that, the polycentric structure of the metropolitan area played a part as it facilitated access to the metropolitan labour market of the residents of the regional hinterland; it also fostered the development of linkages between enterprises regionally.

Activities which were most frequently undertaken by public authorities in the analysed regions in the context of the relationships between the metropolis and the region included the development of transport infrastructure, particularly with regard to creating supra-regional connections between the central city and other metropolitan centres. In consequence, this led to the emergence of transport corridors (roads and railways) which acted as development networks, as well as growth poles or sectors located in the vicinity of regional airports. The development of transport infrastructure was also associated with efforts to develop a polycentric structure in metropolitan areas. Another important type of activities were human capital investments, which frequently were manifested by the development of academic centres in the regional hinterlands of the metropolises. Such undertakings have been successful to varying degrees since these centres as a rule were no competition for the academic potential of the metropolis as the quality of their educational offer would normally be lower, and the scope of the offered courses would be more limited.

References:

Adam, B.,2006, Medium-sized cities in urban regions, European Planning Studies, 14(4), 547-555.

Aguilera, A., 2005, Growth in Commuting Distances in French Polycentric Metropolitan Areas: Paris, Lyon and Marseille, Urban Studies, Vol. 42, No. 9, 1537–1547.

Batten D., 1995, Network cities: creative urban agglomerations for the 21st century, Urban Studies 32(2): 312-327.

Boudeville J., R., 1966, Problems of regional economic planning, Edinburgh

Camagni R., 1994, From city hierarchy to city networks: reflections about emerging paradigm, [in] T.R. Lakshmanan, P. Nijkamp (eds.), Structure and change in the space economy: Festschrift in honor of Martin Beckmann, Springer Verlag, Berlin.

Castells M., 1982, Kwestia miejska, PWN, Warszawa.

Castells M., 1998, The Information Age: Economy, Society and Culture – The rise of network society, Blackwell Oxford.

Cattell, R. B.,1966, The Scree Test for the Number of Factors, Multivariate Behavioral Research, 1(2), s. 245–276.

Christaller W., 1933, Die zentralen Orte in Suddeutschland. (Ośrodki centralne w południowych Niemczech), Przegląd Zagranicznej Literatury Geograficznej, PAN 1.

Couch, C., Karecha, J., Nuissl, H., & Rink, D., 2005, Decline and sprawl: an evolving type of urban development - observed in Liverpool and Leipzig, European Planning Studies, 13(1), 117-136.

Drewett R., Knight R., Schubert U., 1992, The Future of European Cities. The Role of Science and Technology, E.C.FAST FOP 306, Brussels.

Dziewoński K., 1971, Baza ekonomiczna i struktura funkcjonalna miast. Studium rozwoju pojęć, metod i ich zastosowań, Prace Geograficzne IG PAN, t. 87, Warszawa.

Esparza A., Kremenec A., 1994. Producer Services Trade in City Systems. Evidence From. Chicago, Urban Studies, Vol. 31 No. 1, 29-46.

ESPON, 2004, Project 1.1.1., Potentials for Polycentric Development in Europe, NORDREGIO, Stockholm, http://www.espon.eu.

ESPON, 2004, Project 1.1.2., Urban-rural relations in Europe, http://www.espon.eu

ESPON, 2006, 1.4.1. The role of small and medium sized towns (SMESTO), Austrian Institute for Regional Studies and Spatial Planning, Wien, http://www.espon.eu

ESPON, 2006, Project 1.4.3, Study on urban functions, http://www.espon.eu

ESPON, 2007, Project 1.4.4, Preparatory study on feasibility of flows analysis, http://www.espon.eu

Fishman R., 1990, Americas's new city, The Wilson Quarterly, 14, s.24-48.

Geurs, K. T., & van Wee, B., 2006, Ex-post evaluation of thirty years of compact urban development in the Netherlands. Urban Studies, 43(1), 139-160.

Gorzelak G., 1979, *Dobór zmiennych w statystycznej analizie porównawczej*, część 1, Wiadomości Statystyczne, 3; część 2, Wiadomości Statystyczne, 4., 17-21.

Gorzelak G., Smętkowski M., 2008, Metropolis and its region – new relations in the information economy, European Planning Studies, Vol. 16(2008). No. 6, 727-743.

Gluckler J., 2007, Economic geography and the evolution of networks, Journal of Economic Geography 7 (2007) pp. 619–634.

Gordon I.R., McCann P., 2005, Innovation, agglomeration, and regional development, Journal of Economic Geography 5 (2005) pp. 523–543.

Grzeszczak G., 1999, Bieguny wzrostu a formy przestrzeni spolaryzowanej, Prace Geograficzne nr 173 IGiPZ PAN, Continuo, Wrocław.

Hall P., Pain K. (eds.), 2007, The polycentric metropolis: learning from mega-city regions in Europe, Earthscan, London.

Healey M.J., Ilbery B.W. (eds.), 1985, The industrialization of the countryside, GeoBooks, Norwich, England.

Hirschman A. O., 1958, The Strategy of Economic Development, Yale University Press New Haven, Conn.

Hoover E. M., 1980, An Introduction to Regional Economics, Alfred A. Knopf, New York.

Hoyler M., Kloosterman R.C., Sokol M., 2008, Polycentric Puzzles – Emerging Mega-City Regions Seen through the Lens of Advanced Producer Services, Reg. Studies 42(8), 1055-1064.

INTERREG IIIB, 2005, "SEBco" - City-hinterland cooperation as motor for regional development in the South Eastern Baltic, http://www.sebco.eu/

Jauhiainen, J., 2006, Demographic, employment and administrative challenges for urban policies in Estonia, European Planning Studies, 14(2), 273-283.

Keeble D., Tyler P., 1995, Enterprising bahaviour and the urban-rural shift, Urban Studies vol 32, no 6, 975-997.

Korcelli P., 2000, Europejski system miast, Przegląd Geograficzny t. LXXII, z.4, PWN, Warszawa

Krätke S., 2007, Metropolisation of the European Economic Territory as a Consequence of Increasing Specialisation of Urban Agglomerations in the Knowledge Economy, European Planning Studies, 15(1), 1-27.

Kunzmann K. R., 1998, World city regions in Europe: Structural change and future challenges, [in:] Lo F., Yeung Y. (eds.), Globalisation and the world large cities, UN University Press, Tokyo – New York – Paris.

Lo F., Yeung Y. (eds.), Globalisation and the world large cities, UN University Press, Tokyo – New York – Paris.

Lösh A., 1961, Gospodarka przestrzenna, PWN, Warszawa. (Oryg.: Die raumliche Ordung der Wirtshaft, 1944).

Maik W., 1997, Podstawy geografii miast, UMK, Toruń.

McKenzie R., D.,1933, The metropolitan community, McGraww Hill New York

Minar Z., 1997, The Process of Globalization and Social Transformation in Central and Eastern Europe,. Paper for European Science Foundation Conference, Praga.

Myrdal G., 1957, Economic Theory and Underdevelopment Regions, Duckworth, London.

Perroux F., 1950, Economic Space. Theory and Applications, Quarterly Journal of Economics(64): 89-104.

Parr, J. B.,2007, Spatial Definitions of the City: Four Perspectives. Urban Studies, 44(2), 381-392.

Pred A., 1973, The growth and development of system o cities in advanced economies, [in:] Systems of cities and information flows: two essays, Lund Stud. in Geogr.Ser. B, nr 38, s.1-82.

Pred A., 1975, On the spatial structure of organizations and complexity of metropolitan interdependences, Pap. Reg. Sci. Assoc. nr 35.

Pred A., 1976, The interurban transmission of growth in advanced economies: empirical findings versus regional-planning assumptions, IIASA, Laxenburg, Austria.

Preston R.E., Mitchell C.J.A., 1990, Notes on a Combined Economic Base - Central Place Theory and The Study of Urban Systems, [in:] Bourne L.S., Sinclair R., Ferrer M., d'Entremont A., (eds.), The changing geography of Urban Systems, U. of Nevarra Press, Pampalona.

Sassen S., 1991, The global city, Princetown University Press.

Sassen S., 2000, Global City and Global City-Regions: A comparison, [in:] Scott A. J. (eds.), Global City-Regions: trends, theory, policy, Oxford University Press, Oxford.

Schneider A.. Woodcock C.E., 2008, Compact, Dispersed, Fragmented, Extensive? A Comparison of Urban Growth in Twenty-five Global Cities using Remotely Sensed Data, Pattern Metrics and Census Information, Urban Stud 2008; 45(3); 659-692.

Schöller P., 1953, Aufgaben und Probleme der Stadgeographie, Erdkunde(7).

Scott A. J., 1998, Regions and The World Economy: The Coming Shape of Global Production, Competition, and Political Order, Oxford University Press.

Scott A.J, Agnew J., Soja E. W., Storper M., 2000, Global City – Regions, [in:] Scott A. J. (eds.), Global City-Regions: trends, theory, policy, Oxford University Press, Oxford.

Simmie J., 2003, Innovation and urban regions as national and international nodes for the transfer and sharing of knowledge, Reg. Studies Vol. 37 No.6/7, 607–620.

Simmie J., Sennett J., Wood P., Hart D., 2002, Innovation in Europe: a tale of networks, knowledge and trade in five cities, Reg. Studies Vol. 36, No 1, p. 47–64.

Simmie J., Wood P., 2002, Innovation and competitive cities in the global economy. European Planning Studies No 10, p. 149-51.

Smętkowski M., 2000, Przedsiębiorstwo zagraniczne w otoczeniu lokalnym, Kwartalnik Studia Regionalne i Lokalne nr 4, EUROREG, Warszawa.

Smętkowski M., 2004, Program Współpracy Przygranicznej Phare Polska-Niemcy 1994-1999 w opinii przedsiębiorców zlokalizowanych na obszarze wsparcia programu oraz wykonawców projektów, [in:] G. Gorzelak, J. Bachtler, M. Kasprzyk (eds.), Współpraca transgraniczna Unii Europejskiej: doświadczenia polsko-niemieckie, EUROREG, Warszawa.

Smętkowski M., 2005, New Relationships between the Metropolis and the Region in Information Economy: Warsaw Metropolitan Region - A Case Study [in:] Eckardt F., Hassenpflug D. (eds.) 2005, Paths of Urban Transformation, Nr. 5 der Reihe "The European City in Transition". Frankfurt: Peter Lang Verlag.

Smętkowski M., 2007, Nowe relacje metropolia-region w gospodarce informacyjnej na przykładzie Warszawy i Mazowsza, [in:] G. Gorzelak (eds.) Polska regionalna i lokalna w świetle badań EUROREG-u, Wydawnictwo Naukowe Scholar, Warszawa: 163:188.

Smętkowski M., Wójcik, 2009, Regiony w Europie Środkowo-Wschodniej: tendencje i czynniki rozwojowe, Raporty i analizy EUROREG 3/2009, CESRiL, Uniwersytet Warszawski.

SPESP, 2000, Study Programme on European Spatial Planning, http://www.nordregio.se

Stephens G.R., Wikstrom, 2000, Metropolitan government and governance: theoretical perspective, empirical analysis and the future, Oxford University Press: New Jork, Oxford.

Tacoli C., 1998, Rural-urban interactions: a guide to the literature, Environment and Urbanization, Vol. 10, No. 1(98).

Taylor P.J., 2007, World city network: a global urban analysis, Routledge London and New York

Ullman E., L., 1957, American Commodity Flow, University of Washington Press Seattle and Washington.

Winther L., Hansen H. G. K.,2006, The Economic Geographies of the Outer City: Industrial Dynamics and Imaginary Spaces of Location in Copenhagen. European Planning Studies, 14(10), 1387-1406.

Barcelona – Catalonia case study

AMB (Area Metropolitana de Barcelona), 2003, El Territori Metropolita de Barcelona. Datos basicos, evolucion reciente y perspectivas, Barcelona

Barcelona, 2009, In: Aglomeracions Metropolitanes Europees, Regio Metropolitana de Barcelona. Territori-Estrategies-Planejament, Papers 50, IERM, Barcelona

Cebollada A., Riera P., 2008, Daily mobility in the Comarques Centrals, in: La Mobilitata Qoutidiana a Catalunya, Regio Metropolitana de Barcelona. Territori-Estrategies-Planejament, Papers 48; IERM, Barcelona

DIBA (Diputacio de Barcelona), 2009, website,http://www.diba.cat/ladiputacio/en/default.asp, [15.12.2009]

Kaczmarek T., Mikuła Ł., 2007, Ustroje terytorialno-administracyjne obszarów metropolitalnych w Europie, Bogucki Wydawnictwo Naukowe, Poznań

Kozak M.W., 2009, Turystyka i polityka turystyczna a rozwój: między starym a nowym paradygmatem, Wyd. Scholar, Warszawa

Matheu J. M., 2003, The Metropolitan Territory of Barcelona. Basic data, Recent Developments, Perspectives, w: El Teritori Metropolita de Barcelona

Miralles-Guasch C., Donat C., 2007, Poligons d'Activitat Economica: Tendencies de Localizacio I Accessibilitat, Regio Metropolitana de Barcelona. Territori-Estrategies-Planejament, Papers 45; IERM, Barcelona

Munoz-Torrent X., 2008, Terrassa. The Gate of a Territorial Network, speech for the opening session of eurocities's meeting of the Economic development Forum, Terrassa, April 2008

Redondo J. L., 2009, The Regional Spatial Plan of the Metropolitan Region of Barcelona, presentation ppt, 22.04.2009 (courtesy of Author)

Stasiński M., 2008, Barcelona żebrze o wodę, w: Gazeta Wyborcza, 2008. 04. 16

STAT (Statistics), data for Catalunya and the Province of Barcelona (NUTS 3), based on EUROSTAT

Strijp A.G.P., 2008, Administrative crowdedness in Barcelona. An exploration of the significance of a Dutch phenomenon in the context of a foreign metropolis, Report on a foreign internship of two months in the context of the MPA study programme at the Netherlands School of Public Administration (NSOB) in The Hague

Barcelona, (courtesy of Author)

The 22@ Barcelona Project, http://www.insyncbv.nl/pdf/22aBarcelona.pdf; [October 2009]

Wywiady 2009, (interviews 2009), made in metropolis of Barcelona in October 2009 by Marek W. Kozak.

Glasgow – West Scotland case study:

Carmichael P., Midwinter A., 2000, Metropolitan Government in Decline: Lessons from Scotland, The American Review of Public Administration 30/2000.

Fleming A. D.,2005, Scotland's Census 2001 - Statistics on Migration.

Glasgow and the Clyde Valley Joint Structure Plan 2006.

Highlands & Islands Scotland European Regional Development Fund 2007-201, 2008, Structural Funds Operational Programme, The Scottish Government 2008.

Jones C., Leihsman C.,2006, Spatial Dynamics of the Housing Market: An Interurban Perspective, Urban Studies, vol. 43 no 7.

Lowlands & Uplands Scotland European Regional Development Fund Programme 2007-13, 2008, Structural Funds Operational Programme, The Scottish Government.

McConnell, 2006, Central-local government relations in Scotland, International Review of Administrative Science Vol72(1).

Metropolitan Glasgow - Our vision for the Glasgow city region 2008 – 2013.

National Planning Framework for Scotland 2, The Scottish Government.

Rae G., Brown C., 1966, A Geography of Scotland, G. Bell and Sons Ltd., London 1966.

The City Region Boundaries Study, 2002, Scottish Executive Central Research Unit, .

Town and Country Planning (Development Planning) (Scotland) Regulations 2008.

Turok T., Bailey N., Atkinson R., Bramley G., Docherty, Gibb K., Goodlad R., Hastings A., Kintrea K., Kirk K., Leibovitz J., Lever B., Morgan J., Paddison R., Sterling R., 2003, Twin Track Cities? Linking Prosperity and Cohesion in Glasgow and Edinburgh, Department of Urban Studies, University of Glasgow and School of Planning and Housing, Heriot-Watt University.

Turok I., Bailey N., 2001, Does Central Scotland Need a Development Strategy? Urban Change and Policy Research Group, Discussion Paper No., University of Glasgow, Glasgow..

Turok I., Bailey N., 2004,The Theory of Polynuclear Urban Regions and its Application to Central Scotland, European Planning Studies vol. 12 no 3.

Turok I., 2008, Harnessing the Potential of Scotland's Cities, Scottish Affairs No. 63.

Turok I., 2007, Urban Policy in Scotland: New Conventional Wisdom, old Problems? [in:] Keating M., Social Democracy in Scotland, Peter Lang, Brussels, pp. 141-168.

West Region Economic Review, Scottish Enterprise, 2009.

Web sites:http://www.gcvcore.gov.uk; http://www.gro-scotland.gov.uk; http://www.scotland.gov.uk;
http://www.oultwood.com/localgov/countries/scotland.php

Stockholm – Malar Region case study:

Åkerlund, M., & Legerius, B., 2009, The Economy Report. On Swedish Municipal and County Council Finances – October 2008. Stockholm.

Berggren, H., & Hermansson, A., 2008, Local government financial equalisation Information about the equalisation system for Swedish municipalities and county councils in 2008. *Local Government Finance*. Stockholm.

Högberg, J., 2009, Gemensam målbild för Stockholm-Mälarregionen - en syntes av de regionala utvecklingsprogrammen. Stockholm.

OECD., 2006, OECD Territorial Reviews Stockholm, Sweden.

RTK., 2009, Regionala stadskärnor. Stockholm.

RTK., 2009, Stockholmsregionen som kunskapsregion Stockholmsregionens behov, studenternas efterfrågan och lärosätenas attraktivitet. Stockholm.

RTK., 2009, Årsstatistik 2009 för Stockholms län och landsting 2009. Stockholm.

Regionplaneämneden, 2010, *Regional utvecklingsplan för Stockholmsregionen RUFS 2010*. Stockholm: Stockholm Läns Landstig.

SALAR, 2009, Levels of local democracy in Sweden. Stockholm.

SBR, 2007, Facts about Stockholm's business industry. Stockholm.

SLL, 2009, Review of the Draft Stockholm Region RUFS 2010. Stockholm.

Stadsledningskontoret, 2005, Framtidsutredningen Stockholms stad Om stadens ekonomiska utveckling på lång sikt. Stockholm.

Tidestav, K., & Zetterberg, O., 2008, Facts about business in Stockholm Facts about Stockholm ' s business industry. Stockholm.

Tuluza – Midi Pyrenees case study:

Abbott A., 2005, France lays plans for premier cancer centre in Toulouse. Nature. 3/3/2005, Vol. 434. Issue 7029.

Aerospace Valley, INSEE, 2008, Aéronautique – espace en aquitaine et Midi-Pyrénées regions d'Aerospace Valley. Aerospace Valley, INSEE.

AUAT, 2005, Charte interSCOT pour une de l'Aire Urbaine toulousaine. AUAT.

AUAT, 2006, Qui sont les nouveaux arrivants dans l'aire urbanie de Toulouse. AUAT.

AUAT, 2009, L'aire urbaine de Toulouse, une activité à dominante productive, Observatoire partenarial de l'économie et de l'emploi - janvier 2009, Perspectives Villes.

AUAT, INSEE, 2009, Territoires et emploi – aire urbaine de Toulouse – les relations domicile – travail. INSEE, AUAT. Toulouse.

Braudel F., 1986, L'identite de la France. Espace et historie. Paris.

CIEU - Centre interdisciplinaire d'études urbaines, 2002, L'explosion de l'usine AZF à toulouse : une catastrophe inscrite dans la ville. Mappemonde. 65.

Dechy N., Bourdeaux T., Ayrault N., Kordek M., & Le Coze J., 2004, First lessons of the Toulouse ammonium nitrate disaster, 21st September 2001, AZF plant, France.

Dugot P., Laborderie S., Taulelle F., 2008, Midi-Pyrénées, région d'Europe, CRDP Midi-Pyrénées. Toulouse.

Estèbe Ph., 2008, Gouverner la ville mobile. PUF. Paris.

EUROSTAT, 2009, Eurostat regional yearbook 2009.

Gouardin E., 2008, etalement urbain et mobilite : quel avenir pour nos territoires? (Etude d'un cas français), www.vrm.ca/documents/Releve5_Elodie_Gouardin.pdf

Gravier J-F., 1947, Paris et le désert français. Flammarion. Paris.

Grossetti M., 1995, Science, industrie et territoire. Presses Universitaires du Mirail. Toulouse.

Hautreux J., Rochefort M., 1965, Physionomie generale de l'armature urbaine francaise. Annales de Géographie. Vol. 74. No 406.

Jalabert G.,1995, Toulouse métropole incomplète. Anthropos. Paris.

Jalabert G., 2009, Toulouse, l'avion et la ville. Privat. Toulouse.

Journal of hazardous materials, 111(1-3), 131-8. doi: 10.1016/j.jhazmat.2004.02.039.

Kaczmarek T., Mikuła Ł. , 2007, Ustroje terytorialno-administracyjne obszarów metropolitalnych w Europie. Wydawnictwo Naukowe Bogucki. Poznań.

Kerrouche E., 2008, L'intercommunalité en France. Montchrestien. Paris.

Lanusse B., 2006, Toulouse : quel territoire pour quel projet? Agravox. http://www.agoravox.fr/actualites/info-locale/article/toulouse-quel-territoire-pour-quel-16909

Le Boëtté I., Ruhlmann O., Laurin L., 2008, La forte attractivité toulousaine infule sur le marché du logement. 6 pages de l'Insee. 113(2008).

Nevers, J., 2002, Metropolitan government in Toulouse: From fragmentation to federalism. GeoJournal. 58(1).

Nicholls W. J., 2006, Between Growth and Exclusion in Technopolis: Managing Inequalities in Toulouse, France. City and Community. 5(3).

Poumarede J. ,1991, Préhistoire de Midi-Pyrénées, Revue géographique des Pyrénées et du Sud-Ouest, 1991 (3e trimestre, No 62). pp. 245-264.

Projetti H. , 2001, Urbanisation croissante de la region. 6 pages de l'Insee. No 47: avril 2001.

Région Midi-Pyrénées, 2009, Schéma Régional d'Aménagement et de Développement du Territoire, www.midipyrenees.fr/Schema-regional-d-amenagement-et-de-developpement-durable-du

Ruhlmann O., 2007, En Midi-Pyrénées, plus de 55 000 emplois salariés sont liés à l'industrie aéronautique, 6pages de l'Insee. No 104: octobre 2007.

Thierry W. Fen Chong S. , 2008, Les pôles de compétitivité. Futuribles. No 342 - juin 2008.

Tornéro M., 2009, Augmentation record de la population en Haute-Garonne, 6 pages de l'Insee. No 104: octobre 2007.

Weil T., Fen Chong S., 2008, Les pôles de compétitivité. Futuribles. No 342 - juin 2008

Warsaw - references

Gorzelak G., Smętkowski M., 2008, *Metropolis and its region – new relations in the information economy, European Planning Studies*, Vol. 16(2008). No. 6, 727-743.

Smętkowski M., 2005a, *New Relationships between the Metropolis and the Region in Information Economy: Warsaw Metropolitan Region - A Case Study* [in:] Eckardt F., Hassenpflug D. (eds.) Paths of Urban Transformation, Nr. 5 der Reihe "The European City in Transition". Frankfurt: Peter Lang Verlag.

Smętkowski M., 2005b, *Rola infrastruktury transportowej w integracji obszaru metropolitalnego Warszawy* [in:] Z. Makieła, T. Marszał (eds.) Infrastruktura techniczno-ekonomiczna w obszarach metropolitalnych, Biuletyn KPZK PAN, z. 222, Warszawa.

Zegar T., 2003, *Procesy integracji obszaru metropolitalnego Warszawy*, Kwartalnik Studia Regionalne i Lokalne, EUROREG, Nr 1(11).

7. List of annexes

Annex 1. Delimitation of metropolitan macroregions

Annex 2. Characteristic of metropolitan macroregions

Annex 3. Accessibility of statistical data at NUTS3 level

Annex 4. Principal components to differentiation of metropolitan areas (Varimax rotation)

Annex 5. Principal components to differentiation of regional hinterlands (Varimax rotation)

Annex 6. Correspondence analysis of metropolitan areas and regional hinterlands

Annex 7. Typology of metropolitan macroregions – selection of case studies

Annex 8. Structure of in-depth interview

Annex 9. Questionnaire for local governments

Annex 10. Questionnaire for enterprises

Annex 11. Settlement structure and change in population number in analysed metropolitan macroregions

Annex 1. Delimitation of metropolitan macroregions

Based on these assumptions and remarks, the first step of this research has been to define metropolitan and urban areas **(MA)** based on the comparison of Urban Audit Larger Urban Zones (LUZ) and EUROSTAT population data for NUTS3 regions. The following basic rules have been applied:

Rule 1) Size of LUZ

1. Only LUZs with over 250,000 inhabitants have been included in the city-region analysis **(MA)**.
2. Larger LUZs with over 1 million inhabitants have been considered as metropolitan areas **(MAM)** while smaller agglomerations - as urban areas **(MAU)**.

Rule 2) Correspondence between LUZ and NUTS3

1. Only LUZs exceeding 70% of the population threshold of NUTS3 have been included in the city-region analysis **(MA_REG)**[46]**.**
2. In case of LUZs consisting of more than one NUTS3, only regions with at least 50% of the population living within LUZ were considered as a part of the metropolitan area **(MA_REG_PART)**.

Rule 3) Combination of metropolitan areas

Polynuclear metropolitan areas **(MA_POLI)** have been defined in the following circumstances:

1. The distance between LUZ's core cities have been smaller than: 60 km in case of LUZs with over 500,000 inhabitants (at least one) or 30 km in case of smaller LUZs.
2. Rule 2 applies to the whole polynuclear metropolitan area.
3. Polynuclear metropolitan areas have been considered as a compact (MA_POLI_COMP) or scattered (MA_POLI_SCAT) ones depending on other NUTS3 regions that separating them apart.

The regional hinterlands **(RH)** for such metropolitan and urban areas **(MA)** have been delineated using surrounding NUTS 3 combination approximations. Another set of rules has been applied here:

[46] The result has been checked against ESPON 1.4.3. project results and LUZ not classified as large cities (100,000 and more) has been rejected (i.e. Bajadoz (ES) and Maribor (SI)) as well as ESPON 1.1.1. project results to accept selected cities below the threshold (but over ca. 65%) classified as MEGA (i.e. Bordeaux in France, Gdańsk, Łódź and Szczecin in Poland, Sevilla and Valencia in Spain).

Rule 4) Neighbouring regions

1. The regional hinterland **(RH)** consists of all NUTS3 regions directly neighbouring on the metropolitan area in a respective country **(MA_REG).**

2. The regional hinterland consists of NUTS3 regions whose at least 75% of their total area is within the range constituted by the maximum distance between LUZ's core city and the farthest point of the neighbouring regions.

Rule 5) Predominance of larger metropolitan area regions

The neighbouring metropolitan area regions (**MA_REG**) or a metropolitan area situated in the regional hinterland of another metropolitan area constitute a part of the regional hinterland of a larger metropolitan area region if the ratio of their population size is more that 3.

Rule 6) Separate hinterlands

1. The NUTS3 region that is a part of two different regional hinterlands constitutes a part of the regional hinterland: a) of a larger metropolitan area region if the ratio of their population size is more that 3 b) of the neighbouring metropolitan area's hinterland c) of metropolitan area region situated in the same NUTS2 region.

The typology of NUTS3 regions based on these rules allows for identifying two main groups of regions: NUTS3 regions included in city-region analysis and other NUTS.

Table 1. Types of NUTS3 regions

Abbreviation	Code	Name	Description
NUTS3 selected for the city-region analysis			
MA_REG	1,0	Metropolitan area region	Region with LUZ with over 250,000 population and LUZ population > 70% NUTS3 population
MA_REG_PART	1,1	Metropolitan area – part	Regions with LUZ that consists of more than one NUTS3
MA_POLI	1,2	Polynulcear metropolitan areas region	Region with more than one MA_REG and LUZ's core cities within certain distance
RH	2,0	Regional hinterland	NUTS3 neighbouring MA_REG or situated in NUTS2 within certain distance from MA_REG
RH_MA_REG	2,1	Metropolitan area – part of regional hinterland	Region with LUZ three times smaller than larger LUZ of neighbouring MA_REG
RH_MA_REG<70	2,2	Metropolitan area – part of regional hinterland	Region with LUZ three times smaller than larger LUZ of neighbouring MA_REG; LUZ population < 70% NUTS3 population
Other NUTS3 regions			
MA_REG<70	3,0	Metropolitan area – weak LUZ-NUTS3 correspondence	Region with LUZ with over 250,000 population and LUZ population < 70% NUTS3 population
MA_SMALL	4,0	Small urban area region	Region LUZ with less than 250 000 population
RH_MA_SMALL	4,2	Small urban area region – part of regional hinterland	Region LUZ with less than 250 000 population constitutes part of regional hinterland
NUTS3_IND	5,0	Other regions without LUZs	Regions situated outside influence of MA_REG or a part of two separate regional hinterlands

Source: own elaboration.

Annex 2. Characteristic of metropolitan macroregions

Table 2 shows selected components from the profiles of the national settlement systems, highlighting in particular their specific nature related to LUZs as defined in the Urban Audit, as well as NUTS3 administrative divisions. In addition to that, the Table shows LUZs with a population over 250 000, which were excluded from the analysis of city-region relationships due to the following considerations:

- Non-fulfilment of the correspondence criterion (Rule 1),
- Being "dominated" by larger urban centres located in the vicinity (Rule 5),
- Impossibility to delimit the regional hinterland due to penetrating influence of the neighbouring urban centres or geographical barriers (Rule 6).

In particular, this applies to the relationship between metropolitan areas and their surroundings in the case of polynuclear metropolitan regions, which were singled out in the Netherlands, Belgium, central England and northern Spain. Secondly, it refers to LUZs with a large surface area as defined by the Urban Audit, which led to the setting of the extent of their impact quite broadly, on the basis of the adopted delimitation procedure (e.g. Berlin, Prague). On the other hand, such relationships may de distorted in the case of small LUZs (e.g. Bucuresti, Porto and Lisboa). We tried to take these considerations into account while interpreting the results. For the case studies selected for detailed analysis, we attempted to make the research polygons more unified.

Table 2. Characteristics of the metropolitan macroregions sample in individual countries

Country	Number of selected macroregions	Characteristic features	LUZ with more than 250 000 inhabitants (rejected)		
			a) weak correspondence with NUTS3	b) dominate be larger Urban centers	c) difficulties in delimitation of regional hinterland
Austria	5	Relatively small LUZ of Wien in comparison to other urban centres in the country. Potential transborder relations of Wien.	-	-	-
Belgium	2	One dominant polynuclear metropolitan macroregion as a result of small distances	-	-	-

		between Brussels, Antwerp, Gent and Charleroi.			
Bulgaria	2	The capital city macroregion covers substantial part of the east part of the country.	Plovdiv	-	-
Cyprus	0	Geographical barriers as a result of location on the island (including division of the Cyprus).	Lefkosia		
Czech Republic	1	Large surface area of Prague LUZ and as a result very large regional hinterland that consists of number of smaller LUZs regions Penetrating influence of urban centres situated in Silesia and Moravia.	Brno	Plzeň	Ostrava
Denmark	2	Penetrating influence of urban centres situated in Jutland. Potential transborder relations of Copenhagen. The role of geographical barriers e.g. Odense.	-	-	Aalborg, Odensee
Estonia	1	The capital city macroregion covers substantial part of the whole country.	-	-	-
Finland	1	Helsinki macroregion covers substantial part	Tampere	Turku	-

		of the country and the most densely populated areas.			
France	4	Significant number of LUZ rejected mainly as a result of weak correspondence with NUTS3 regions. Large metropolitan macroregion of Paris consists of number of LUZ regions. Penetrating influence of urban centres situated in Alsace, Loraine and Provence.	Lille, Nice-Grasse, Marsylia, Metz, Nancy, Strasbourg, Dijon, Caen, Renes, Nancy, Tours, Limoges	Amiens, Rouen, Orleans, Reims, Clermont-Ferand, Grenoble	-
Germany	18	Small size of NUTS3 regions lead to strong correspondence between LUZ and NUTS3 regions. This allows delineation of macroregions even for small urban centres (like Gottingen). Berlin LUZ has a very large surface area as a result of administrative division (LAU2). Penetrating influence of urban centres is observed very often. The macroregion of Hamburg consists of former East Germany territories.		Kiel, Schwerin, Karlsrue	Koblenz
Greece	2	Athena	-	-	-

		macroregion covers large number of islands.			
Hungary	1	The capital city macroregion covers substantial part of the whole country. Penetrating influence of urban centres situated in the east part of the country.	Miszkolc, Debrecen	-	-
Ireland	1	Artificial boundaries of Dublin macroregion as result of NUTS3 division of the country.	-	-	-
Italy	8	The number of polynuclear metropolitan macroregions: Bologna-Modena, Venezia-Padova, Napoli-Caserta-Salerno. The macroregion of Genua has specific shape as result of geographical barriers. Penetrating influence of urban centres situated in the north and south part of the country.	Verona, Bari, Pescara	Brescia	Taranto
Latvia	1	The capital city macroregion covers substantial part of the whole country.	-	-	-
Lithuania	1	Penetrating influence of LUZs Vilnius and Kaunas that have also	Kaunas	-	-

		very large surface areas.			
Luxembourg	1	Potential transborder interactions.	-	-	Luxembourg
Malta	0	Geographical barriers as a result of location on the island.	-	-	-
Netherlands	2	One dominant polynuclear metropolitan macroregion as a result of small distances between Randstad Holland urban centres as well as Breda, Tilburg, Eindhoven, Arnhem and Nijmegen. Relative importance of Groningen situated in the north part of the country.	Twente	-	-
Norway	2	Large surface area of NUTS3 regions and as a result large macroregions of Oslo and Bergen.	Stavanger	-	-
Poland	6	Polycentric settlement system whit large number of smaller cities (but usually weak correspondence between LUZ and NUTS3). Penetrating influence of urban centres. LUZs of Szczecin, Gdansk and Lodz have very large surface areas.	Kraków, Poznań, Olsztyn, Opole, Kielce, Bydgoszcz, Toruń.,	Częstochowa, Radom	-

Portugal	2	Small LUZs of Lisboa and Porto.	-	-	-
Romania	1	Small LUZs and as a result weak correspondence between LUZ and NUTS3. LUZ of Bucaresti has small surface area.	Cluj-Napoca, Craiova, Timişoara	-	-
Slovakia	1	Potential transborder relations of Bratislava. Penetrating influence of smaller urban centres.	Košice	-	-
Slovenia	1	The capital city macroregion covers substantial part of the whole country.	Maribor	-	-
Spain	6	Macroregion of Madrid is very large. Penetrating influence of urban centres in case of Andalusia and in the macroregion of Valencia. LUZs of Saragossa and Seville have very large surface areas. Polynuclear metropolitan macroregion in Basque Country and Cantabria.	Badajoz, Oviedo, Gijon, Vigo, Cordoba, Malaga, Pamplona	Valladoid, Alicante, Murcia	-
Sweden	1	Large surface area of NUTS3 regions. Potential transborder relations of Malmo.	Goeteborg, Malmo		
Switzerland	1	Potential transborder	Bern	-	Geneve, Lausanne.

		interactions.			
United Kingdom	10	Very large polynuclear metropolitan macroregion of Central England. LUZs of Aberdeen, Kingston-upon-Hull, Newcastle upon Tyne have very large surface areas. Penetrating influence of urban centres in case of Glasgow-Edinburgh and Bristol-Cardiff.	Exeter	Cambridge, Portsmouth, Stoke-on-Trent, Worcester, Wrexham	

Source: prepared by the author.

Table 3. Population in selected NUTS3 types

Type of LUZ/NUTS correspondence	No	% of total	Population LUZ	% of total	Population NUTS3	% of total	Population ratio LUZ / NUTS3
Metropolitan areas regions (fitted)	126	40.9	172 177 948	77.3	188 560 444	37.5	91.3
- single NUTS	*36*	11.7	*50 352 896*	22.6	*57 538 575*	*11.4*	*87.5*
- combination of NUTS	*36*	11.7	*73 797 740*	33.1	*78 408 726*	*15.6*	*94.1*
- polynuclear areas	*48*	15.6	*48 027 312*	21.6	*52 613 143*	*10.5*	*91.3*
Metropolitan areas (unfitted)	63	20.5	30 921 373	13.9	59 011 649	11.7	52.4
Metropolitan areas subordinated within metropolitan macroregions	21	6.8	8 499 365	3.8	14 383 432	2.9	59.1
Urban areas (LUZ<250 000) subordinated within metropolitan macroregions	33	10.7	5 089 015	2.3	15 216 131	3.0	33.4
Urban areas (LUZ<250 000)	65	21.1	11 164 121	5.0	27 082 682	5.4	41.2
Other NUTS3 regions (848)	:	:	:	:	198 834 137	39.5	:
Total	308	100.0	222 762 807	100.0	503 088 475	100.0	44.3

Source: prepared by the author.

In conclusion (Table 3), of a total of 308 LUZs (including also Marseilles, Lille and Nice-Grasse) in the EU27, Norway and Switzerland, 126 (40%) were accepted for further analyses. These areas, however, were inhabited by nearly 80% of the overall LUZ population, while almost 40% of the population of the entire researched area were living

in NUTS3 regions corresponding to these LUZs. Among them, 72 LUZs were predominantly monocentric in character, whereas 48 LUZs were parts of 11 polynuclear systems having at least a bipolar character (Table 4).

Table 4. Characteristics of polynuclear metropolitan regions

Polynuclear metropolitan areas region	Number of LUZ	Names	Population of metropolitan areas regions [mln]	Population of regional hinterland
Central England	10	Wolverhampton Leicester Sheffield Wrexham Manchester Liverpool Bradford-Leeds Birmingham Nottingham Coventry	12,0	8,8
Rheine-Ruhr	6	Bonn Köln Düsseldorf Mönchengladbach Wuppertal Ruhrgebiet	10,2	6,2
Netherlands	9	Utrecht Breda Eindhoven Tilburg Arnhem/ Nijmegen Rotterdam s' Gravenhage Amsterdam	7,1	5,0
Frankfurt am Main	4	Mainz Darmstadt Wiesbaden Frankfurt am Main	3,8	3,0
Central Belgium	4	Gent Charleroi Antwerpen Bruxelles / Brussel	3,5	3,8
Munchen	2	Munchen Augsburg	3,2	2,9
Napoli	3	Salerno Caserta Napoli	3,1	2,1
Bilbao-Santander	3	Santander Bilbao Vitoria/Gasteiz	1,5	1,2
Leipzig-Halle	2	Leipzig Halle an der Saale	1,4	1,7
Bologna-Modena	2	Modena Bologna	1,1	2,0
Padova-Venezia	2	Padova Venezia	1,2	2,2
Geneve-Lausanne	2	Lausanne Geneve	0,8	-

Source: prepared by the author.

At the same time, the barrier identified in the case of 63 LUZs (20% of their aggregate number) was their poor fit with NUTS3 regions. This meant that on average slightly over 50% of the NUTS3 population where a given LUZ was located inhabited an urban area. It should be noted that as a rule these were smaller cities' LUZs. This is proved by the fact that they had a lower than 15% share in the population of all the urban areas defined in the Urban Audit. Another important group was made up of LUZs (regardless of their population) which were incorporated in the regional hinterlands of much bigger urban centres. Although there were as many as 54 of such LUZs, they had a minor share in the aggregate population (6%). As insignificant in terms of the population were smaller urban areas with a population under 250 000, which were also poorly fitted with the NUTS3 administrative level (on average, only 40% population were living in a given urban area).

Annex 3. Accessibility of statistical data at NUTS3 level

To be elaborated

Annex 4. Principal components to differentiation of metropolitan areas (Varimax rotation)

Variables	**Components**			
	„Modern economy"	„Population potential"	„National growth pole"	„Weak suburban zone"
Principal component value	4,6	2,8	2,2	2,2
Share of variance (%)	25,5	15,8	12,2	12,2
Population	0,00	**0,75**	0,07	-0,35
Density of population (person/sq km)	0,10	0,53	0,22	-0,43
GDP per capita (EUR)	**0,89**	0,06	-0,09	-0,12
GDP per capita (respective country=100)	0,16	0,16	**0,84**	0,20
Population of metropolitan area	-0,04	**0,81**	0,10	0,04
Share of metropolitan city in total population (%)	-0,13	0,11	0,10	0,56
GVA in agriculture (%)	-0,57	-0,29	-0,04	-0,09
GVA in industry (%)	-0,03	**-0,71**	0,28	-0,28
Labour productivity in agriculture (EUR)	0,42	0,14	-0,10	**-0,77**
Labour productivity in industry (EUR)	**0,74**	-0,10	-0,10	-0,29
Labour productivity in agriculture (% total productivity)	-0,12	0,11	-0,03	**-0,74**
Labour productivity in services (% total productivity)	-0,46	0,18	0,23	0,22
GVA simple services (%)	**-0,73**	0,07	0,41	0,23
GVA specialised services (%)	**0,62**	**0,66**	0,01	0,02
GVA public services (%)	0,17	0,07	**-0,88**	0,04
Share of specialised services in service sector (%)	**0,74**	0,44	0,12	-0,10
Employees per 100 inhabitants	**0,67**	-0,01	0,41	0,33
Unemployment rate (%)	**-0,73**	0,02	-0,39	0,01

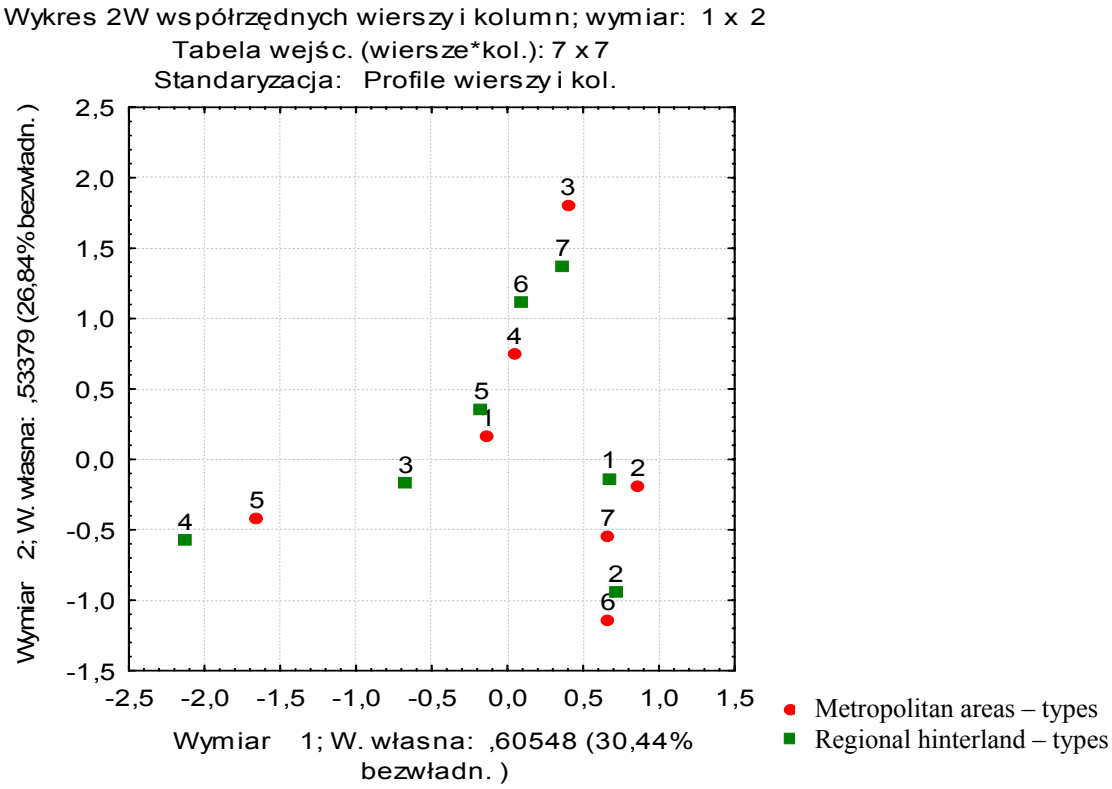
Source: prepared by author.

Annex 5. Principal components to differentiation of regional hinterlands (Varimax rotation)

Variables	**Components**			
	„Modern economy"	Rozwinięty rynek pracy	„Population potential"	Dualność gospodarki
Principal component value	3,8	3,0	2,6	1,9
Share of variance (%)	19,9	16,0	13,8	10,1
Population	0,10	0,15	**0,81**	-0,06
Density of population (person/sq km)	0,34	0,23	**0,61**	-0,15
GDP per capita (EUR)	**0,78**	0,43	0,06	-0,14
GDP per capita (respective country=100)	0,00	0,59	0,30	0,40
Population of the largest city	0,06	0,06	**0,84**	-0,16
GVA in agriculture (%)	**-0,67**	-0,37	-0,08	0,06
GVA in industry (%)	-0,46	0,59	0,04	-0,14
GVA in services (%)	**0,92**	-0,22	0,04	0,07
Labour productivity in agriculture (EUR)	**0,70**	0,04	0,45	-0,01
Labour productivity in agriculture (% total productivity)	0,16	-0,30	0,54	-0,46
Labour productivity in industry (% total productivity)	-0,03	0,12	-0,14	**0,69**
Labour productivity in services (% total productivity)	-0,28	-0,23	0,06	**0,70**
GVA simple services (%)	0,03	-0,01	-0,18	0,59
GVA specialised services (%)	**0,68**	0,08	0,42	-0,20
GVA public services (%)	0,58	-0,57	-0,11	-0,25
Employees per 100 inhabitants	0,21	**0,75**	-0,03	-0,04
Activity rate (%)	0,01	0,56	0,08	-0,12
Unemployment rate (%)	-0,22	**-0,72**	-0,01	0,01

Source: prepared by author.

Annex 6. Correspondence analysis of metropolitan areas and regional hinterlands



Annex 7. Typology of metropolitan macroregions – selection of case studies

Typology of macroregions			GDP per capita MA/RH ratio – change (1995-2004)					
			Growing		Stable		Declining	
			RH good performance	RH weak performance	RH good performance	RH weak performance	RH good performance	RH weak performance
GDP per capita MA/RH ratio – level (1995)	High	MA good performance	Budapest **Warszawa** Bucureşti	Tallinn Madrid Riga **Stockholm** Ljubljana Bratislava Sofia Edinburgh Hamburg Kobenhavn Paris	Regensburg Munchen		Graz **Toulouse** Lisboa	
		MA weak prrformance			Linz	Oslo Aberdeen	Dublin Groningen Porto Central Belgium Frankfurt	Wien
	Moderate	MA good performance	Lyon Netherlands Nürnberg Roma	Helsinki Vilnius Gdańsk Praha Dresden	Bordeaux Milano			
		MA weak prrformance			Salzburg		Szczecin Saarbrücken Lipsk/Halle	Berlin Hannover
	Low	MA good performance	London Bristol Firenze Padova/Venzia	Wrocław Belfast Varna Athina Zürich	Magdeburg Erfurt Stuttgart Arhus		Freiburg	
		MA weak prrformance		Central England Bilbao/Santander Zaragoza Thessaloniki Cardiff Newcastle upon Tyne Liege Genova **Glasgow** Kingston-upon-Hull	Valencia Łódź Bremen Ruhr-Rheine	Torino Bergen Neapol	**Barcelona** Sevilla Innsbruck Bielefeld Bolonia/Modena	Katowice-Żory Göttingen

Annex 8. Structure of in-depth interview

PART 1: METROPOLITAN REGION AND ITS CONSTITUENTS

1. What is the spatial range of the metropolitan centre's (city's) influence on the following aspects in its surrounding area?

2. Is there a commonly accepted delimitation of the city's metropolitan area and what are its criteria?

3. Does the dominant city have an administrative or statistical counterpart reflecting the area of its influences (metropolitan region)?

4. Does the existing administrative division on the regional level (NUTS2) and subregional level (NUTS3) corresponds to the city's influence areas, i.e.: a) the metropolitan area, b) the metropolitan macroregion?

PART 2: RELATIONS BETWEEN THE METROPOLIS AND THE REGION

1. What are the most important examples of links between the metropolis and its surrounding region?

2. Are there large differences between the metropolis and the remaining part of the metropolitan region, of the following type: a. economic, b. social?

3. Does the metropolis and its surrounding region become homogenous in respect of: a) economic structure b) social structure?

4. Are there examples of cooperation / competition of public administration within the metropolitan region? Which one dominates?

PART 3: FACTORS DETERMINING ECONOMIC RELATIONS BETWEEN THE METROPOLS AND THE REGION

1. What are the most important factors determining the economic links between the metropolis and its surrounding region?

2. Are the factors mutually related?

PART 4: IMPORTANCE OF THE LINKS FOR METROPOLIAT REGION'S DEVELOPMENT

1. What are the most important examples of positive influence of metropolis on its surrounding region?

2. What are the most important examples of negative impact of metropolis on its surrounding region?

3. Do the metropolis and its surrounding region mutually need each other?

a. Does the metropolis need the region?

b. Does the region need metropolis?

PART 5: STRENGTHS AND WEAKNESSES OF THE METROPOLIS AND THE REGION

1. What are the most important strengths and weaknesses of the metropolis (the metropolitan area)?

2. What are the most important strengths and weaknesses of the region surrounding the metropolis?

3. Is it possible to show relationship between strengths and weaknesses of the metropolitan area and the metropolitan region?

PART 6: ACTIVITIES OF THE PUBLIC ADMINISTRATION

1. Are the actions of various actors coordinated in: a) the metropolitan area b) the metropolitan macroregion?

2. Do the actions of public authorities take into account intraregional differences?

3. What actions are taken in order to increase the positive influence of the metropolitan centre on its surrounding region?

4. What actions are taken in order to limit the negative impact of the metropolitan area on its surrounding region?

PART 7: DEVELOPMENTAL PERSPECTIVES

1. Will the differences between the metropolis and the region increase or diminish?

2. What is going to be the main cause of this process?

Annex 9. Questionnaire for local governments – Glasgow example

a. SECTION 1 Location

1. Name of the council area					
2. Is the are of the municipality crossed by:	Motorway or expressway	□			
	Primary route	□			
	Other A road	□			
	Railway (with station)	□			
3. Please estimate a distance to the center of Glasgow (km)					
3.1. What is the estimated average travel time to the centre of Glasgow [in minutes]?	By passenger car (min)				
	Bus, minibus (min)				
	Train (min)				
4. Please rate the quality of communications with Glasgow for the following:	Very good	Good	Average	Bad	Very bad
Travel time by passenger car	□	□	□	□	□
Travel time by public transport	□	□	□	□	□
Availability of public transport	□	□	□	□	□
Frequency of public transport	□	□	□	□	□
General assessment of communication with Glasgow:	□	□	□	□	□

5. Do you think that the state of communication with Glasgow has an influence on development of your council area?
1. Yes □ → If so, the impact of the current state of communication with Glasgow on your council area is:
2. No □ □
positive
3. Difficult to say □ □
negative

SECTION 2 Metropolitan centre's influence

6. Do the inhabitants of the council area (if so: to what extent):	**Please tick if yes**	**i. Please indicate whether you consider this relationship:**				**Please classify the extent of change over the past 3 years:**			
		Weak	Average	Strong	Difficult to say	Increase	No change	Decline	Difficult to say
- commute to work in Glasgow (every day)	□	□	□	□	□	□	□	□	□
- commute to work in Glasgow in weekly cycle (come back for weekends only)	□	□	□	□	□	□	□	□	□
- go to Glasgow for shopping	□	□	□	□	□	□	□	□	□
- commute to Glasgow secondary schools	□	□	□	□	□	□	□	□	□
- commute to Glasgow tertiary schools	□	□	□	□	□	□	□	□	□
- go to Glasgow for cultural purposes (e.g. cinema, theatre, exhibitions, etc.)	□	□	□	□	□	□	□	□	□
- go to Glasgow to receive medical services	□	□	□	□	□	□	□	□	□
- permanently move to Glasgow	□	□	□	□	□	□	□	□	□

7. Do the inhabitants of Glasgow (if so: to what extent):	**Please tick if yes**	**ii. Please indicate whether you consider this relationship:**				**Please classify the extent of change over the past 3 years:**			
		Weak	Avera-ge	Strong	Difficult to say	Increase	No change	Decline	Difficult to say
- commute to work in the council area (every day)	□	□	□	□	□	□	□	□	□
- commute to work in the council area in weekly cycle (come back for weekends only)	□	□	□	□	□	□	□	□	□
- go to the council area for shopping	□	□	□	□	□	□	□	□	□
- go to the council area for recreation	□	□	□	□	□	□	□	□	□
- permanently move to the council area	□	□	□	□	□	□	□	□	□
8. Do the Glasgow-based enterprises:									
- locate their offices in the council area	□	□	□	□	□	□	□	□	□
- locate their production facilities in the council area	□	□	□	□	□	□	□	□	□
- locate their trade offices in the council area	□	□	□	□	□	□	□	□	□
- locate its services outlets in the council area	□	□	□	□	□	□	□	□	□
- locate its warehouses or similar facilities in the council area	□	□	□	□	□	□	□	□	□

9. Please indicate whether there are following facilities within your council area and whether these have had a positive, neutral or negative impact on the development of your council area	**Please tick if yes**	**Number**			**Impact on your council area**			
		Large	Average	Small	Positive	Neutral	Negative	Difficult to say
- complexes of multi-family homes inhabited by the Glaswegians*	□	□	□	□	□	□	□	□
- fenced complexes of single-family homes inhabited by Glaswegians*	□	□	□	□	□	□	□	□
- single-family homes inhabited by Glaswegians*	□	□	□	□	□	□	□	□
- recreational houses belonging to Glaswegians	□	□	□	□	□	□	□	□
- allotments belonging to Glaswegians	□	□	□	□	□	□	□	□
- accommodation (conference) facilities offering services to inhabitants of Glasgow and Glasgow-based companies	□	□	□	□	□	□	□	□
- agrotourist farms	□	□	□	□	□	□	□	□
- private nursing homes for old-age pensioners from Glasgow	□	□	□	□	□	□	□	□
- distribution centres handling Glasgow-based enterprises	□	□	□	□	□	□	□	□
- disposal sites receiving waste from Glasgow	□	□	□	□	□	□	□	□

* The term refers to inhabitants of Glasgow who have moved to the gmina in the last 5 years

SECTION 3 Cooperation

10. Please indicated if the council cooperates with the following organisations and where appropriate rate the quality of this cooperation	**Please tick if yes**	***Assessment of the cooperation***				
		Very good	Good	Average	Bad	Very bad
Community councils	□	□	□	□	□	□
Local council	□	□	□	□	□	□
Scottish government	□	□	□	□	□	□
Glasgow City Council	□	□	□	□	□	□

11. Please indicate the areas in which your council currently cooperates or plans to cooperate with Glasgow City Council from the list below	**Currently**	**In the future**	**Difficult to say**
Transport infrastructure	□	□	□

Public transport	□	□	□
Environmental protection	□	□	□
Waste management	□	□	□
Spatial management plans	□	□	□
Other (what?) ……..	□	□	□

Annex 10. Questionnaire for enterprises

SECTION 1. Basic information

1. Type of the main activity of the enterprise	Manufacturing	Industry (or NACE 2004 code)	Services	Industry (or NACE 2004 code)
	☐	……	☐	……

2. Location of the enterprise (see the map)			**2a. Please estimate a distance to the center of Glasgow (km)**	
	Glasgow City within administrative borders	☐		
	Glasgow metropolitan area (ie Lanarkshire, Renfrewshire, Durbantonshire)	☐		

3. What is the number of employees in the enterprise?			**4. For how many years is the enterprise economically active?**	
	1-9	☐	up to 2 years	☐
	10-24	☐	3 - 5 years	☐
	25-49	☐	6 – 10 years	☐
	50-249	☐	11 – 20 years	☐
	250 and over	☐	20 and over	☐

5. Is there foreign capital invested in the enterprise?	yes	☐
	no	☐

SECTION 2. Spatial relations

Organizational structure			**If so, please indicate the location of the main office**				
			Glasgow metropolitan area **(see the map)**	The rest of the South Western Scotland or Southern part of Highlands and Islands **(see the map)**	Other regions of the UK	EU countries	Other countries
6. Is the enterprise a local / branch office of a larger company?	yes	☐	☐	☐	☐	☐	☐
	no	☐					

	If so, please indicate the location of branch offices more than one area may be indicated				
	Glasgow metropolitan area **(see the map)**	The rest of the South Western Scotland or Southern part of Highlands and Islands **(see the map)**	Other regions of the UK	EU countries	Other countries

7. Does the enterprise have own local / branch offices?	yes	□	□	□	□	□	□
	no	□					
8. Is the company going to create new local offices in the next 3 years?	yes	□	□	□	□	□	□
	no	□					

9. What is the spatial extent of the enterprise's contacts?	**Please indicate up to two most important markets / areas**				
	Glasgow metropolitan area **(see the map)**	The rest of the South Western Scotland or Southern part of Highlands and Islands **(see the map)**	Other regions of the UK	EU countries	Other countries
location of the providers of goods	□	□	□	□	□
location of basic services providers (e.g. cleaning, security services, etc.)	□	□	□	□	□
location of the higher-order services providers (e.g. advertising, accountancy, consulting, etc.)	□	□	□	□	□
location of the consumers / clients	□	□	□	□	□
location of competitors	□	□	□	□	□
staff recruitment area	□	□	□	□	□
sources of investment capital	□	□	□	□	□
sources of information on innovations	□	□	□	□	□
10. What changes in the share (%) of the metropolitan region (ie. South Western Scotland and Southern part of Highlands and Islands except Glasgow Metropolitan Area) have occurred in the last 3 years regarding:	No relations	Share increase	No change	Share decline	Difficult to say
location of the providers of goods	□	□	□	□	□
location of basic services providers (e.g. cleaning, security services, etc.)	□	□	□	□	□
location of the higher-order services providers (e.g. advertising, accountancy, consulting, etc.)	□	□	□	□	□
location of the consumers / clients	□	□	□	□	□
location of competitors	□	□	□	□	□
staff recruitment area	□	□	□	□	□
sources of investment capital	□	□	□	□	□
sources of information on innovations	□	□	□	□	□
10 a . What changes in the share (%) of foreign markets have occurred in the last 3 years regarding:	No relations	Share increase	No change	Share decline	Difficult to say

location of the providers of goods	□	□	□	□	□
location of basic services providers (e.g. cleaning, security services, etc.)	□	□	□	□	□
location of the higher-order services providers (e.g. advertising, accountancy, consulting, etc.)	□	□	□	□	□
location of the consumers / clients	□	□	□	□	□
location of competitors	□	□	□	□	□
staff recruitment area	□	□	□	□	□
sources of investment capital	□	□	□	□	□
sources of information on innovations	□	□	□	□	□

SECTION 3. Local environment

11. Please rate the attractiveness of the Glasgow metropolitan area for investors on the following issues using the ratings:	**Ratings**					
	Very low	Low	Average	High	Very high	Difficult to say
Well-developed transport infrastructure in the metropolitan area	□	□	□	□	□	□
Well-developed transport infrastructure linking the metropolis with other areas	□	□	□	□	□	□
Availability of space for business activity	□	□	□	□	□	□
Good price of space for business activity	□	□	□	□	□	□
Large supply of labour	□	□	□	□	□	□
Low price of labour	□	□	□	□	□	□
Highly qualified labour force	□	□	□	□	□	□
Large sales market	□	□	□	□	□	□
Opportunities for cooperation with other companies	□	□	□	□	□	□
Developed business environment infrastructure	□	□	□	□	□	□
Developed business social networks	□	□	□	□	□	□
Numerous sources of information on innovations	□	□	□	□	□	□
Good living conditions	□	□	□	□	□	□
Business-friendly attitude of the local authorities	□	□	□	□	□	□

SECTION 4. Innovativeness

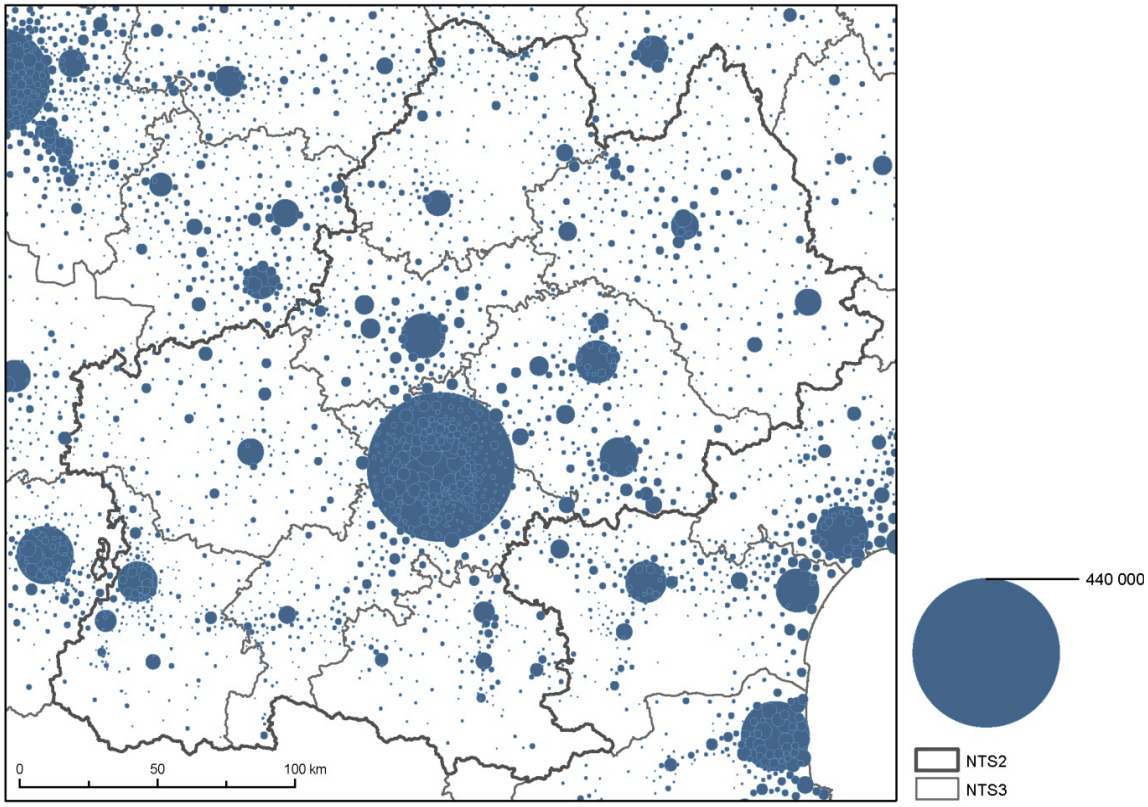
12. Has the enterprise in the last 3 years undertaken any of the following activities?		
Marketing own, new, or modernized, products, goods or services	Yes	□
	No	□
Introduction of new technological processes	Yes	□
	No	□
Organizational or technical changes	Yes	□
	No	□

13. If the enterprise has undertaken any of the aforementioned actions, what were the sources of information	Please tick if	**Please indicate the location of the information sources** Please indicate up to two most important areas

on the introduced innovations?	yes	Glasgow metropolitan area (see the map)	The rest of the South Western Scotland or Southern part of Highlands and Islands (see the map)	Other regions of the UK	EU countries	Other countries
Own research and development infrastructure, management staff	☐	☐	☐	☐	☐	☐
Other companies in the same corporate group	☐	☐	☐	☐	☐	☐
Competitors	☐	☐	☐	☐	☐	☐
Clients	☐	☐	☐	☐	☐	☐
Consulting companies	☐	☐	☐	☐	☐	☐
Providers of equipment, materials, components	☐	☐	☐	☐	☐	☐
Research institutes / universities	☐	☐	☐	☐	☐	☐
Patent disclosures	☐	☐	☐	☐	☐	☐
Conferences, meetings, specialist press	☐	☐	☐	☐	☐	☐
the Internet	☐	☐	☐	☐	☐	☐
Trades, exhibitions	☐	☐	☐	☐	☐	☐

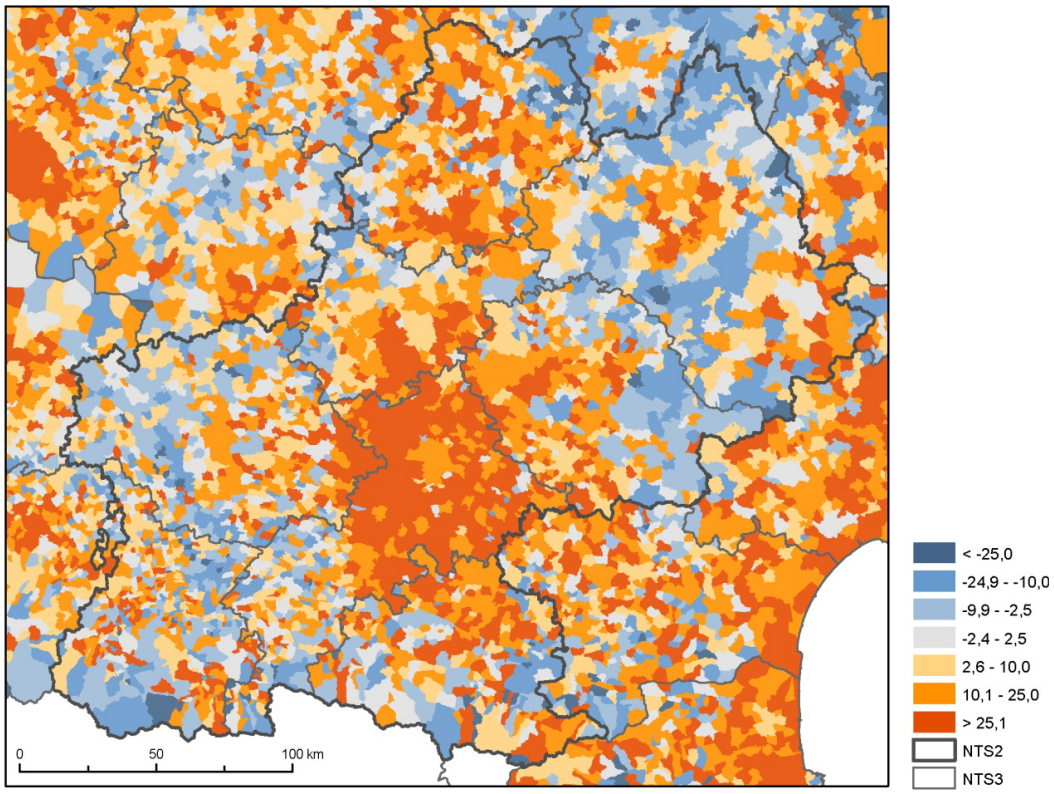
Annex 11. Settlement structure and change in population number in analysed metropolitan macroregions

Figure 1a. Midi-Pyrénées – population 2006



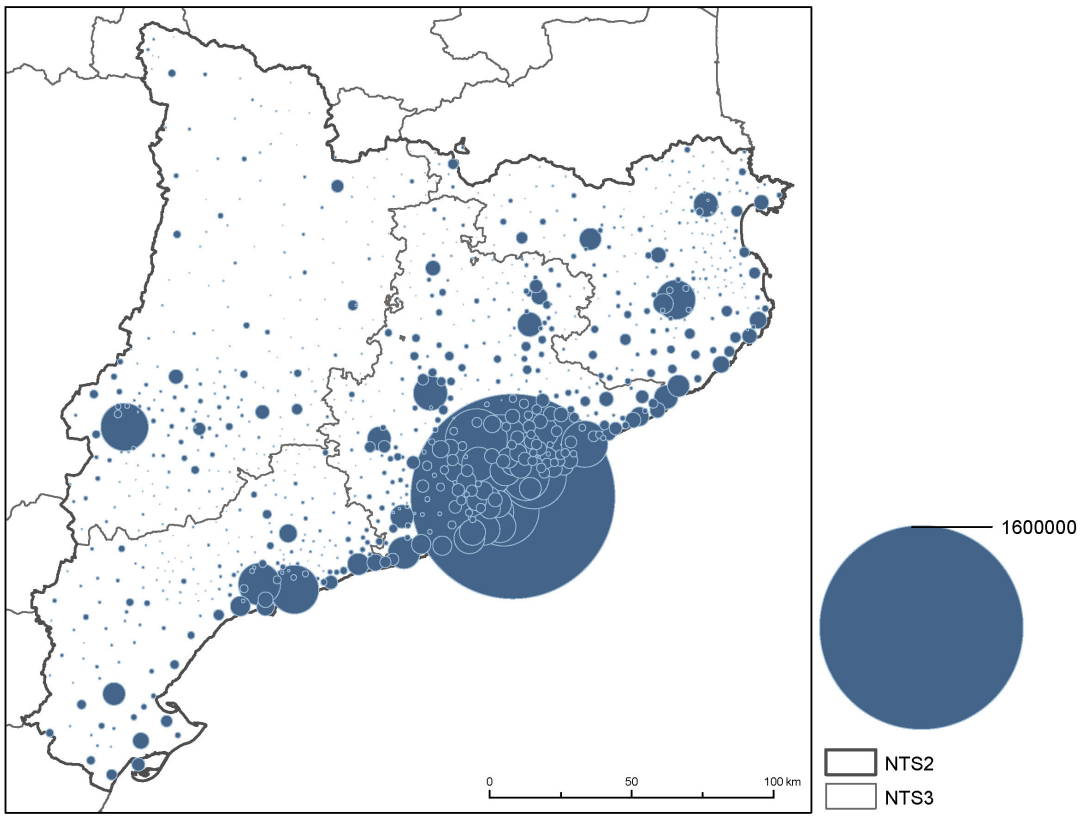
Source: prepared by author based on INSEE data.

Ryc. 1b. Midi-Pyrénées – change in population number [%] (1990-2006)



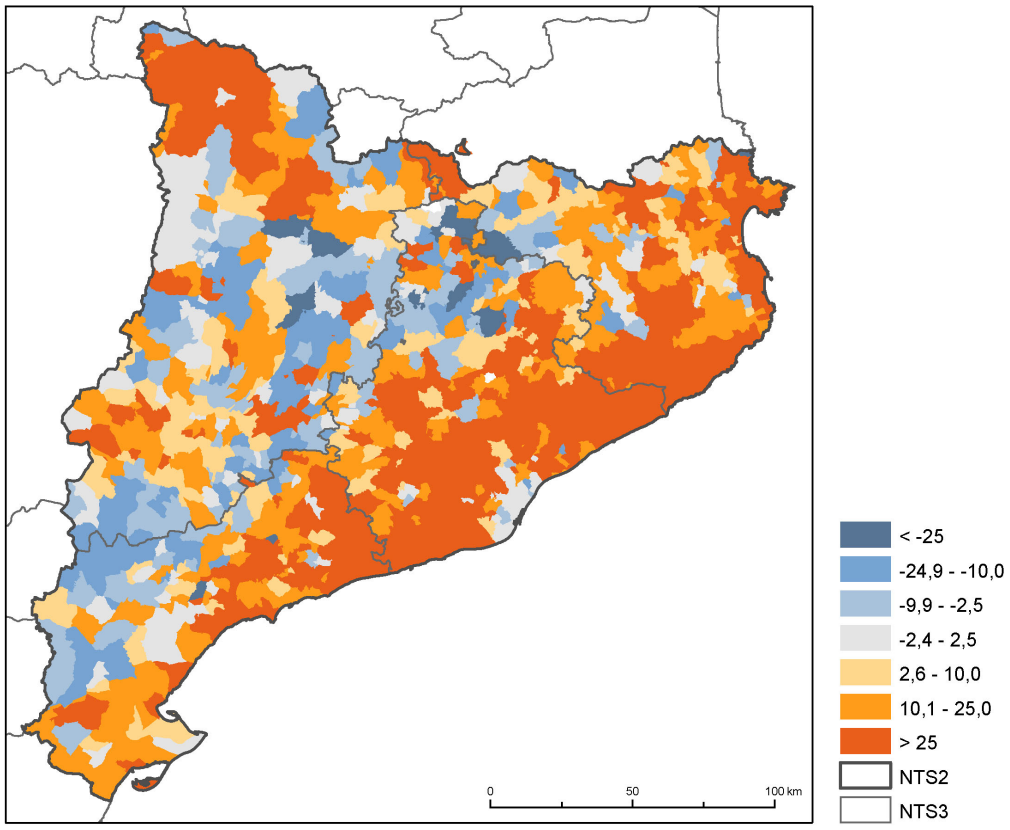
Source: prepared by author based on INSEE data.

Figure 2a. Catalonia – population 2006



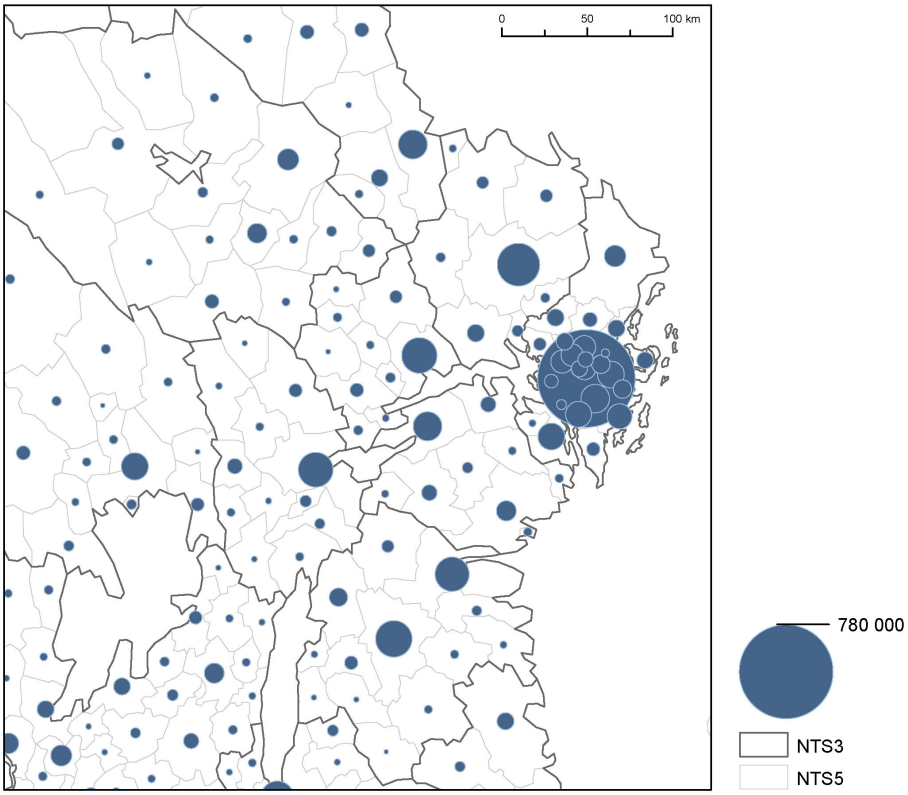
Source: prepared by author based on INSEE data.

Figure 2b. Catalonia – change in population number [%] (1991-2006)



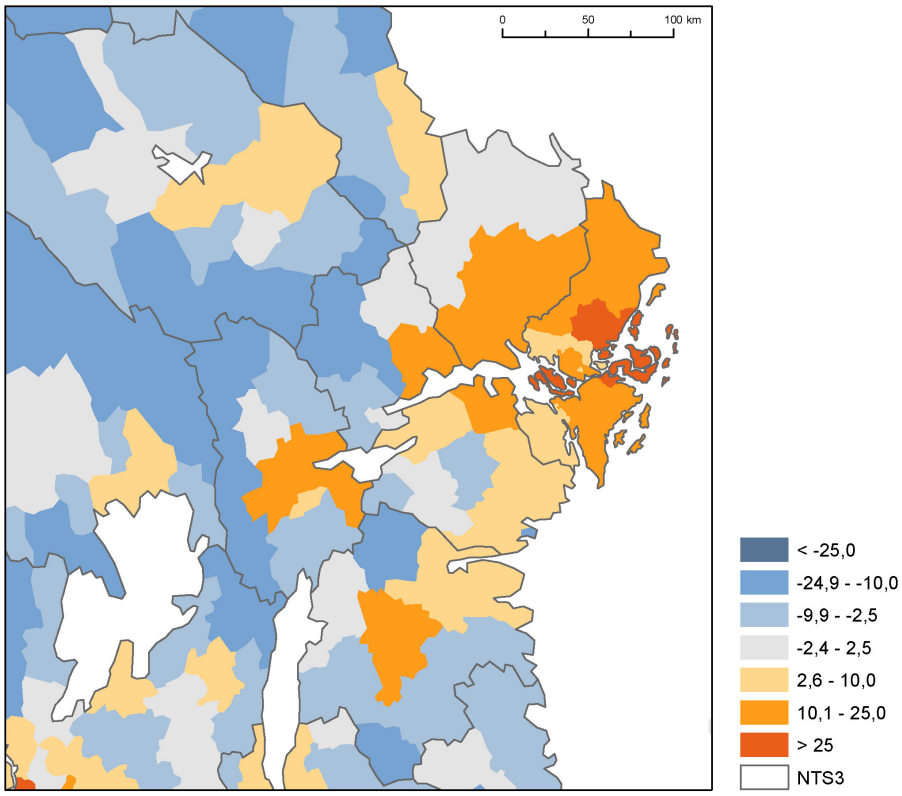
Source: prepared by author based on INSEE data.

Figure 3a. Region Malar – population 2006



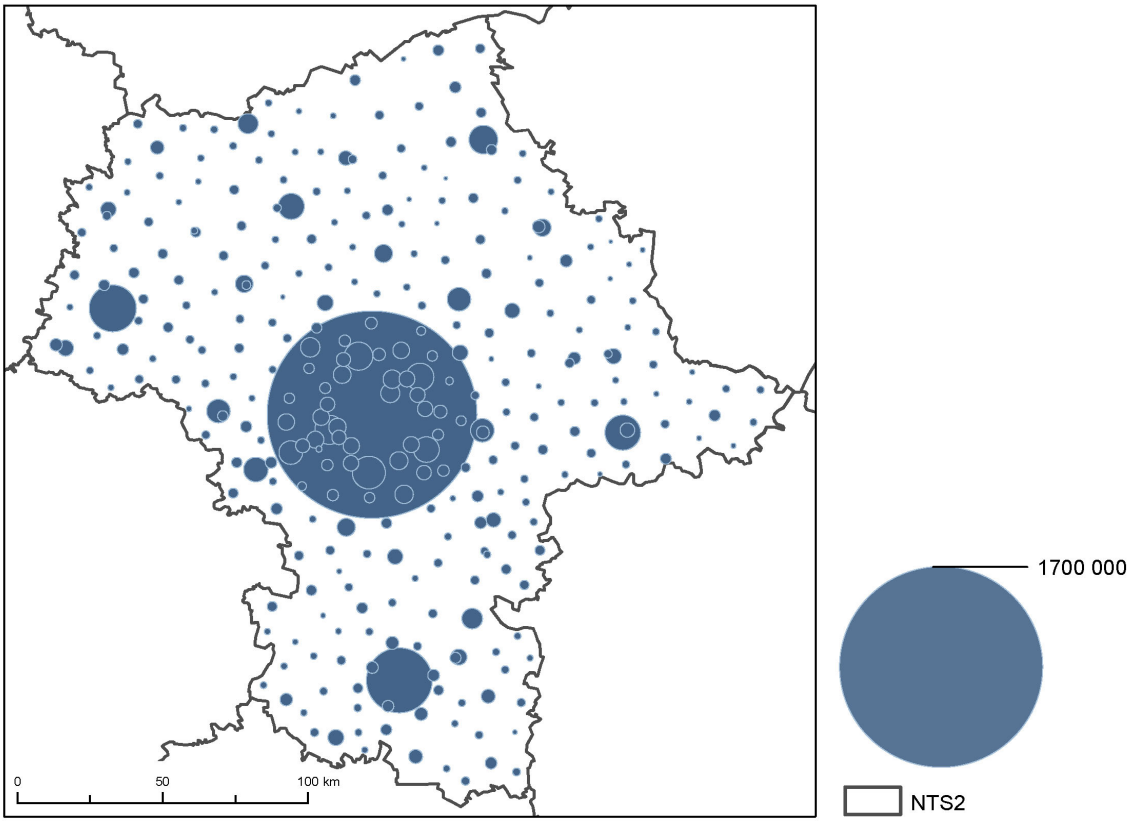
Source: prepared by author based on SCB data.

Figure 3b. Region Malar – change in population number [%] (1990-2006)



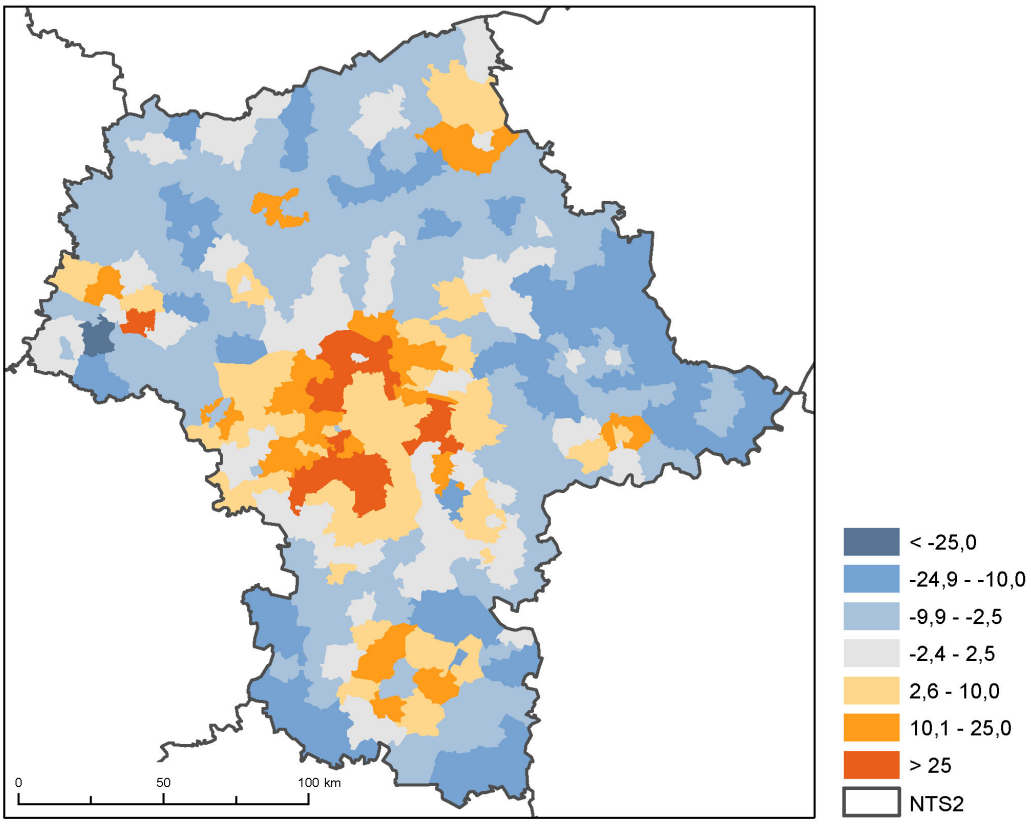
Source: prepared by author based on SCB data.

Figure 4a. Województwo mazowieckie – population 2008



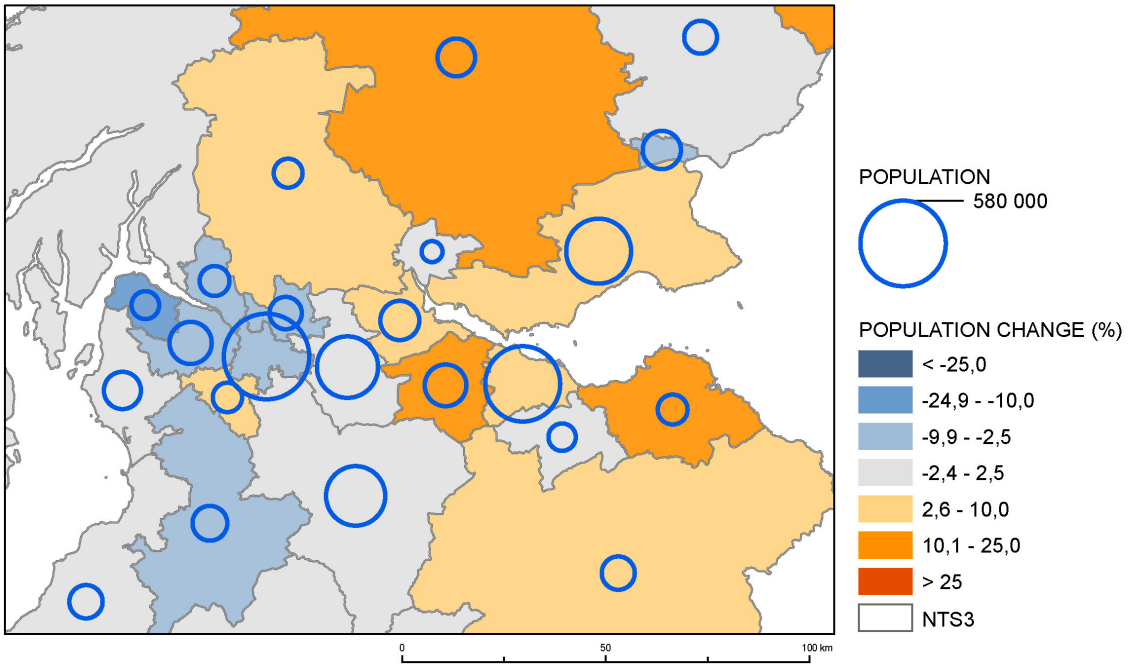
Source: prepared by author based on GUS data.

Ryc. 4b. Województwo mazowieckie – change in population number [%] (1995-2008)



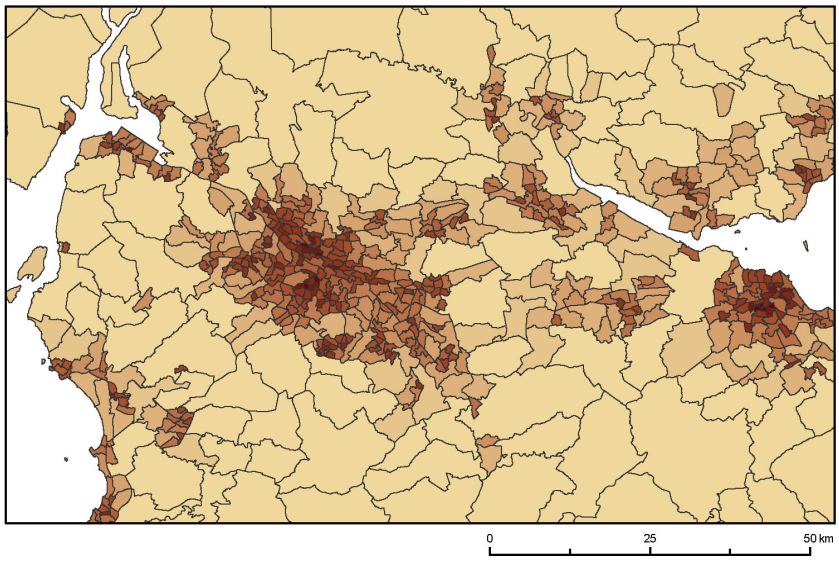
Source: prepared by author based on GUS data.

Figure 5a. Scotland – population 2006 and change of population number [%] (1990-2006)



Source: prepared by author based on GROS data.

Fog. 5b. Glasgow Metropolitan Region – population density 2001



Source: prepared by author based on GROS data.

Chapter 9 – Opportunities through "polycentric" cooperation

M. Angelidis and G. Karka. Contributions: K. Santimpantakis, E. Tsigkas and V. Bazoula –– National Technical University of Athens

Part A. The ESPON space: methods and first empirical results

1. Introduction

1.1. Remarks on the completeness of some sections of the Report

This Report presents our work on WP4: "Opportunities through Polycentric Cooperation". The plan of this work was presented in the Interim Report. However this work has not progressed exactly as it was previewed: (a) It was, initially, forecasted that our work would be supplied with data and analyses from WP2 on cities networking in order to avoid double work. A part of these data was given to us very recently (b) Also, it was forecasted that we would be given other statistical data and analyses necessary for WP4. The elaboration of these data has been proved more time-demanding than expected; therefore, they also have been given to us very recently. Also, case studies as they were previewed in the IR have not progressed enough. Our workgroup studied the cases of Eastern Balkans and Greece as pilot case studies. We present in next the main results of this work. Therefore, the results of a limited number of analyses, which have been progressed less than expected for the pre-final report, will be presented in the final report.

1.2. Polycentric Potential urban networks approach: complementarities and integration[47]

Polycentricity has been agreed upon as a major policy goal within European territorial policies; however, evidence on how to exploit "Polycentric Potentials" is still not sufficient.

European level polycentricity has been studied in more depth by relevant ESPON 2006 and other studies, based on sufficient evidence. Exploiting *"regional polycentric potentials"* aims at improving networking and complementarities between cities at the inter-regional and intra-regional levels. Generally, at this level existing research did not have enough data to use. An important recent research which went in depth on "regional polycentricity" studied only a part of the Western Europe. Thus further relevant research is needed for the entire ESPON territory.

[47] See in more extent in the respective Annex of the FOCI Interim Report (2009).

Evidence on global cities and, even more, on lower level urban networking, remains very often based on ***attributes*** because the relevant data are abundant while ***data on direct links, or even flows,*** which could more clearly inform on the relationships among the cities as nodes of networks ***are poor.*** In this respect, recent research has attributed growing importance to the ***use of the internal structure of firms and, even more, of large Advanced Producer Services (APS) as a proxy to measure actual flows of information among cities.*** *The analysis of the territorial effects of real flows through transport means (air-lines, TGV and motorways) also becomes important.* However, research on all the latter has been mainly conducted on regional and national case studies, not covering the entire ESPON space.

The concept of "Polycentric Potential" urban networks is closely related to ***"territorial complementarities"***. Promoting territorial complementarities means that, local and regional authorities, by combining appropriate infrastructures can improve the use of the assets as well as the provision of services in their common territory, thus better address actual economic, social and environmental challenges.

More specifically, concerning urban networks:

The intensified networking among the cities-nodes of the contemporary "Polycentric" Urban Regions is closely related to the presence of complementary relationships between the cities-nodes. Inversely, enhancing complementarities by integrating infrastructures through planning implementation could enhance cities networking and its positive effects. A relatively recent theoretical attempt to characterise complementarity in urban networks states that "different settlements or regions can fulfil different and mutually beneficial roles, through simultaneously embracing the advantages of competition but also overcoming the associated disadvantages" (Hague and Kirk, 2003 cited in Meijers 2006). Complementarity can be about the whole range of urban functions, not just business and economic development (ibid). According to Meijers (2006a), in order for cities in PURs to be complementary, there must be differentiation between the cities in terms of urban functions or activities as well as the geographical markets of demand for their urban functions/activities or environments must at least partly overlap. Activities in one city should provide their services also to businesses or citizens located in the other city. Businesses and households should consider the working and residential environments in several parts of the PUR with respect to their location decisions.

Several recent studies underlined that promoting complementarities which foster the role of small cities in a network dominated by a strong city could have negative effects. In the same argumentation line: economic actors generally seem to prefer more concentration of APS in "First" cities. Thus, the different types of complementarities should be further examined in the perspective of the monocentricity and agglomeration / polycentricity and balanced distribution dilemma. According to some researchers, ***measuring complementarity in a "Polycentric Potentials" area needs to measure the extent of differentiation (opposite to duplication) between its cities.*** This differentiation can be related to a wide variety of urban functions. However, the effects of this differentiation on the efficiency of each specific urban system depend

on the type / level of complementarities (see above) and need to be further examined.
We will use the ***correspondence analysis method*** to measure the degree of differentiation of urban functions as an indicator of complementarity in PP urban areas ***– see in chapter 8.***

"Polycentric Potentials" and Integration areas
In the line of the previous arguments, a "Polycentric Potentials" area includes an urban network that presents better pre-conditions to develop complementarities among its cities, in order for the entire area to become more integrated. Studying the potentials to enhance complementarities and integration this seems more important than the measuring existing morphological polycentricity of the urban network.
First relevant research within the ESPON 2006 programme started by the ***hypothesis that neighbouring cities with overlapping travel-to-work-areas can be functionally integrated and can gain from co-operation.*** Thus it used 45 minutes isochrones as proxies for travel-to work areas and a threshold of 10% overlapping among those areas to define 'Polycentric Integration Areas" (PIAs).
As it resulted from this exercise, ***there are many PIAs in West Europe, while there are few in Southern and Eastern Europe, because in the first population densities are much higher and distances between cities are much smaller. PIAs in West Europe are strong while they are weak in the rest of Europe.***

This approach of "Polycentric Potentials" was criticised by other researchers, both concerning the conceptualisation of PIAs and the use of a uniform isochrone level for all the cities of the ESPON space. An alternative concept was proposed, that of ***poly-FUAs,*** *groups of relatively equal potential FUAs with overlapping travel-to-work areas.*
In our opinion, the respective ESPON 2006 projects did not go in depth in the analysis of the internal structures and external linkages of the "Polycentric Potentials" areas at regional level, due to the lack of data and lack of time and resources for their research.

As the notion of polycentricity is highly scale and size-dependent, ***it is necessary to more appropriately link the different types (and levels) of urban systems with their surrounding ("Potential integration") areas.*** A first such typology takes into account: (a) Cities (or urban networks) with more than 1 million people ("global" and "sub-global" cities) and their hinterlands, (b) "Regional" cities (or urban networks) with 250.000-1.000.000 inhab. in territories with more than 500.000 inh. (c) "Provincial' cities (or urban networks) with 100.000-250.000 inhab. in territories with less than 500.000 inhab.
We should do here an important clarification: using this division does not mean that our approach pertains to the Christallerian approach of cities networks. *It is only a necessary simplified means to study some aspects of the structure and performance of PP urban networks.* Previous research has shown that multi-level

polycentric relationships among cities are much more complex than the absolutely hierarchical Christallerian urban networks (see, also in the respective FOCI IR working paper). In reality, the city by city network relationships are not uniform and complying to a single hierarchy, as in the Christaller theory. They are multiform and comply with multiple hierarchies. For example, a city can have much more intense networking relationships with some distant (not neighbouring) cities of similar potential (population etc) than with its closest centre of higher level.

Another quite similar typology takes more into account the urban-rural spatial patterns, together with the density of the regions and their proximity to big urban centres.

As previous research suggests, more important linkages to study are the internal linkages of regional territories and the linkages of these last to the upper levels of urban systems, with emphasis on the direct linkages / flows described previously.

1.3. General objective of the study, territorial levels, main question

As we explained, our ***general objective*** *is to* ***move from an approach based on the attributes of individual cities to a more network oriented one***, thus going from the past morphological approaches based on potential links to one trying to assess "real" links.

Taking into account scale-dependency, our research examines polycentricity at the ***"mega-region" (including trans-national), national and regional levels.***

We study how to improve networking and complementarities between cities at these levels.

We examine which urban networks, polycentric or monocentric, are already integrated and which present potentials to become more integrated.

We can distinguish, taking into account our previous remarks***, three types (or levels) of polycentric relationships*** (see in more extent, in the respective FOCI IR (2009) working paper).

Higher Level (HL): Cooperation in business and on higher level infrastructures, creating competitive networks and network clusters and improving provision of higher level services

Research here concentrates in evaluating the degree of existing complementarities and networking and the lack of linkages by infrastructures and services among the sub-centres and the sub-units of each one territory. On this base we will evaluate its performance.

Lower level (LL): Daily commuting, lower level transport and other infrastructures and services, allowing a group of cities to share resources and possibly reach a "critical mass" for economic competition through the exploitation of their complementarities.

Research here prioritises the collection of the necessary local data to understand both existing links and complementarities, notably in terms of infrastructure and resource sharing". We will also study the governance structures and existing cooperation policies

Service provision (SP) Cooperation in service provision in order to allow service providers to retain a sufficient size for efficiency while ensuring service coverage for the entire population.

Research here concentrate on how to combine the location and potential of infrastructures and services at different territorial scales.

2. Linking the levels of cities with the levels of "Polycentric Potential" territories

For this task, PIAs of ESPON 1.1.1 -*see in Figures 1 and 2 in next*- are not suitable, because their definition presents several problems as well as because they do not cover each entire national territory.

Each **Polycentric Potential territory** should include, apart from the respective cities / FUAs, a number of smaller settlements so as to constitute a whole zone which cities provide with services. Therefore, all cities (and small territories) of a national territory should be included in PP territories.

According to a great number of researches, the **First city of each PP territory** (whether this last is monocentric or polycentric) **has a more or less first role in providing the PP territory with services.** The First city role is very often related to its prime position in the administrative system of each country.

Therefore, a **starting hypothesis on a "combined" typology of First "cities" and the corresponding Polycentric Potential territories ("areas of interest")** constitutes obviously a necessary methodological choice in studies focusing on interactions / complementarities among cities (as "places", "points) as well as between the cities and their wider areas.

We will use here as a basis the typology of relationships of First cities / PP territories defined by the POLYNET study[48].
From this scope, we discern **three types of urban systems associated to their areas of interest (territories):**

(A) **Metropolitan areas (MAs)**, mono-nuclear or poly-nuclear, whether they are MEGAs or not, associated to their wider territories.

We included here the 76 MEGAs defined by ESPON 1.1.1 project and the poly-nuclear metropolitan areas defined by ESPON 1.4.3 project -see in next the Figure 1.

(B**) "Regional" cities -population 250,000–1,000,000**- associated to **territories with more than 500.000 inhab.**

(C) **"Provincial" cities -population 100,000–250,000**- associated to **territories with less than 500.000 inhab.**

3. Type of relationships to be studied per type of urban systems and their associated territories

(HL) Higher level
This first type of relations concerns essentially the two first types of urban systems / their areas of interest: **(A) – Metropolitan Areas and (B) - "Regional".**
(LL) Lower level
These types of relationships are relevant within both **the previous types (A) and (B) of urban systems / their areas of interest**: the MAs and "regional" territories (mono-nuclear or poly-nuclear large entities -see previously**) as well as the "provincial" territories,** in other words, the territories which are not dominated by large cities.
(SP) Service provision
Despite the fact that this level of relationships is important, we will examine it **only within national case studies** because of the lack of time and necessary data.

4. Identification and delimitation of PP urban networks[49]

4.1. The three steps to apply

We should clarify here that for all kinds of potentially polycentric territories, we should
(a) **first identify the respective urban networks** and then
- **delimit the area of each respective territory,**

[48] This typology is also used to a considerable extent by other studied as for instance by the ESPON 1.4.3.
[49] Associated with Metropolitan Areas (MAs), "regional" territories and "provincial" territories.

This is necessary **in order to be able to (c) "measure" different indicators** (both "attribute» and "network" indicators) that would enable us to **evaluate the polycentricity degree, the performance, the complementarities etc of each Potentially Polycentric Territory.**

For both the **identification and delimitation** of the previous territories as well as for the **evaluation** of the polycentricity degree etc, **we will use both "attribute" and "network" data and analyses, but *not the same kind of analyses for each step*.**

While it is relatively easy to identify the Metropolitan Areas and delimit the respective territories, this is **much more difficult in the case of the "regional" and the "provincial" territories**.

4.2. Search and organisation of data, creation of a FUAs network geodatabase

- First, we have approximated FUAs (in Metropolitan Areas and "regional" territories) with NUTS3 units. We try now to approximate FUAs with LAU2 units using commuting data that IGEAT provided us recently in order to use SIRE database NUTS5 data. We will also use data for the FUAs included in the ESPON 1.1.1 FUAs Database: population 2000, population density, indicators on economy, tourism, administration etc. In this project, FUAs were mainly defined on the basis of LAU2 units.
- We used Eurostat data at NUTS3 level (in cases we approximated FUAs to NUTS3 units) in order to create the profiles of cities per economic sector- see in next.
- In order to be able to analyse different kinds of territorial data on links among the European FUAs, we considered it more appropriate to create (with ESRI ArcGIS) a *network geodatabase linking all 1500 ESPON FUAs.*

The foundation of this geodatabase is a *matrix of links among 1500 x 1500 FUAs* (evidently we will not use all the links in our analyses).

The respective shapefile, of course, includes a very big number of links (2,5 millions).

We first attributed to the **nodes** of the shapefile the respective data from ESPON 1.1.1 FUAs (point) shapefile (population and several indicators on economic activities etc)

We are loading gradually all necessary categories of data to the nodes (FUAs) of this geodatabase: Urban Audit data, transport data etc.

4.3. Identification and delimitation of the Metropolitan Areas / MAs, links to be studied in this case

In order to define the metropolitan areas to include in this category, we started from the 77 MEGAs of the ESPON 2006 1.1.1 and 1.4.3 projects.

Some of them are **mono-nuclear (more monocentric) (category A-1) while others are part of poly-nuclear entities («poly-FUAS») (category A-2).**
Apart from them, there are some **other poly-nuclear metropolitan areas which do not contain any MEGA (category A-3)**. In any case the population of the respective territory (PP area) is higher than 500.000 inhab.

Links to be studied in this case:
The links among the different Metropolitan Areas and from the Metropolitan Areas to the "regional" cities / territories

5. Definition of "Regional" PP urban networks and territories

While the definition of the Metropolitan Areas is enough clear, the "regional" and "provincial" urban networks / territories should be defined more concretely. This definition could be made to a considerable extent according to the correspondent type of polycentric relationships.
We used for this purpose both "attribute" and networking data and we have developed several appropriate methods – see in next
We remark that there is a kind of circularity here noted however, among others, by POLYNET study. In other words, we made a starting hypothesis that will be checked during the following analysis.
Here, evidently we have to examine the whole group of cities constituting the urban network of the PP territory. It is possible that the most populated city of this network has less than 250.000 inh. but in these cases there are two or three important cities which very probably all together have a population over 250.000 inh.

Links to be studied
(a) The Internal links within "Regional" cities / territories,
(b) The links from "Regional cities" (B) to the Metropolitan Areas (A) and the 'Provincial cities" (C).

6. Identification of "regional" urban networks: mainstream methods for the entire ESPON territory

As the identification of "regional" urban networks is of crucial importance for our subject, we tried to develop several different methods for this identification. Some of them are "mainstream" in the sense that they are elaborated or suggested by previous ESPON projects: identification of PIAs by the ESPON project 1.1.1 or improvement / reorientation of this method suggested by the ESPON project 1.4.3. We present them in 6.1 and 6.2. Further on, we developed a method of identification of "regional" urban networks using isochrones from the "regional" or "provincial" centres as not overlapping "service" territories - see in 6.3.

We also tried to develop "innovative" methods taking into account more appropriate properties of the networking among cities. These methods could not be applied for the entire ESPON territory due to the lack of data for some countries. They could be used beneficially in the case studies. We present these methods in the section 7.

6.1. The PIAs of ESPON 1.1.1

The identification of PIAs in ESPON 1.1.1 was based on the proximity of cities to each other*: The preconditions for polycentricity are best where cities are located in proximity to each other…* Morphological proximity is of course no guarantee of co-operation, but proximity does nevertheless provide cities with a better opportunity for functional integration…".
In this sense, they suggested ***Potential Urban Strategic Horizons (PUSHs) and Potential Polycentric Integration Areas (PIAs -***Figure 1 and 2). For each of the FUAs, they have calculated *the area that can be reached within 45 minutes by car from the FUA centre.* The resulting areas are labelled ***PUSH*****.** In a next step, they have identified ***PIAs***, based on the *hypothesis that neighbouring cities with overlapping travel-to-work-areas can be functionally integrated and can gain from co-operation*. A total of *249 PIAs* were found where at least two PUSH areas shared more than 1/3 of their area with each other. These areas concern 1,139 PUSHs, while the remaining 456 PUSHs are more isolated.

We could make here some useful remarks:
- The PIAs with more than 500.000 inhabitants coincide more or less to the *"Regional" cities -population 250,000–1,000,000-* associated to **t***erritories with more than 500.000 inhab***.** -see in Figure 1.
- The PIAs with less than 500.000 inhab. coincide more or less (however not fully) to the **"***Provincial" cities -population 100,000–250,000-* associated to *territories with less than 500.000 inhab. - see in Figure 2.* In this category of PIAs, rural areas remote from big urban centres are mainly included, situated mainly outside the EU "blue banana", mostly in Southern and Eastern Europe.
Despite the weakness of their definition, PIAs represent in many cases plausible "regional" urban networks. We evaluate their performance in terms of GDP (the results will be presented in the Final report) and we evaluated preliminarily their complementarity degree -see in Chapter 8.

6.2. Improving the definition of PIAs: more functional PP urban networks

We start here from the criticism of ESPON 1.4.3 to ESPON 1.1.1 stating that "it was not realistic to assume that all FUA centres, including the smallest ones, can extend their zones of influence over the area situated within the 45 minutes travel time isochrone. If clusters of PUSH and PIA areas were to form magnets for further concentration of economic and demographic potential, they would have *to be based*

upon the network of large cities which offer real attracting power in terms of labour market and the range of specialized services".

For this purpose we are now trying to define PP urban networks as following: (a) we started from the 45 min isochrones from the FUAs (b) we will include in each "area of interest" the neighboring LAU2 units if more than 50% of their area included in the isochrone (c) we will test different cases of overlapping etc.

For the creation of isochrones, we used the European road network provided by Transtools package[50]. For the speed rate by segment of the network we used the "Free speed" field containing the values of the allowable speed in each segment. The speed rate data are provided to Transtools by official providers. We are now working on the above steps (b) and (c).

After completion, we will evaluate the performance of the respective PP urban networks using the same methods as for PIAs.

[50] Transtools is a package of projects directed by the EC JRC (Joint Research Center). We used the 2009 version of this package.

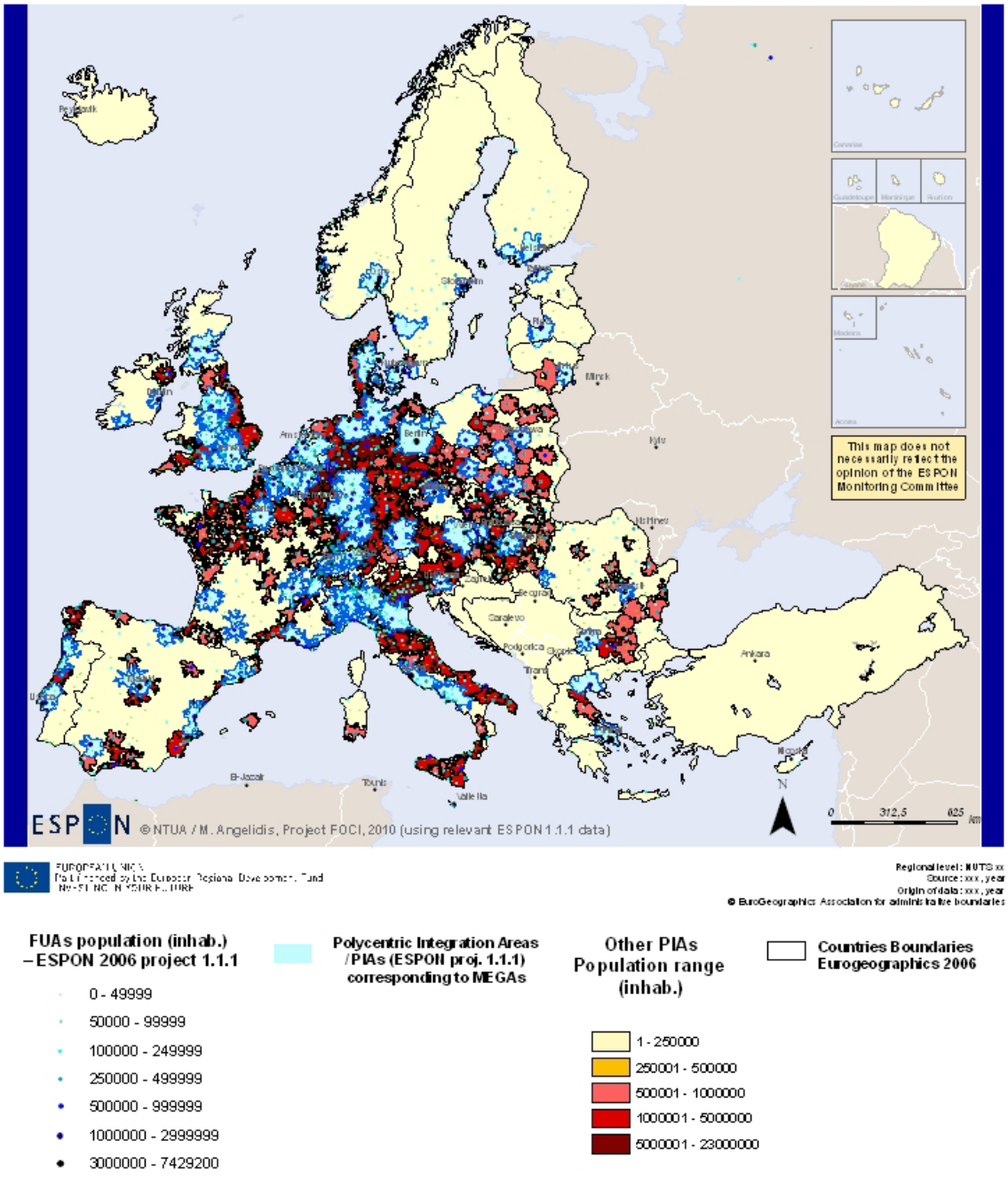


Figure 1: Attempts to build a typology of EU 'Polycentric Potential" areas to be used in FOCI

ESPON 1.1.1 PIAs of MEGAs and PIAs with population more than 500.000 inhab.
They correspond to a considerable extent to "regional" cities / territories in "Intermediate" regions

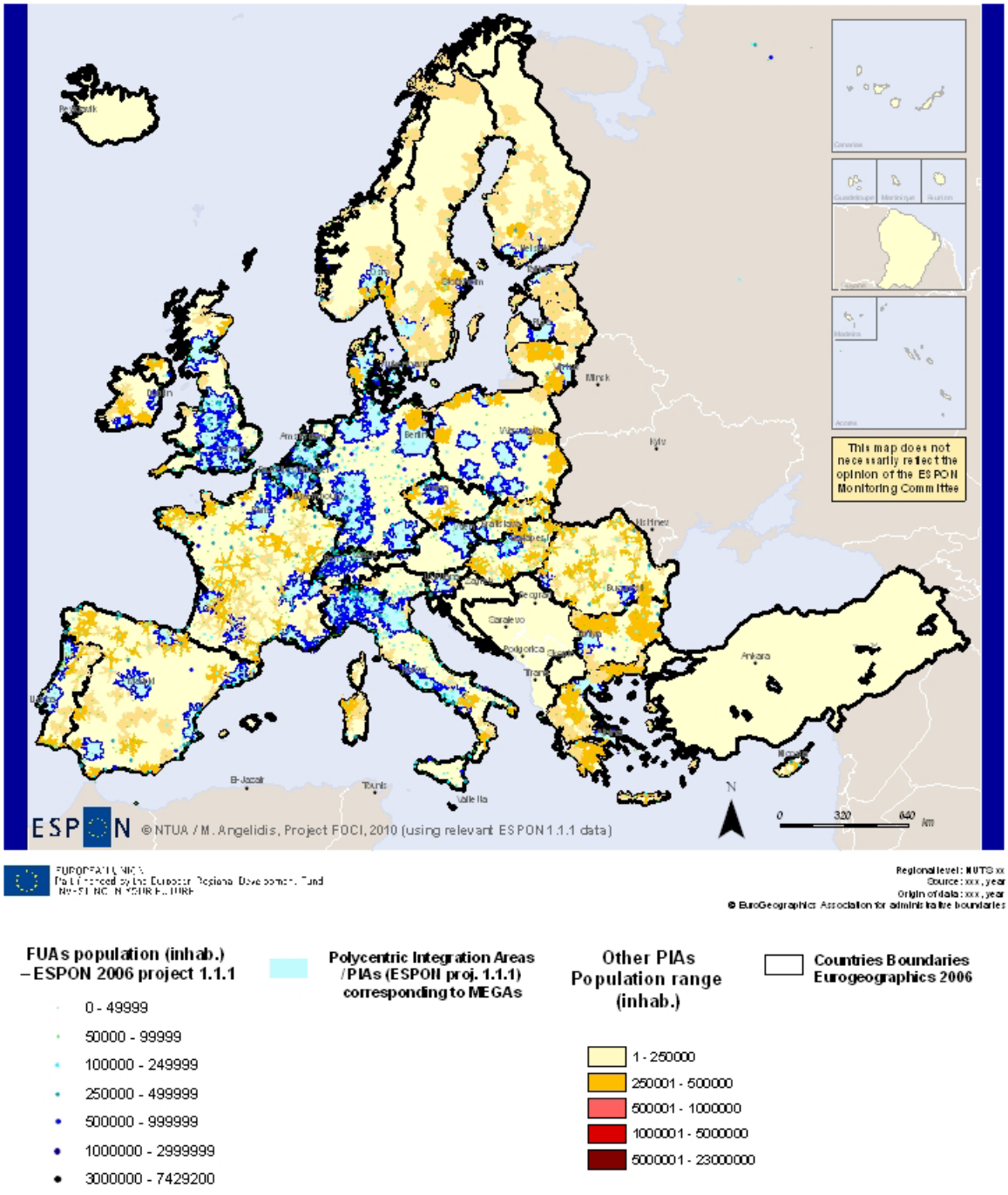


Figure 2: Attempts to build a typology of EU 'Polycentric Potential" areas to be used in FOCI
ESPON 1.1.1 PIAs with population less than 500.000 inhab.
They correspond to a considerable extent to "Provincial" cities / territories in "Intermediate" regions.

6.3. Defining PP urban networks through appropriate isochrones from "regional" FUAs as not overlapping "service" territories

For the creation of isochrones, we also used the European road network provided by Transtools and the "Free speed" field.
We defined the 45', 60', 90' and 120' isochrones from cities with more than 250.000 inh. (as well as with more than 200.000, 150.000 and 100.000).
From the above alternatives, the most appropriate is the combination of cities with more than 250.000 inh. (see previously) and 90' isochrone, as this is closer to the "regional relationships" in PP urban networks.
We decided to create not overlapping territories. In the respective *Figure 3* we can see that in some countries (Spain, Greece etc) there are zones not included in the latter 90' isochrones.
We used for these zones the results of the exercise with 90' isochrones and "First cities", firstly with 100.000-250.000 inh. and then with 50.000-100.000 inh.
The advantage of this method is exactly that we do not have overlapping PP urban systems / territories, thus in the evaluation of the performance of the respective PPUN we will not have a city included in two or more PPUN, a fact that would have distorted the results.
We will also evaluate the performance of these PPUN. We evaluated preliminarily their complementarity degree -see in Chapter 8.

7. Identification of "regional" urban networks: innovative methods to be gradually applied for the entire ESPON territory

7.1. The steps to apply

We proceeded in two steps:

1st step:

We created a first scheme of "regional" territories using "attribute" data: population of supposed "regional" cities (above 250.000 inh.), population of supposed "provincial" cities (below 250.000 inh.) and distances among the cities.

We made this analysis only for the case of Eastern Balkans countries

2nd step:

We identified strong relationships from supposed "regional" FUAs to "provincial" and other FUAs.
We used for this purpose data on flows among the cities in relation to the population of cities.
We used primarily the intensity of the road traffic among the FUAs.

We made this analysis for the case of France and the cases of the Eastern Balkans countries.
This analysis could be made for a large part of the ESPON space, except for the cases of countries where there are not data from the Transtools package (see in next) on road traffic.

We present in next the different methods used and their results.

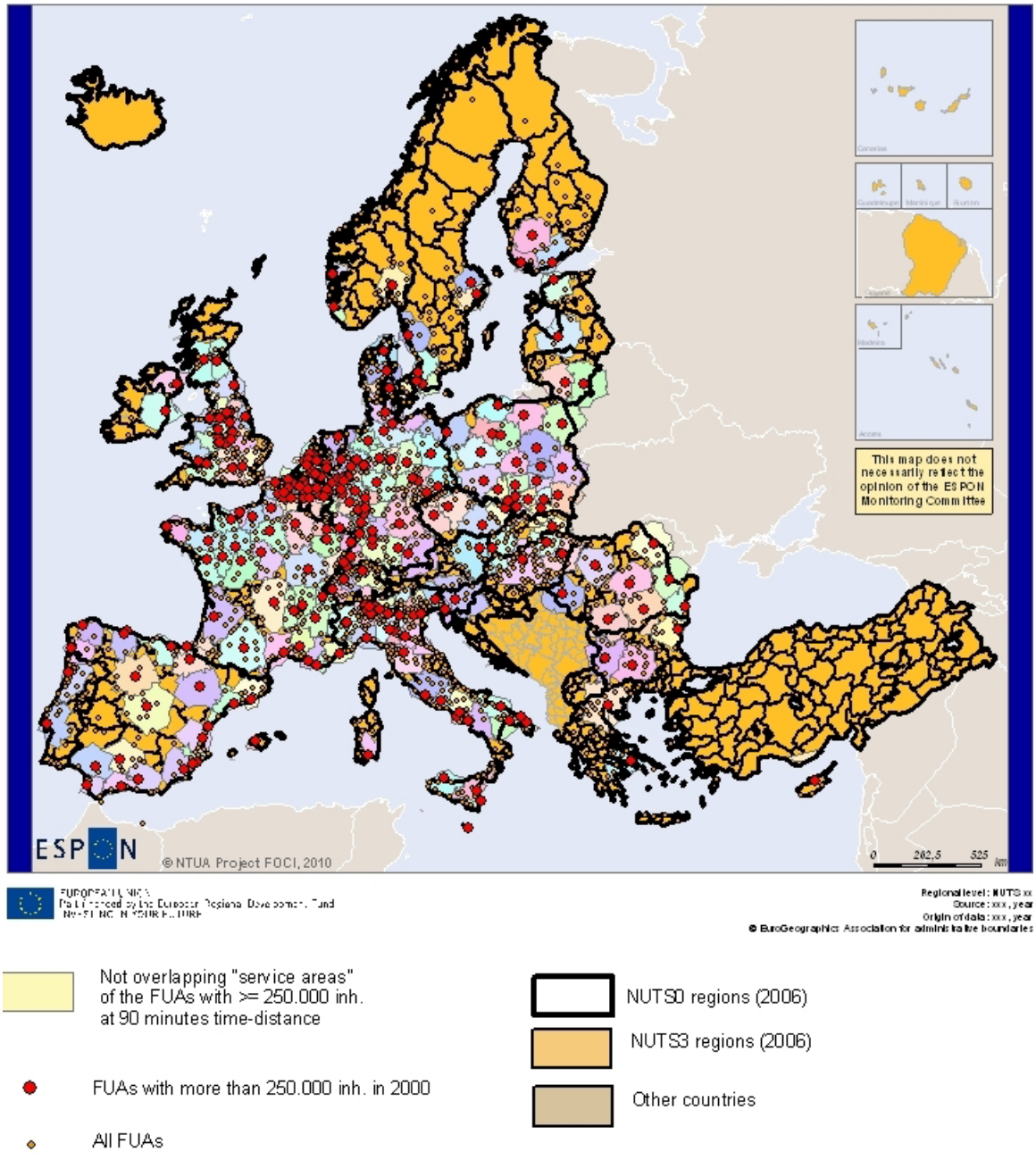


Figure 3: Polycentric Potentials urban networks defined as not overlapping "service areas" of the FUAs with more than 250.000 inh. at 90 minutes time-distance

7.2. Methods applied and results taken from the use of transport flows for the identification of "regional" territories / Comparison and selection of links from "regional" to "provincial" and other FUAs

(a) Use of the Road transport flows /

Road transport is more important as it represents 80% of the total transport traffic
We present next some of the several attempts made using total traffic from FUA to FUA, average traffic, coefficient k taking into account the intensity of road traffic and the population of cities etc.

(a1) Use of the average daily traffic from FUA to FUA

We used the road transport data provided by the "Transtools" package of projects directed by the EC JRC (Joint Research Center). We used the 2009 version of this package, referenced as: Rich J., Bröcker J., Hansen C.O., Korchenewych A., Nielsen O.A., Vuk G. (2009): *Report on Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, taking into Consideration the External Dimension of the Union – TRANS-TOOLS version 2; Model and Data Improvements*, Funded by DG TREN, Copenhagen, Denmark.
We used, more specifically: (a) The European road network provided by Transtools. (b) The data on Annual Average Daily Traffic / AADT by segment of the network, provided by Transtools. While several values used in Transtools are calculated by its models, the AADT values were provided to Transtools by several sources. The sources of these data are listed in the "ANNEX - Sources of historical traffic data" of the document": Leduc G (2008)., Road Traffic Data: Collection Methods and Applications; Working Papers on Energy, Transport and Climate Change JRC 47967 – 2008.
The AADT values used are specified in the following: "The preload base year table contains 2005 AADT figures for road links within a zone. Road links passing a zone border carry, in principle, exclusively inter zonal trips and therefore traffic is not preloaded. Since the preload figures are not split by vehicle type, we assume generally a split of 80% passenger cars and 20% goods vehicles (heavy and light goods vehicles). Busses are not considered, because their share is marginally on roads considered in the model. Intra zonal vehicle km (T) preloaded to the model network is then the product of AADT (x) and length (l) for links within the zone

We present below the example of Bulgaria.
During this work, we used different sets of values of parameters of the population of First cities ("regional" centres) and "provincial" cities. We present below the final set of parameters used.
The links go from FUAs with > 150.000 inh. (First cities of "regional" territories) to FUAs with < 150.000 inh. ("provincial" FUAs). The intensity of links corresponds to the average traffic density per link: ***median AADT / total length.*** Only the links at a distance less than 250 Km from the First cities have been taken into account.

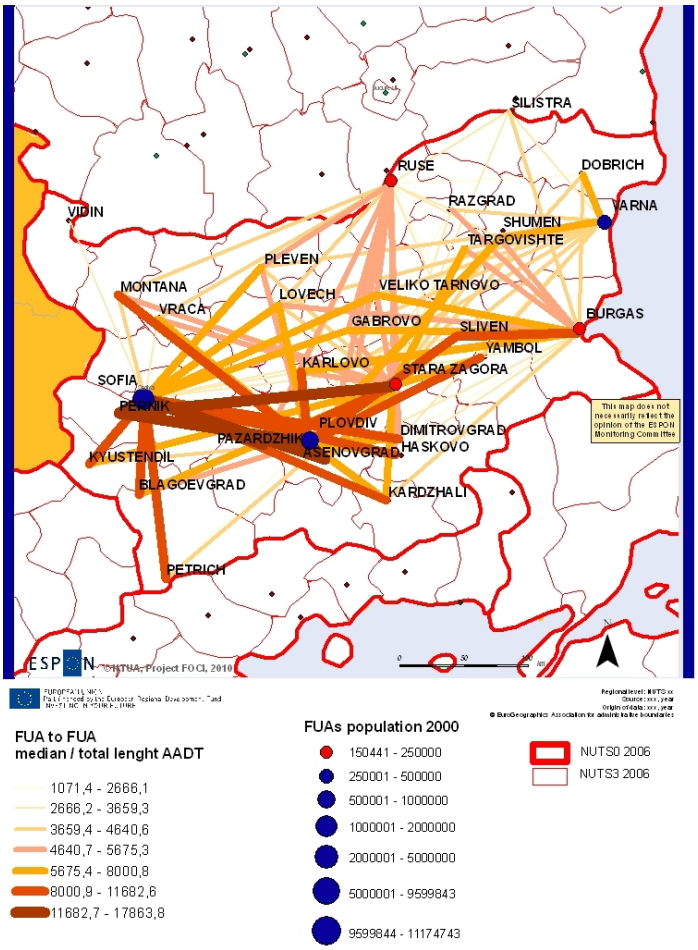


Figure 4: Bulgaria FUAs road links intensity from "regional" centres to lower level centres
– FUA to FUA median AADT / total length
(a2) Use of the rates of the coefficient k taking into account the intensity of road traffic and the population of cities.

Indicator k measure the intensity of FUA to FUA relationships.

k = observed traffic / theoretical traffic

Theoretical traffic = a * (m x m') / d ^{2}, where:

- **m and m'** represent the population of the considered FUAs
- **d** their **distance** (we could use d or d ^{2} according to the specific use of the model)
- **a is a simple coefficient of adjustment** of data on the national average of the considered traffics.

We present below one of the attempts for the case of France.

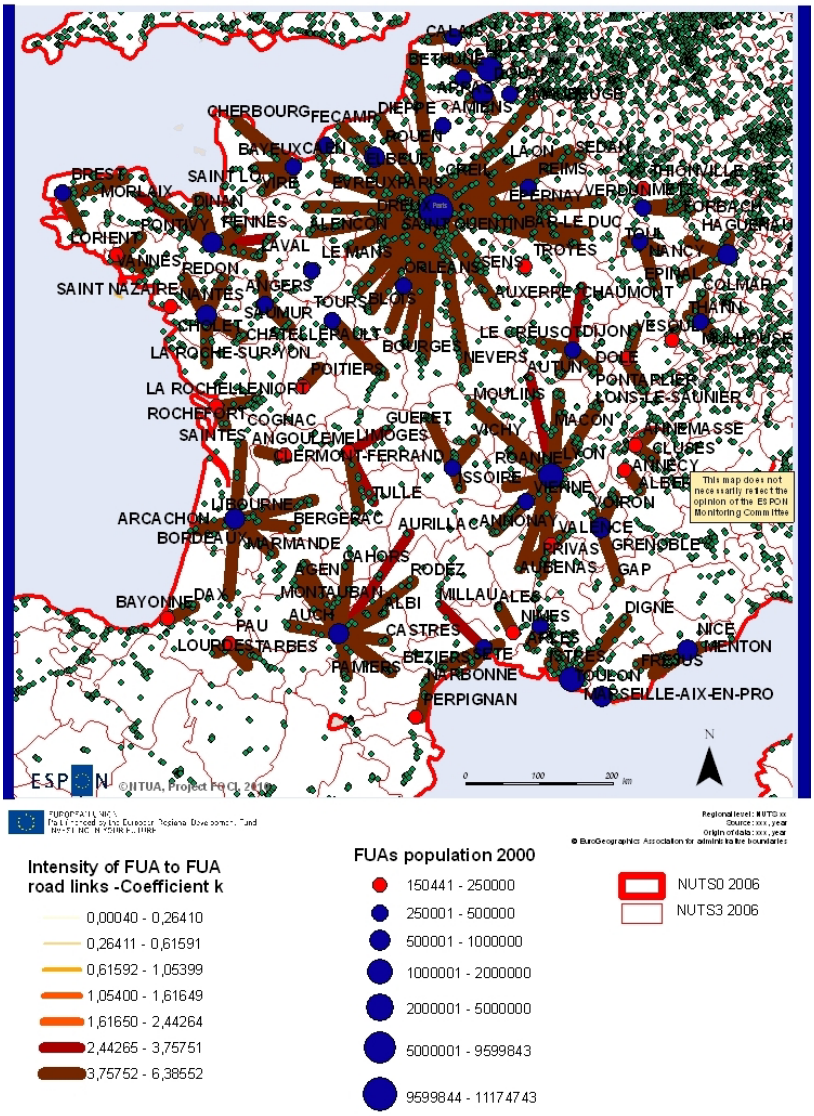


Figure 5: France: FUAs road links intensity from regional centres to lower level centres – Coefficient k

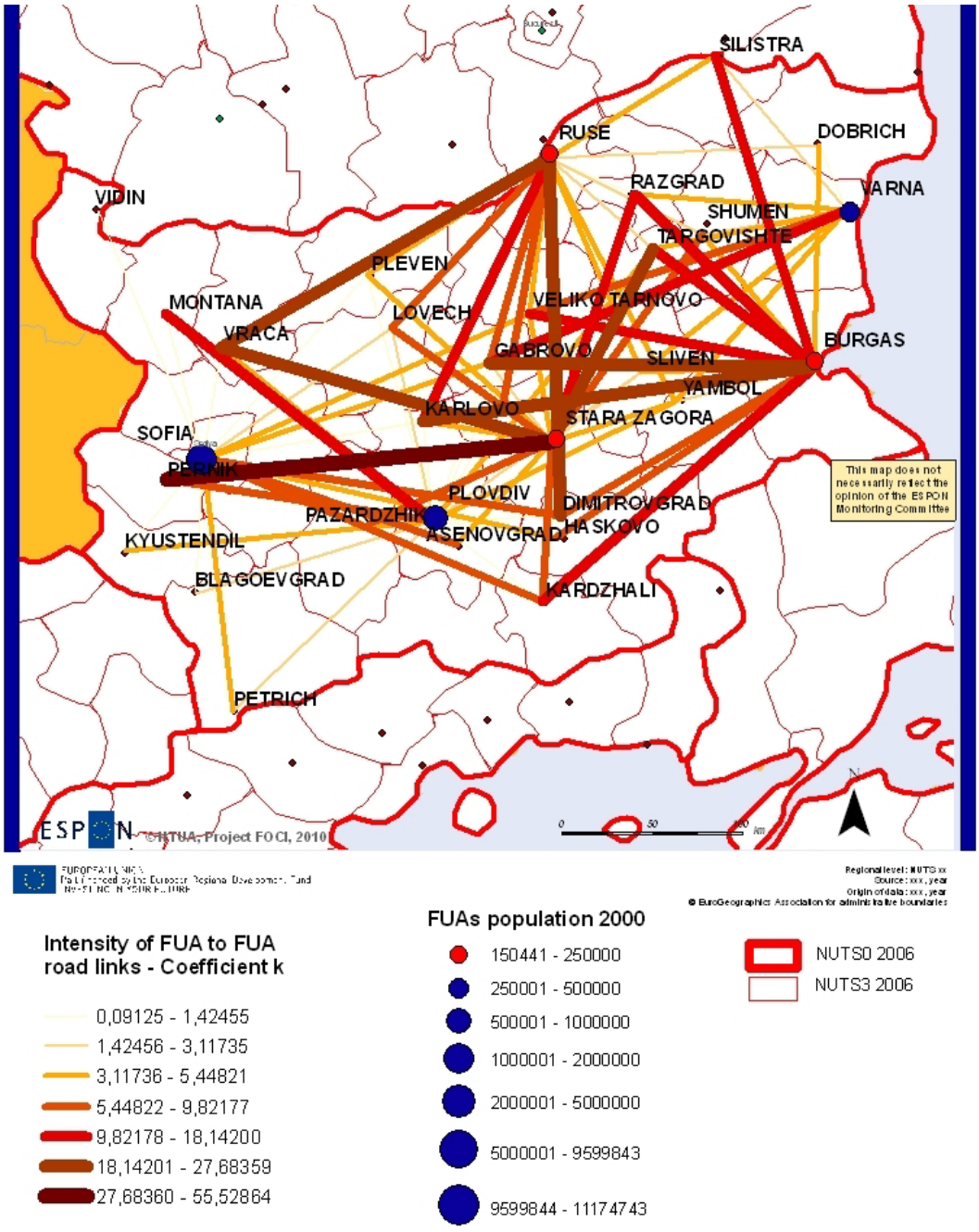


Figure 6: Bulgaria FUAs road links intensity from regional centres to lower level centres – Coeffeicient k

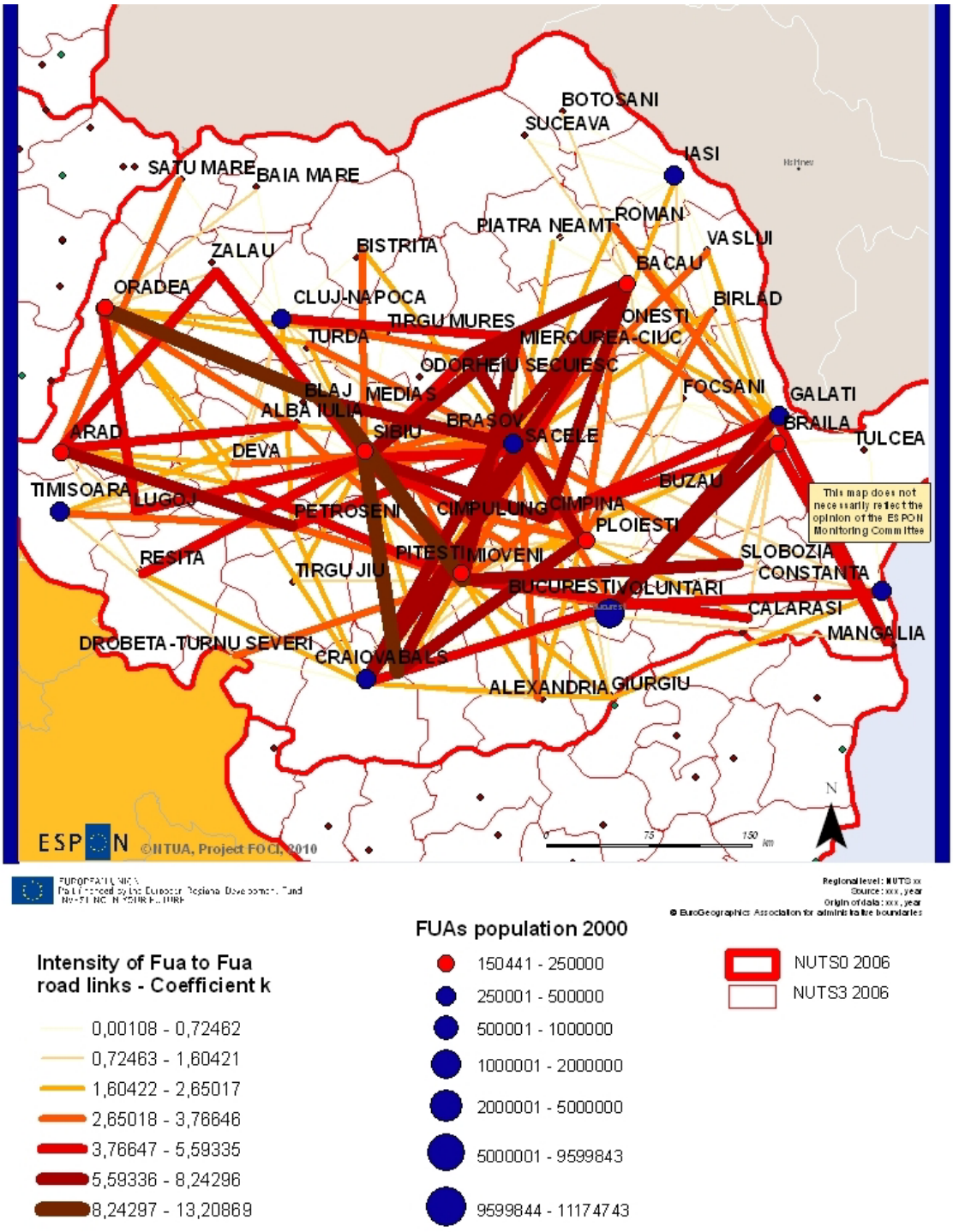


Figure 7: Romaria FUAs road links intensity from "regional" centres to lower level centres – Coeffeicient k

(a3) Further improvement of the method of comparison and selection of links among the regional and secondary FUAs **using the average density traffic**

Each secondary city is attributed to the regional city the link with which has the highest rate (of average density traffic) and appropriated other criteria have been taken into account:

Max distance among FUAs with exception for cities with < 50 Km distance from the supposed "regional" centres (the provincial centre is attributed obligatorily to the nearest "regional" centre).

This method gave the more satisfactory results taking into account our purpose.

We present below the case of France.

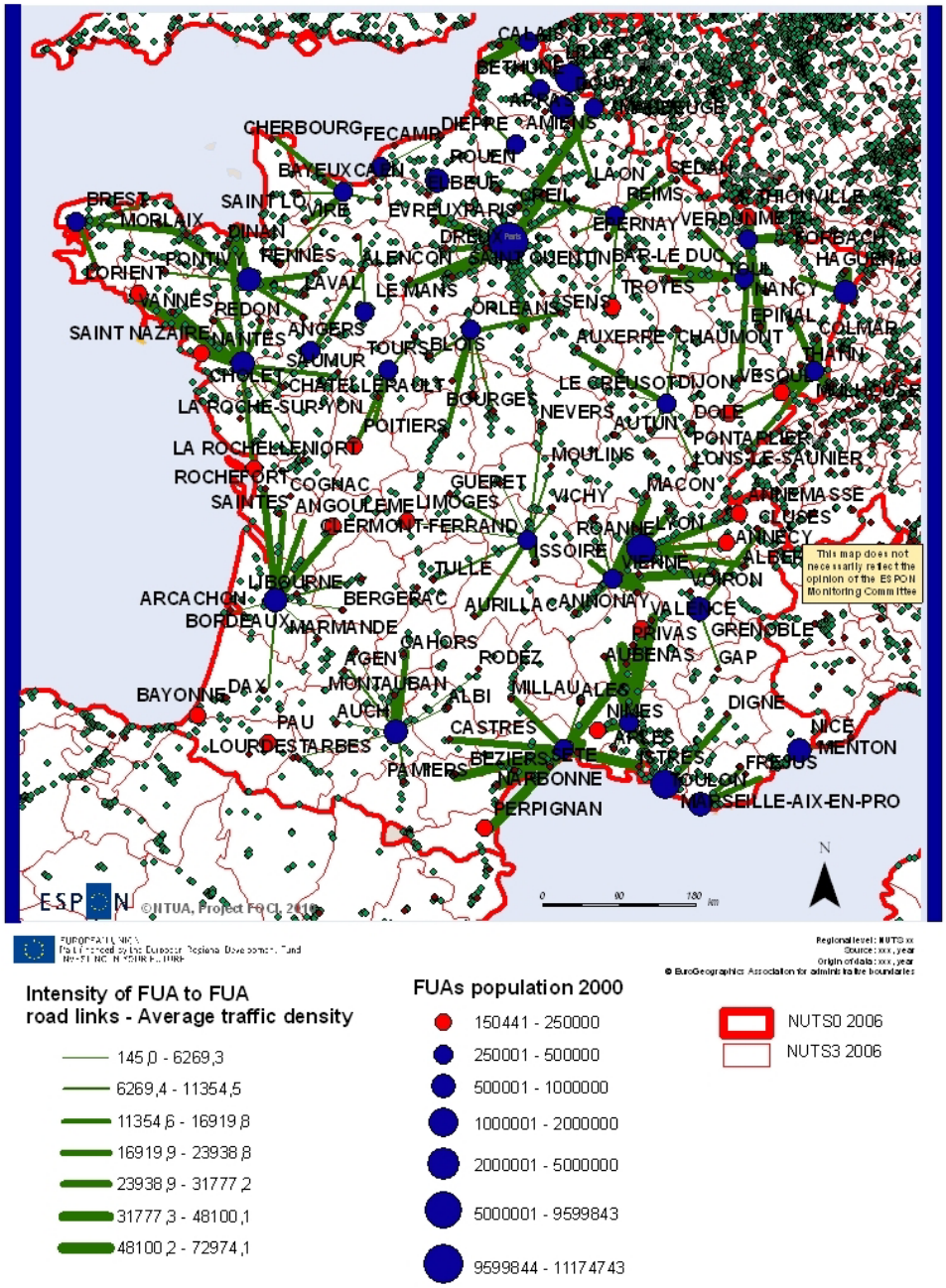


Figure 8: France: FUAs road links intensity from "regional" to lower level centres: Average density traffic max distance = 160 Km (exception for cities with < 50 Km distance

We applied the same method for Bulgaria and Romania.

Conclusions / Selection of "regional" urban networks / territories for the case of Eastern Balkans

Because the work on Eastern Balkans was exploratory, we selected the above third method and improved the results taking additionally into account the rail traffic among cities and the administrative structures of the three respective countries. The final result is presented in the chapter 7 of the Part 2A of the Report / Eastern Balkans.

Conclusions for the ESPON space

We concluded that the third method presented above could be used as starting point for all the ESPON space countries in condition that the daily traffic data is complemented for all these countries.
However, it needs some improvements:
For instance, *the maximum distance from the First FUA to the other FUAs depends on the country characteristics.*
Also, as we already mentioned, we need also take into account:
(a) The air and rail transport links, the intra-firms and research links and so on.
(b) The administrative system of each country etc.
However, in our opinion, taking into account that the road traffic is far more important indication of the "total flows" among cities, the final result will not be essentially different from the above (using the intensity of road traffic as flows / networking parameters).

The results of this exploratory / innovative work will be presented in a separate working paper towards the final report.

8. Evaluation of the performance / complementarities of the PP urban systems

8.1. In the case of Metropolitan Areas

Research here concentrates in *evaluating the degree of existing complementarities and networking and the lack of linkages by infrastructures and services among the sub-centres and the sub-units of each one Metropolitan Area.*
We are using for this purpose both "attribute" and networking / flows data. The results will be presented in June and further on in the Final Report

8.2. In the rest PP urban networks

8.2.1. Data and analyses for Higher Level (HL) relationships concerning "Regional" cities / territories (B) in order to evaluate performance and complementarities in "regional" Polycentric Potential urban networks

This essentially concerns relationships between Metropolitan Areas or "regional" territories (often above 500.000 inh.) containing at least one large city (above 250.000 inh.).
Their size allowed us to approximate them with NUTS3 areas.
We have also referred to the Metropolitan Areas in section 7. Therefore, we will refer here only to "regional" PP territories.
In general terms:
Research here concentrates in evaluating the degree of existing complementarities and networking and the lack of linkages by infrastructures and services among the sub-centres and the sub-units of each "regional" territory [51]. On this base *we evaluate its performance.*
This analysis has progressed considerably for the pilot case study of the Eastern Balkans countries (and in even more detail for the case of Greece).

In more detail:
We *measure in order to evaluate the performance and the complementarities:*
- The economic performance of the total territory, the First City, the sub-centres etc
- The composition of the employment by sectors
- The intensity of firms / research and transport links from the First to the other FUAs of the territory
etc.
See more specifically in next.

8.2.2. Higher Level relationships among cities examined using attribute indicators (HL-1)

We first approximate a degree of "actual" ***functional polycentricity*** in the examined areas.

(a) We first use attribute data / indicators corresponding to each sub-centre (constituent city) of the MA or the "regional" territory in order to get an idea about their *comparative sizes and functions.* This work will be finalised in June.
(b) We have also compared the composition of each sub-unit or regional PP urban networks by economic sectors and examine the degree of complementarity of the economic pattern of each sub-unit to the others -see in next.

[51] Social disparities in relation to the provision of services will not be analysed

We will do the same exercise for the Metropolitan Areas for the Final Report.

8.2.3. Use of the correspondence analysis to measure complementarity in PP urban networks, empirical results

8.2.3.1. Starting point: the use of the correspondence analysis by Meijers

One of the most interesting methods to measure complementarity in PP urban networks through
the evaluation of the differentiation in the economic roles of cities (see in section 1.2) is the use of the correspondence analysis. We will apply the respective methodology developed by D. Meijers (see in Meijers 2008 and Meijers 2009). We will adapt his method whenever it is necessary.

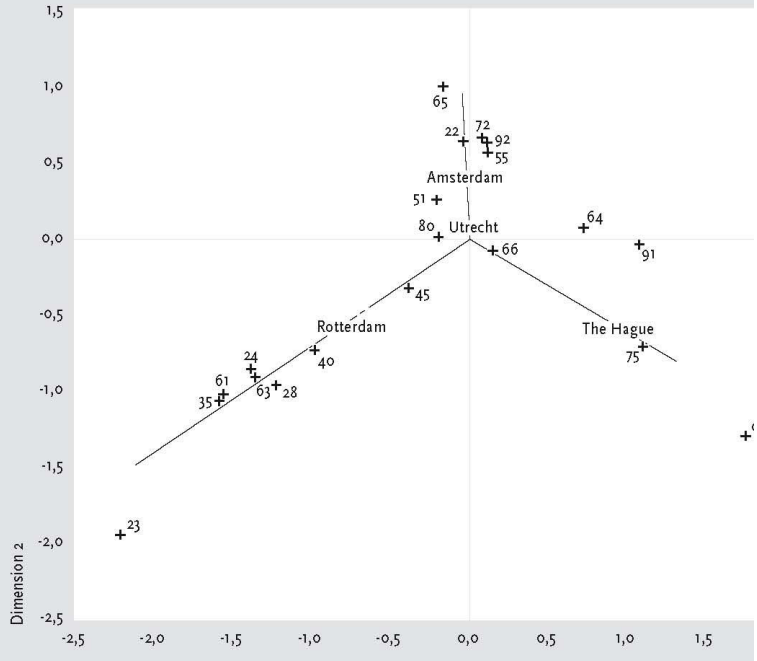
"Correspondence analysis is a technique to analyse the association between rows and columns of a table or matrix by representing the rows and columns as points in a low-dimensional Euclidean space (in practice, often a two-dimensional plot)[52]. Categories with similar distributions will be represented as points that are close in space, and categories that have very dissimilar distributions will be positioned far apart. Although often used as a tool to enable graphic interpretation of complex data, ***correspondence analysis also provides a single statistic that describes the extent of differentiation in the economic profiles of a group of cities.*** This statistic is called the ***total inertia.*** *Total inertia is a measure of the extent to which the profile points are spread around a centroid, representing the average profile.*

> *The larger the distance of the category points to the centroid, the higher the inertia. The highest attainable inertia is equal to the dimensionality of the problem (in our case, the number of cities – 1).* This maximum would be reached if all the cities have completely different economic profiles, whereas zero inertia is attained when they all have exactly the same economic profiles. In reality, values will be far from the maximum… Correspondence analysis corrects for such activities in the sense that they do not, or hardly, contribute to the total inertia statistic. In order to enable a comparison of the inertia between polycentric urban regions, a ***complementarity ratio*** is defined for which ***the total inertia is normalised by dividing it by the maximum total inertia possible and multiplying this by 100, resulting in a value between 0 and 100".*** See in detail the analysis of the case of Randstadt for the years 1996 and 2002 in Meijers 2009. Meijers concludes that the economic profiles of cities within the Randstad are becoming less differentiated.
>
> One of the main advantages of correspondence analysis is that it graphically displays associations, thus enabling an easier interpretation of complex contingency tables. Here, we are interested in associating cities with economic activities (see Figure 2.2 of Meijers 2009). The two dimensions displayed represent a reasonable 84.2 % of the total inertia. The two axes together

[52] We summarize here the description of the method by Meijers.

indicate the origin (0.0), which resembles the average profile of the four cities. This plot requires careful interpretation. If two cities lie close together, then their economic profiles are more or less similar. The same condition applies to the economic activities. Economic activities lying close together are more or less similarly distributed between the cities. The distances between cities and economic activities are more complicated, since these are not defined as chi-square distances. All cities influence the location of an economic activity and, the other way around, all economic activities contribute to the location of a city. In general, cities and activities will be close to each other when the observed value for this pair of points in the table is larger than expected, and the distance will be large when the observed value is less than the expected value".
Meijers used for the analysis a dataset containing the 1996 and 2002 data on the number of jobs classified according to two-digit NACE Rev. 1 classification of economic activities for the municipalities of Amsterdam, Rotterdam, The Hague and Utrecht.

Figure 2.2 Cities associated with economic activities in the Randstad (N=4), 2002 (percentage of inertia explained: 84,2%)



Dimension 1

01	Agriculture, hunting and related service activities	63	Supporting and auxiliary transport activities travel agencies
22	Publishing, printing and reproduction of recorded media	64	Post and telecommunications
23	Manufacture of coke, refined petroleum products and nuclear fuel	65	Financial intermediation, except insurance pension funding
24	Manufacture of chemicals and chemical products	66	Insurance and pension funding
28	Manufacture of fabricated	72	Computer and related activities

	metal products		
35	Manufacture of other transport equipment	75	Public administration and defence: compulsory social security
40	Electricity, gas, steam and hot water supply	80	Education
45	Constructions	91	Activities of membership organisations n.e.
51	Wholesale trade and commission trade	92	Recreational, cultural and sporting activities.
55	Hotels and restaurants		
61	Water transport		

See for the conclusions of this analysis in Meijers 2009.

8.2.3.2. The use of the method in ESPON 1.1.1 PIAs

We used the correspondence analysis method in ***the three kinds of PP Urban networks defined in Chapter 6:*** (a) The ESPON 1.1.1 PIAs (b) The ESPON space PP urban networks defined on the basis of 90' isochrones starting from the FUAs with more than 250.000 inh. (c) The Greek PP urban networks. We present here the application of the method and the first respective empirical results for the cases (a) and (b). We will present the empirical results for the case of Greece (c) for the pre-final report.

We first applied this method to the 249 *PIAs of the ESPON 1.1.1 project.*
We approximated each FUA with the correspondent NUTS3 region as we did not have detailed data on the economic profiles of FUAs at LAU level.
We used for the definition of the economic profiles of cities Eurostat data for the year 2001 on the following six groups of branches of the NACE classification*:

- Agriculture, hunting, forestry and fishing (code: A_B).
- Mining and quarrying; industry, electricity, gas and water supply (C_E).
- Construction (F).
- Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods; hotels and restaurants; transport, storage and communication (G_H_I).
- Financial intermediation; real estate, renting and business activities (J_K)
- Public administration and defence, compulsory social security; education; health and social work; other community, social and personal service activities; private households with employed persons (L_to_P).

*The NACE codes are taken from the respective Eurostat Table

We elaborated the % rates of each group of branches which have been used as input in the analysis.

We should remark the following:
- There are not values of Total inertia for the cases of urban networks the cities of which are located in the same NUTS3 unit.
- The results for the cases where two or more cities are located in the same NUTS3 unit are less valuable.

- An important number of PIAs are constituted by only two cities. Therefore the respective results are also less valuable.

In summary, *only for about 150 urban networks we have valuable results.*

It is possible that in some of these cases the result is not statistically acceptable. We further examine this issue.

We then ordered in the respective Table the values of Total Inertia (TI) observed by decreasing order. *The respective Table 8.1 will be included in Annex in the final version of the Scientific Report*

First empirical results

- The higher Total Inertia values, reflecting *a high degree of functional differentiation (complementarity) are observed:*

(a) In PP Urban Networks (UN) of the Eastern and Southern Europe countries, mainly in the PPUN dominated by capital cities.

(b) In PPUN of the Western Europe the one or more, bigger cities are highly specialized in financial services.

Further improving the application of the method

- Using FUAs defined on the basis of LAU units but data (from SIRE database) only for three groups of branches: agriculture, industry, services.
- Using data from the ORBIS database on firms per FUA and group of branches. Evidently, the respective results will differ considerably from the above, as the public sector, the small enterprises and the main part of the agricultural sector will not be represented.
- Furthering the analysis already done by using data for the two distant years 2001 and 2006.

9. The use of the method in the PP urban networks defined on the basis of 90' isochrones starting from the FUAs with more than 250.000 inh.

Same as for the PIAs, we approximated each FUA with the correspondent NUTS3 region and we used for the definition of the economic profiles of cities Eurostat data for the year 2001 on six NACE groups of branches. Next, we elaborated the % rates of each group of branches which have been used as input in the analysis.

Similar problems emerged:

- There are not values of Total inertia for the cases of urban networks the FUAs of which are located in the same NUTS3 unit.
- The results for the cases where two or more cities are located in the same NUTS3 unit are less valuable.
- An important number of PP urban networks are constituted by only two cities. Therefore the respective results are also less valuable. However, the number of PPUNs with only two cities is less than in the case of PIAs.

In summary, *only for about 120 urban networks we have valuable results.*

We then ordered in the respective Table the values of Total Inertia (TI) observed by decreasing order.

First empirical results

Same as for the case of PIAs – *see in Figure 9.*

- The higher Total Inertia values, reflecting *a high degree of functional differentiation (complementarity) are observed:*

(a) In PP Urban Networks (UN) of the Eastern and Southern Europe countries, mainly in the PPUN dominated by capital cities.

(b) In PPUN of the Western Europe the one or more, bigger cities are highly specialized in financial services.

Further improving the application of the method

In addition to the remarks for the case of PIAs:

We will also examine PP urban networks defined on the basis of 90' isochrones starting from the FUAs with 100.000-250.000 inh

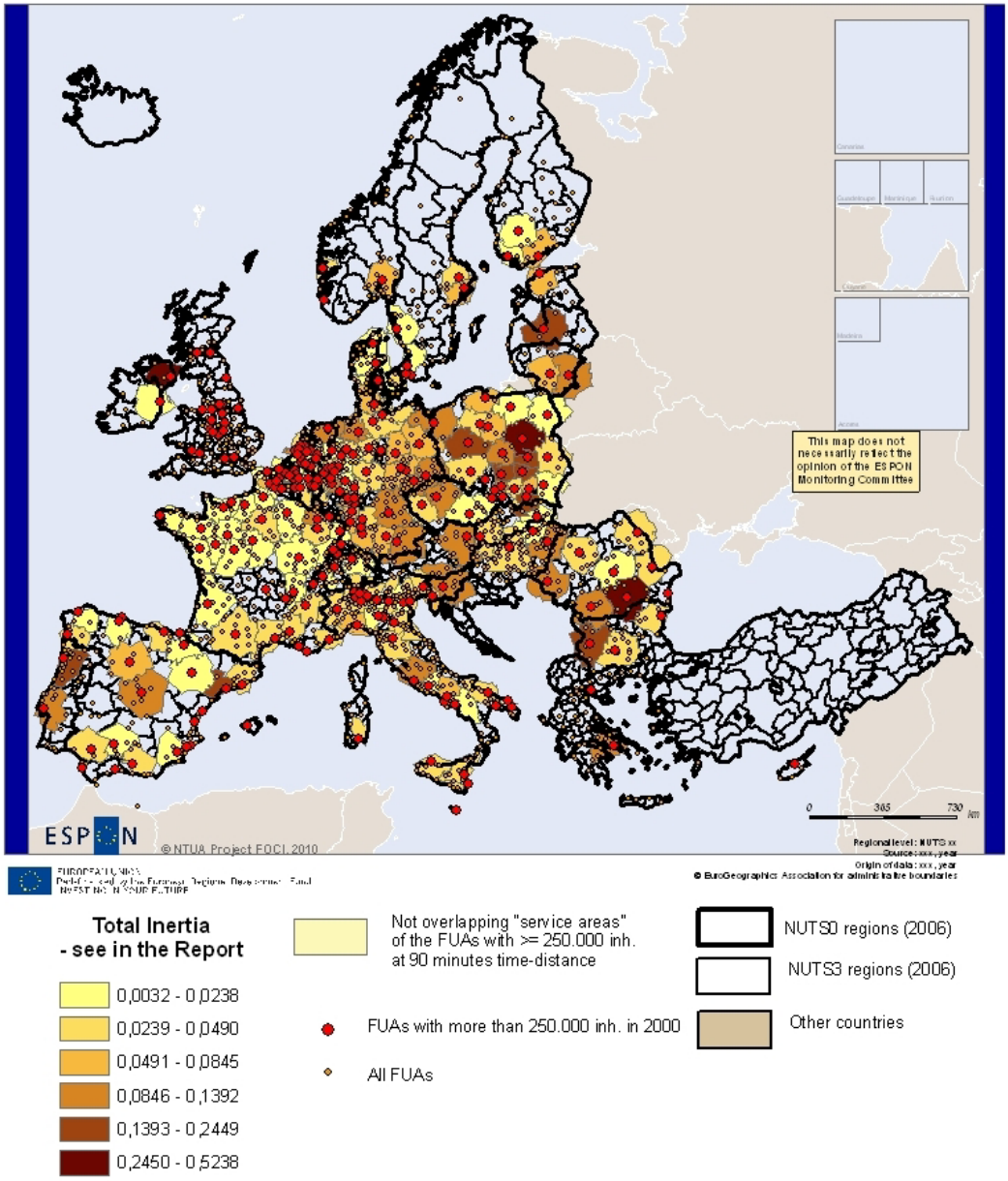


Figure 9: The degree of complementarity (correspondence analysis: total inertia) in PP urban networks in the ESPON territory

8.2.4. Higher Level relationships among cities examined using network / flows indicators (HL-2)

We have already made a part of the work on measuring the *intensity of linkages among cities in "regional" PP territories using network (flows / links) data.* The results of this work will be presented in June. In next we mention all the categories of data to be used, the data already found and the analyses already done.

8.2.5. Using firms and research data and analyses

(1) Firms' internal structure

(1a) Data of the GaWC (Globalisation and World Cities) Study Group

Our workgroup used the GaWC data on the intra-firms networking for 50 European cities (the large majority of which are MEGAs). We will use the respective analysis for the polycentricity at European – transnational level: relationships among MEGAs etc. In this frame, we produced a *Figure -10-* for the *ESPON space* where we present the intensity of links among the firms offices located at different cities, the potential (number) of offices per city and the respective population. We also present here the *Figure 11 for the Western Europe.*
We further analyse the orientation of links from the head office to the other offices, develop indicators of connexity among cities etc.

(1b) Other analyses on intra-firms networking in FOCI

As we received the data of the ORBIS firms database recently, we now analyse them as in the above (1a). We will also use the recent results of the WP2 work on firms networking.

(1c) Other data on firms – case studies

The above as well as possibly other data and analyses could be further exploited in the WP4 case studies.

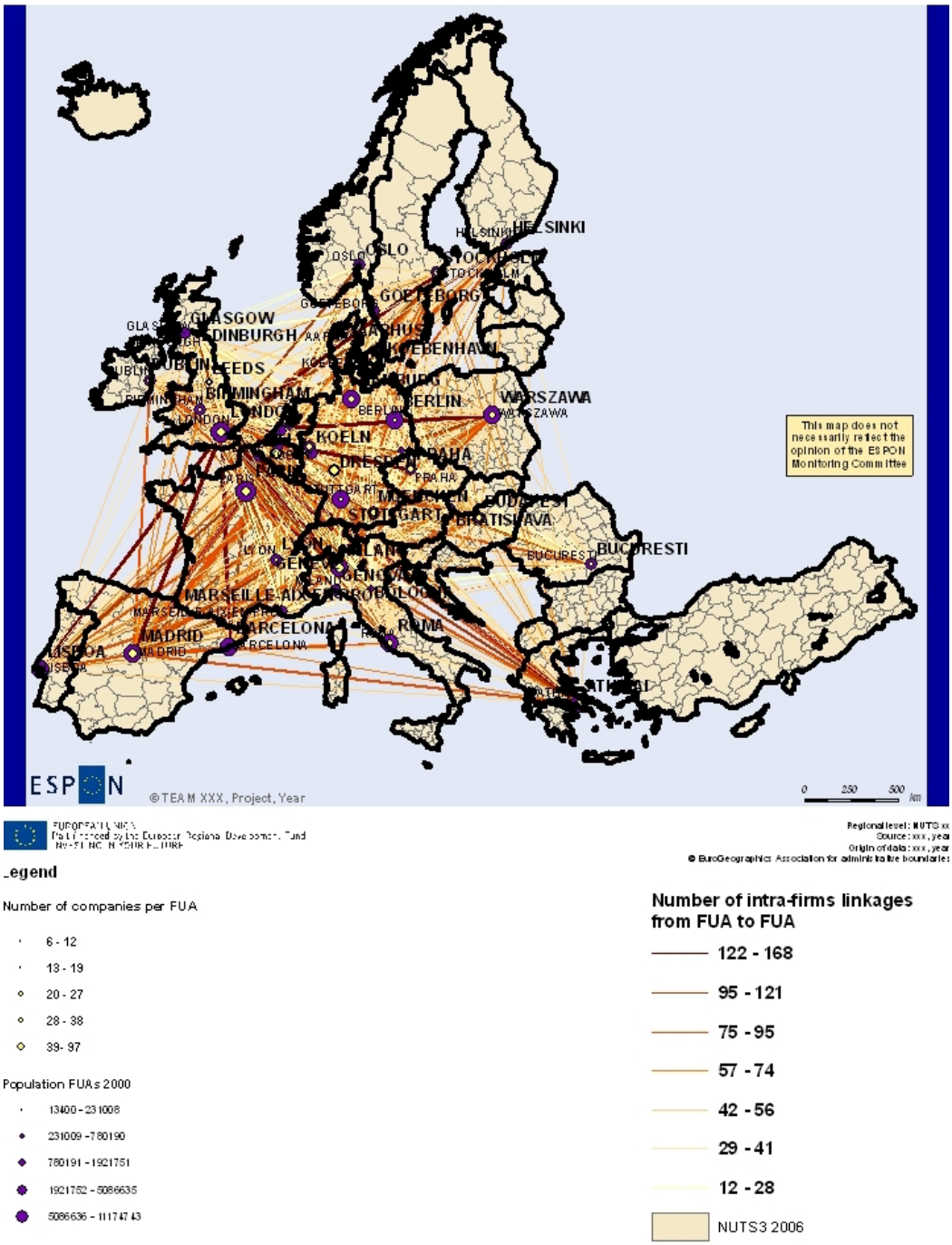


Figure 10: GAWC companies: Intra-firm linkages from FUA to FUA / ESPON space

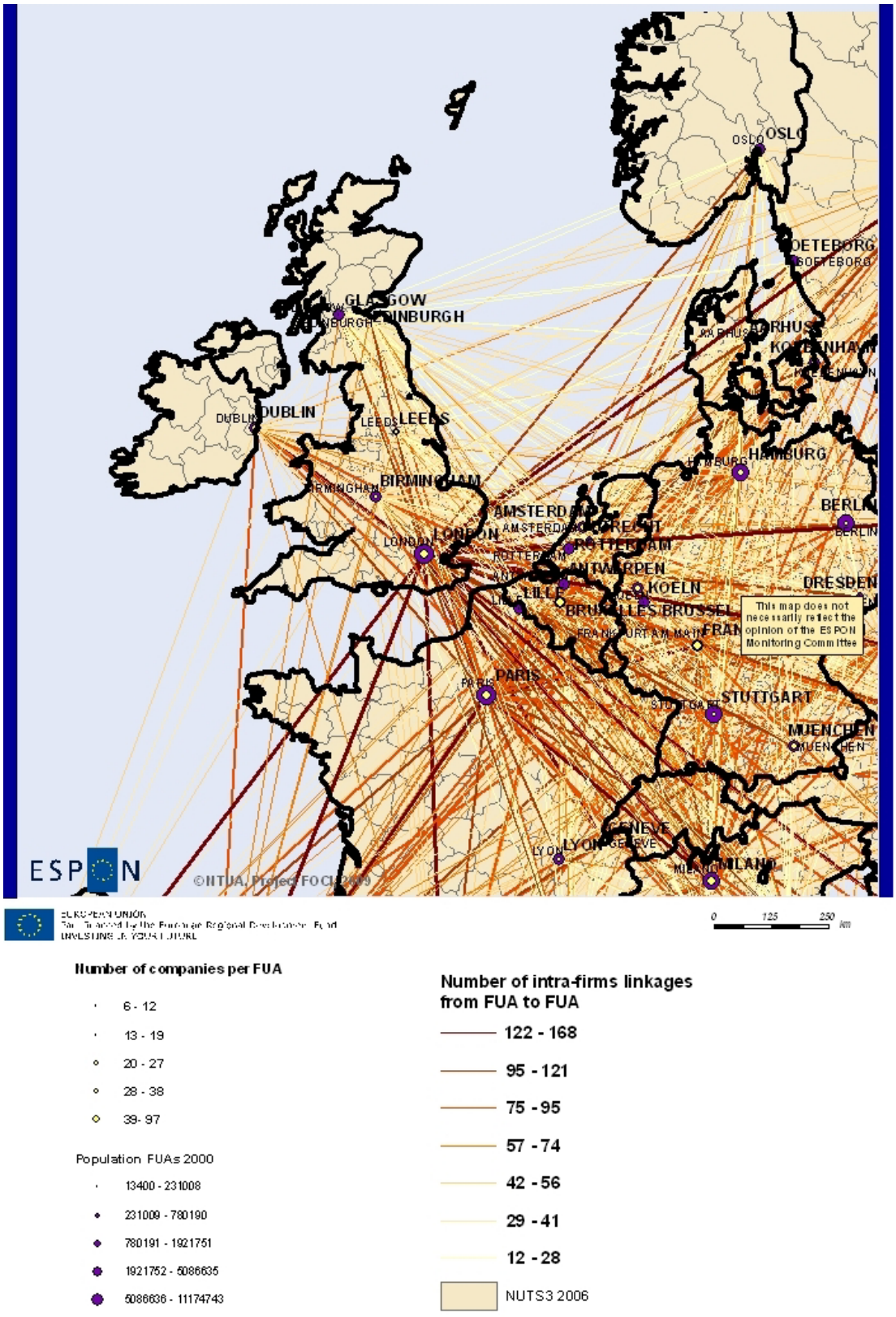


Figure 11: GAWC companies: Intra-firm linkages from FUA to FUA / West Europe

(2) Exploitation of the CORDIS research projects database

Since it was necessary to test their use in analyses in WP4, we extracted from the CORDIS research projects database (2009) the relevant data for the three countries of the Eastern Balkans area (Greece, Bulgaria and Romania). Then we defined the network linkages among FUAs (of the Eastern Balkans area) and we presented the intensity of linkages among the participants in EU projects (located in the three countries). *See for details in the section 6 of the Part 2A / Eastern Balkans case study.*

8.2.6. On transport -air, rail and road- linkages

Air transport

We started by using the (all airports) x (all airports) database of the Transtools project, associated to the respective geo-referenced links. We have used until now the indicator "Annual number of air flights from airport to airport" to evaluate the intensity of links: (a) between MEGAs
(b) between MEGAs and "Regional" FUAs (c) between "Regional" - "Secondary" FUAs. The results of this work will be presented in June.
The respective results for the EB area are presented in the Part 2A.

Rail transport

We have advanced in this type of analysis in the Eastern Balkans area case study.
- We used data from our own recording from the sites of the National Railway Organizations of these countries on the daily number of trips from FUA to FUA - We used data of the Greek Railway Organization on the number of passengers from railway station to railway station. We calculated the **total numbers of passengers from FUA to FUA.**
The respective results will be presented in June and in the Final Report.

9. Lower level (LL) relationships for all types of PP territories

We remind that the couples FUAs / territories taken into account in this analysis are defined by *daily commuting.* This concerns all types of PP territories: Metropolitan Areas (A), "regional" (B) and "provincial" (C) territories.
Due to the fact that the study of these relationships demands the elaboration of a great number of data for the entire ESPON space, we will proceed, firstly, with the case studies.
We also remind that *(C) cities / territories are "Provincial" FUAs with population 100,000–250,000 inh.. associated to territories ("provincial" PPs, "provinces") with less than 500.000 inhab.* (the population of the PP area is lower than 500.000 inhab.).

We will do this analysis for June since we have received very recently the appropriate data on "commuting areas".

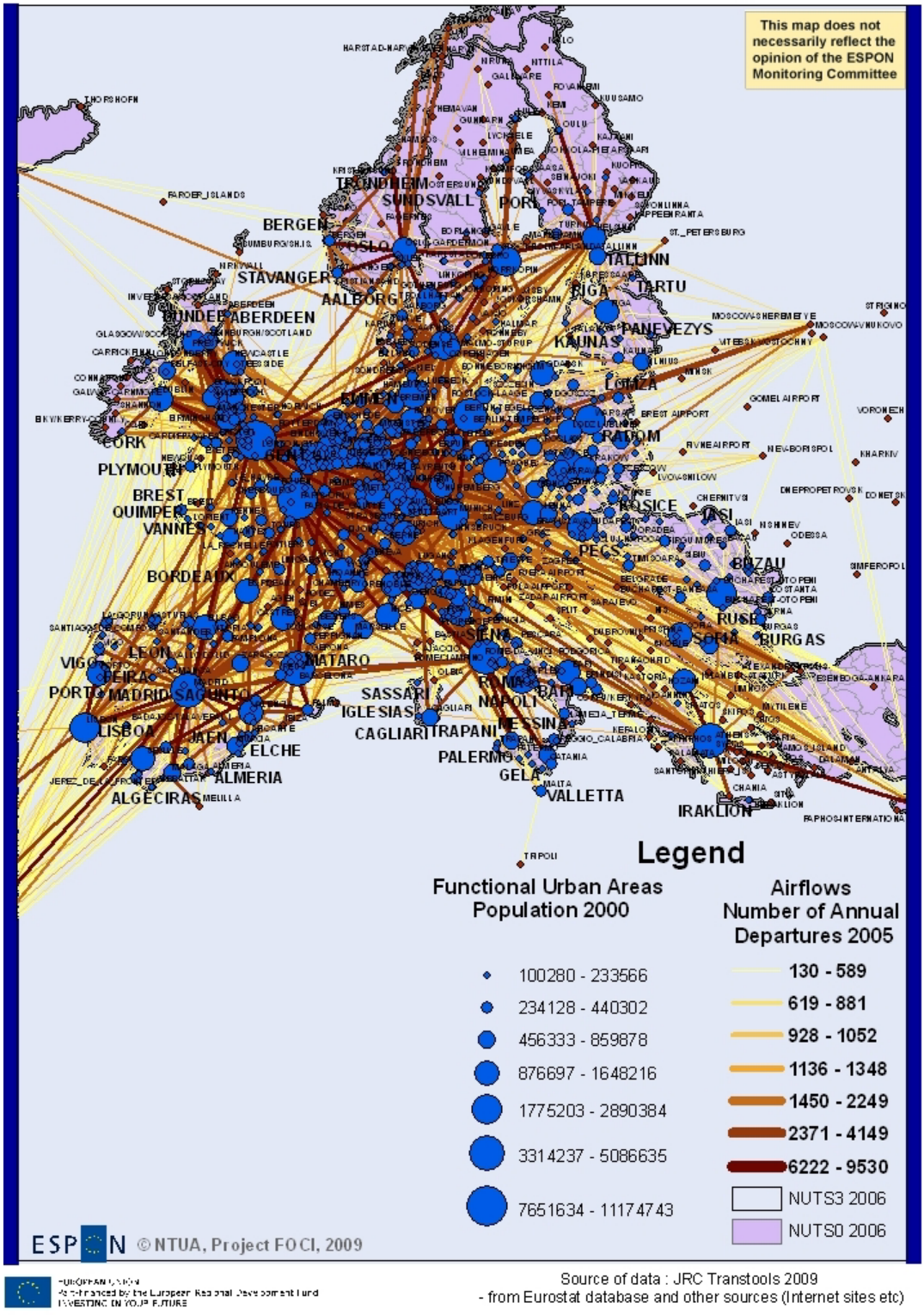


Figure 12: Polycentric cooperation potential analysis at European level: Air-travel flows

Part B. The group of case studies on Eastern Balkans

According to the methodological approach that we have presented previously we decided to work on case studies selected according to the three types (or levels) of polycentric relationship presented above.
Case studies should also refer to *different spatial development contexts.* The *Eastern Balkans (EB) area*, including *Greece, Bulgaria and Romania*, constitute a distinguishable spatial development context.
According to our general approach (see in the Interim report and its Annex / WP4 – polycentric potentials), *in the frame of the same spatial development context, different spatial levels case studies should be examined.* Therefore, we decided to examine the three following case studies included in the EB area:
- The entire EB area, where we mainly examine the higher level polycentric relationships focusing on the transnational ones.
- The case Greece / Athens where we study: (a) higher level national / regional polycentric relationships (b) lower level polycentric relationships
- The case of the trans-border region Greece - Bulgaria, where we examine the specific polycentric relationships created in trans-border areas.

1. The Eastern Balkans area case study

11. Initial methodological remarks, specific characteristics of the approach of the EB area

According to our system of hypotheses, *the EB urban system will be approached as an accelerator of polycentric territorial integration in the Eastern Balkans.*
The region of Eastern Balkans, which includes ***Greece, Bulgaria and Romania***, is transformed considerably since the end of '80s due to the transition of the two last countries to the free market economy, the pre-accession procedure that they followed and their accession to the EU on 2007.
This development process transformed not only the internal structure of the urban systems of the two recently accessed countries but, even more, their networking with the urban systems of the neighbouring EU countries, especially with the Greek urban system.
(a) Taking into consideration that the urban systems consist the main component of the transnational territorial integration, it is of great importance to examine precisely the *change* of the urban systems of Eastern Balkans from this scope. In other words, *we will first study the urban / territorial integration in the Eastern*

Balkan area as a case of transnational territorial integration of the European mega-regions through the integration of the urban system. The geographical position and the former historical evolution permit the formulation of the hypothesis that *the Eastern Balkans area is a trans-national mega- region with strong potential of integration.*
(b) We have also examined the *higher level "regional" polycentric relationships in the three countries of the Eastern Balkans area.*

2. The Eastern Balkans in the European Space (the issue of "context")

In the European space we can clearly distinguish different socio-economic and territorial contexts: the one of the areas included in the 'pentagon" or outside it, the one of the regions in the North and the ones in the South, that of the regions in the more developed Central-Western Europe, in Southern Europe (included mainly in the EU-15 "Cohesion countries") and the regions of the new member states of Eastern and South-Eastern Europe.
The SE Balkans area represents the regions outside the "pentagon", the regions of Southern Europe, as well as the regions of the new member states of Eastern and Southern- Eastern Europe.

2.1 The development framework in the three countries

The consequences of Bulgaria's and Romania's transition to the free market economy have become more intense since they have become accession countries and, even more, since they became full EU members.

2.1.1 Population

Population at national level

During the decade 1991-2001 while the population of Greece grown considerably (6,8%), the population of Bulgaria and Romania diminished (-8,3 % and -3,3% respectively).
In the period 2001-2007 while the population of Greece continued to grow (2,2%), the population of Bulgaria continued to diminish with a slower rate (-3,2%) and the population of Romania diminished a bit more than in the previous period –Table 2.1.1. in Annex.

Population density at NUTS3 level - as an indication of the polycentricity degree at national level

From the analysis of the population density in 2006 (inh. / Km2, source: Eurostat) per NUTS3 regions of EB -*Figure 13*- we concluded that:

- *In Greece population is mostly concentrated in the two MAs: Athens and Thessalonica*, in the NUTS3 regions which are located along the development axis Patras- Athens – Thessalonica – Kavala as well as in the coastal areas (NUTS3).
- In Bulgaria, *the population is more equitably distributed,* with higher densities in the NUTS3 regions of Sofia, Plovdiv and Varna.
- In Romania, population is even more equitably distributed per NUTS3 regions, with high population density in 6 big cities, strongly indicating increased polycentricity.

Population change

We have chosen to examine the population change per NUTS3 regions of the EB in relatively extended period that starts from 1991, almost at the beginning of the period of transition of the economies of Bulgaria and Romania to the market economy accompanied by a impressive raise of immigration from the East European countries to Greece –and lasts to 2006 – see in *Figure 14.*

We concluded that:
- In Greece population increased considerably in all NUTS3 regions that were already most developed and were most densely populated: in the two MAs, in the regions of the axis Patras- Athens – Thessalonica – Kavala and in the coastal zones.
- In Bulgaria and Romania, as we have already noted, the total population per country decreased in the period 1991-2006. In more detail:

(a) In Bulgaria, population decrease is less in the NUTS3 regions that include big cities while we observe a substantial raise of the population in Sofia, a small raise in Varna and no change in the regions of Burgas and Pazardzik.

(b) In Romania, we have a considerable population increase in Bucharest, lower increases in 4 NUTS3 areas (including Iasi), no change in a considerable number of regions and population decrease in several others, mainly in the Western part of the country.

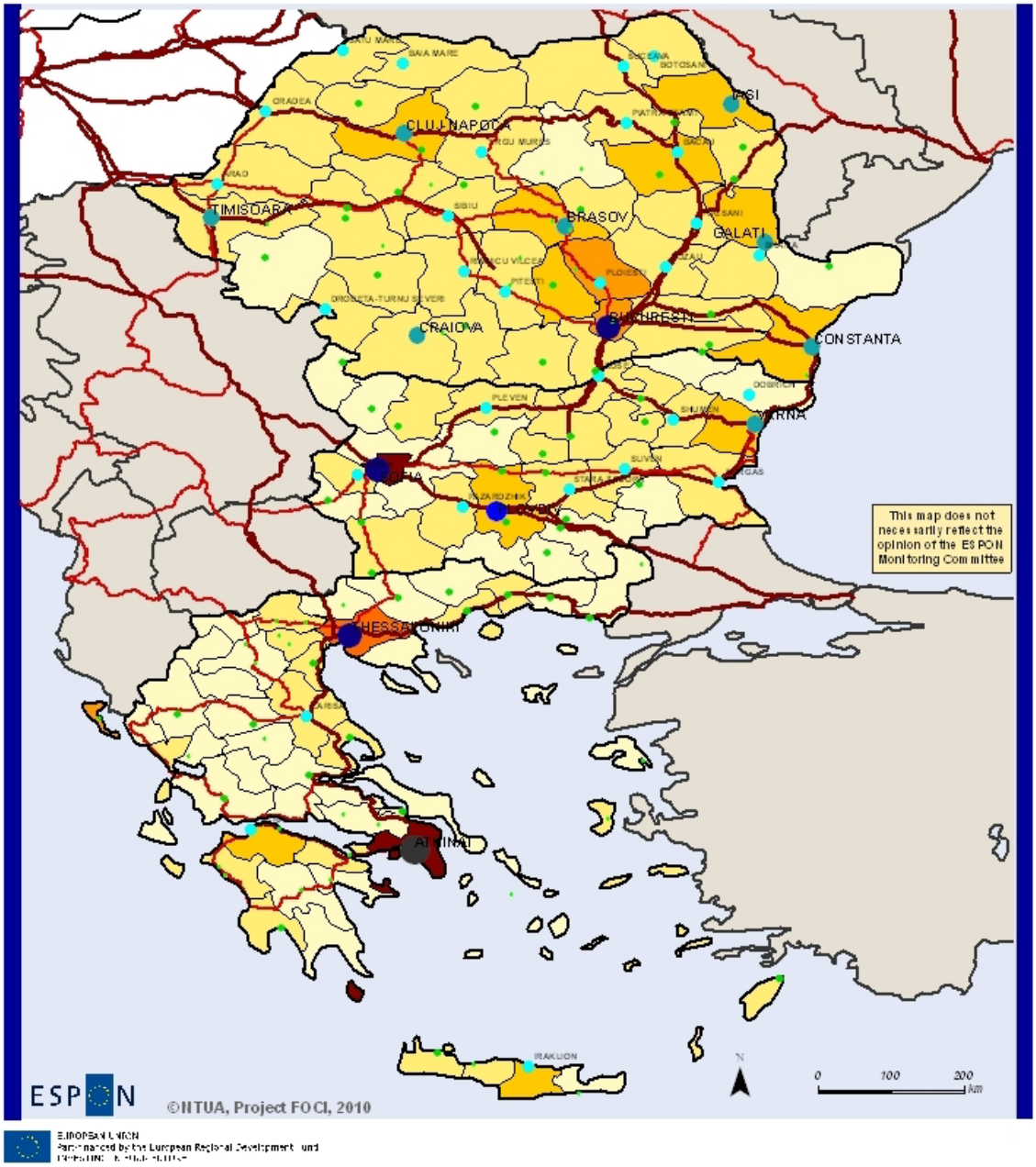


Figure 13: Population density per NUTS3 regions and population of FUAs in 2000 in the EB countries

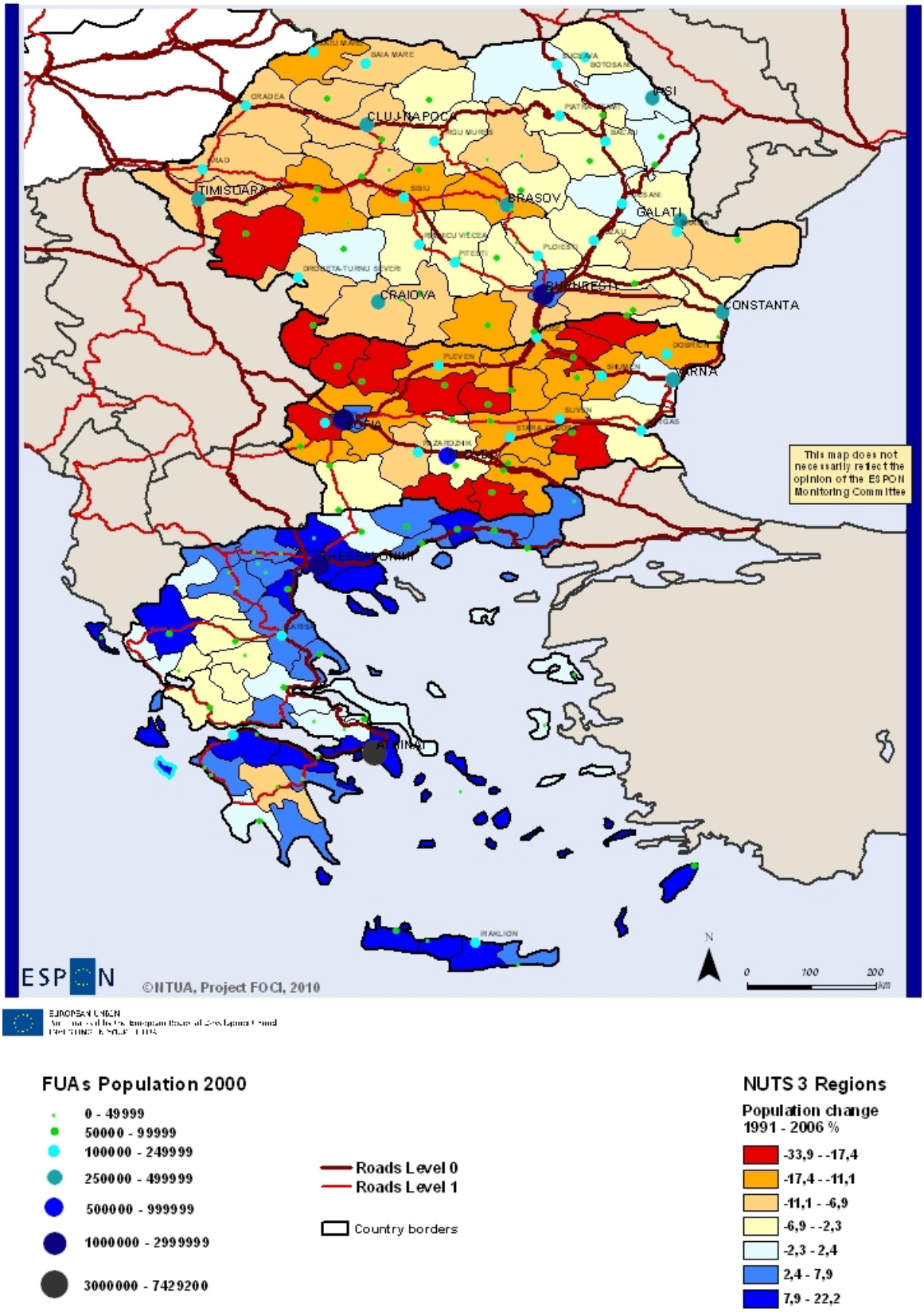


Figure 14: Population change %1991-2006 per NUTS3 regions and population of FUAs in 2000 in the EB countries

2.2 Economy

GDP at national level

The GDP per capita (Euros per capita – in current market prices, source: Eurostat) for the year 2006 was for Bulgaria 3.300, for Greece 19.100 and for Romania 4.500. *During the decade 1996-2006 (for Romania 1998-2006) it has increased in all three countries.* Especially in Greece the increase was up to 101,1%, in Bulgaria 175% and in Romania 164,7%.

GDP per NUTS3 regions in 2003

- As we have already noted, GDP per capita in Greece is much higher than that of Bulgaria and Romania. Therefore, it is expected that almost all the NUTS3 regions of Greece have higher GDP then the all the respective regions of Bulgaria and Romania.

- In Greece, the higher GDP values are observed in the Metropolitan Area of Athens and in its neighbouring NUTS3 regions as well as in the touristic area of Cyclades –see in the *Figure 15,* followed by the areas of the axis Athens - Thessalonica and the rest touristic island areas.

- In Bulgaria, the NUTS3 regions of Sofia and the other big cities: Varna, Burgas and Stara Zagora clearly distinguish from the rest of the country.

- In Romania, the NUTS3 regions of Bucharest and some of the other big cities: Timisoara, Cluj Napoca, Brasov and Konstanta clearly distinguish from the rest of the country.

Greek DI in Bulgaria and Romania

From 1989, and with a speeding rate, until today, Foreign Direct Investments (FDI) in Bulgaria and Romania are increasing. Greek DI in these countries has increased significantly, contributing to the territorial integration in the EB area.
Greek DI are primarily concentrated in the capital cities of Bulgaria and Romania and secondly: (a) to the rest big cities of Bulgaria and Romania (b) to the Bulgaria border region neoghboring to Greece.
See in more detail in section 4 -Networking analysis of the EB urban systems as well as in the forthcoming working paper on the EB area.

Other spatial economic relationships and immigration

Commercial exchanges between Greece and the two other countries, tourist flows (particularly from Greece to Bulgaria and Romania) and Greek private investments in real estate in the two other countries were increased substantially[53].
It should be emphasized that *immigration* of Bulgarian and Romanian workers to Greece as well as the level of wages paid to them are not very controlled. These workers are often employed in the "informal economy" sector.
Some aspects of the above interactions, particularly the shift of industries from Greece to

[53] It is illustrative from this scope that mainly during the last six years, the number of residents of the Greek border region (to Bulgaria) who go to the opposite side in order to be supplied with commercial products and services in lower prices has increased

Bulgaria and Romania and the presence of Bulgarian and Romanian workers with low wages in Greece have created tensions which are representative of tensions that are presented generally in EU in the current period immediately after the enlargement with the twelve new countries.

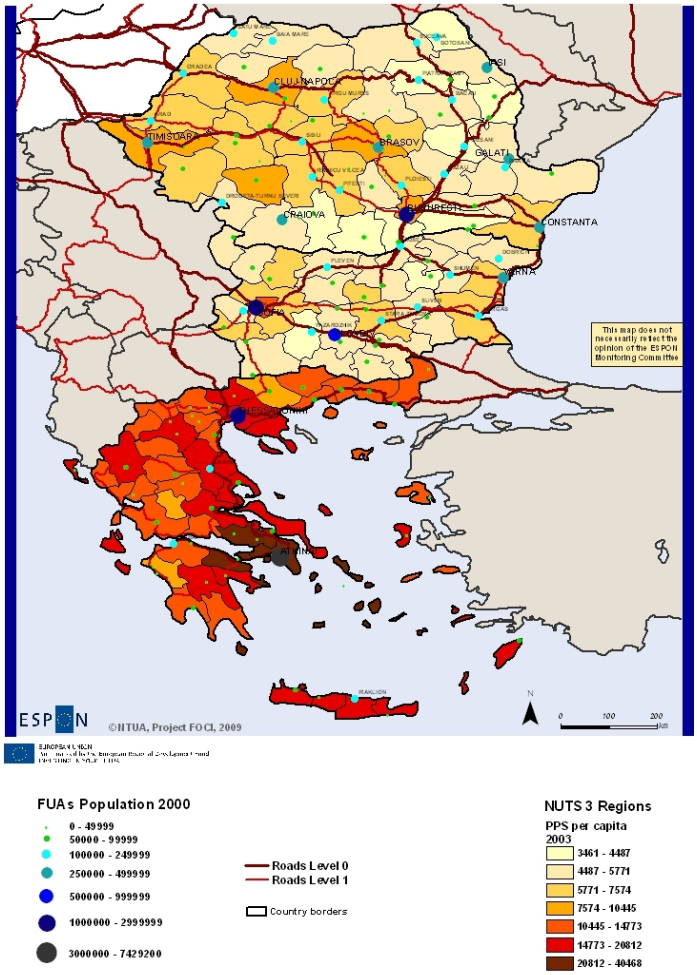


Figure 15: GDP PPS per capita 2003 per NUTS3 regions of the EB countries

3. The Eastern Balkans Functional Urban Areas (FUAs)

3.1 Typology of Functional Urban Areas (FUAs)

The ESPON 2006 1.1.1 project constructed a typology of FUAs which is based on the average scores of seven features and functions of the FUAs, population, transport, tourism, industry, knowledge, decision- making and administration (see in detail in this project).

Three concepts are used for the typology, (1) Metropolitan European Growth Areas (MEGAs), (2) Transnational / national FUAs and (3) Regional / Local FUAs.

The total number of functionally significant urban areas in Europe is 1595. 76 of these are MEGAs, 219 are transnational / national FUAs and 1312 are regional/local FUAs.

According to the ESPON 1.1.1 project, Greece has 21 FUAs, Bulgaria has 33 FUAs while Romania has 48 FUAs.

3.2. The EB MEGAs and the EB "Mega-region"

3.2.2 Identification and delimitation of the Metropolitan Areas / MAs, links studied

MEGAs of the three EB countries have a particular importance.

The MEGA analysis seeks to identify those urban areas that may be seen as "counterweights" to the Pentagon in the future. There are four building blocks here, namely (1) mass criterion, (2) competitiveness, (3) connectivity and (4) knowledge basis. Each of these building blocks consists of two variables or indicators. The typology of the MEGAs is based on indices of these four building blocks (cf. ESPON 1.1.1).
According to ESPON 1.1.1 project, there are 5 categories of MEGAs ordered by significance:
Global nodes, Category 1 MEGAs, Category 2 MEGAs, Category 3 MEGAs and Category 4 MEGAs.
In more detail: (a) *Global nodes:* Two, London and Paris, are considered to be Europe's global nodes: the largest and most competitive urban systems with high connectivity levels. (b) *Category 1 MEGAs:* There are often large, highly competitive, and possess strong human capital and good accessibility. Most of these FUAs are located within the Pentagon, though a few are located outside. These FUAs play a key role in building a more polycentric economic growth pattern in Europe. (c) *Category 2 MEGAs:* Category 2 MEGAs comprise cities that are relatively large, competitive and often possess strong human capital. *(d) Category 3 MEGAs:* These MEGAs are smaller, have lower competitiveness are more peripheral and often have weaker human capital than Category 2 MEGAs. *(e) Category 4 MEGAs:* These MEGAs are often smaller, less competitive, more peripheral, and have lower human capital figures than Category 3 MEGAs.

In the entire EB area there is only one FUA belonging to the MEGAs -2 category –Athens- and 3 FUAs: Bucharest, Sofia and Thessalonica included in the MEGAs -4 category.

As it was stressed in ESPON 1.1.1, the MEGA analysis identified some strong poles outside the Pentagon, however it found that no individual MEGA outside the Pentagon demonstrates a sufficient capacity to concentrate functions and mass in order to form a **Global Integration Zone** which could be an alternative to the "Pentagon". They pointed out that "such a potential may however arise by looking at groups of MEGAs". We will try to see if the MEGAs and, eventually, other big cities of the EB area present such a potential.
For this purpose we examine in next both the respective "attribute values" and the networking among the bigger EB FUAs.

3.2.3 Evaluation of performance / complementarities in the case of Metropolitan Areas

3.2.3.1 Firms and research networking

Intra-firms networking

(a) According to the FOCI Interim Report, considering the Firms (source of data: GaWC, data analysis and Maps design: IGEAT), significant is the presence of Athens (Headquarters and Offices) as well as of Sofia and Bucharest (Offices).
(b) The results of the GAWC firms analysis (see in Part 1) are very similar.
(c) As the number of GAWC companies which have branch offices in EB countries is small, we proceeded to an analysis of the *major Greek companies' networking in Eastern Balkans* (the number of Bulgarian and Romanian companies operating in Greece are very small). That means we examined the locations of the branch offices of these companies in the cities of Bulgaria and Romania. We also made a similar analysis for Greece.
We concluded that the presence of these companies is much more important in Sofia and Bucharest; however they have branch offices in an important number of regional capitals of Bulgaria and Romania.

3.2.3.2 Participation of cities in research networks

(a) Some results for the EB area could be derived from the work of the FOCI respective team (D. Pumain-C. Rosenblat) on the participation of ESPON space cities in research networks (extracted from the NBIC- Euro database) -see the relevant Maps of the FOCI IR.

(b) Our workgroup used the CORDIS Research projects database to find data for the *cooperation in research among the EB regions and cities.*
We recorded the research projects:
(a) Which refer to two fields of high technology: "Information processing, information systems" and "Biotechnology".
(b) The coordinator of which is located in Greece, Bulgaria or Romania and with participants from Greece, Bulgaria or Romania.
We elaborated the respective data per NUTS2 / NUTS3 levels and per FUA - *see in the Figure EB4.2.1*

We made the following conclusions:
(a) Concerning the trans-national level linkages:
We elaborated in total 655 projects. Most of coordinators -634- are located in Greece, 15 of them are located in Bulgaria and only their 6 of them are located in Romania.
Only 16 projects (2,4% of the total number of projects) refer to cooperation of cities in Greece with cities in Bulgaria, 32 (4,9%) to cooperation between Greek and Romanian cities and 8 (1,2%) to cooperation between Bulgarian and Romanian cities.
Mostly the capital cities participate in the collaborations in all three countries.
Attiki / Athens take the leading role (in number of projects compared to Sofia and Romania).

But the percentages of the participants from Romania (Bucuresti) and Bulgaria (Sofia) in projects the coordinator of which are located in Attiki are very low (4% and 2,1%, respectively)

Therefore, only the three capitals and Thessaloniki have a trans-national role in research networking in EB. This kind of networking is growing. It was not spread until recently but this spread is now growing.

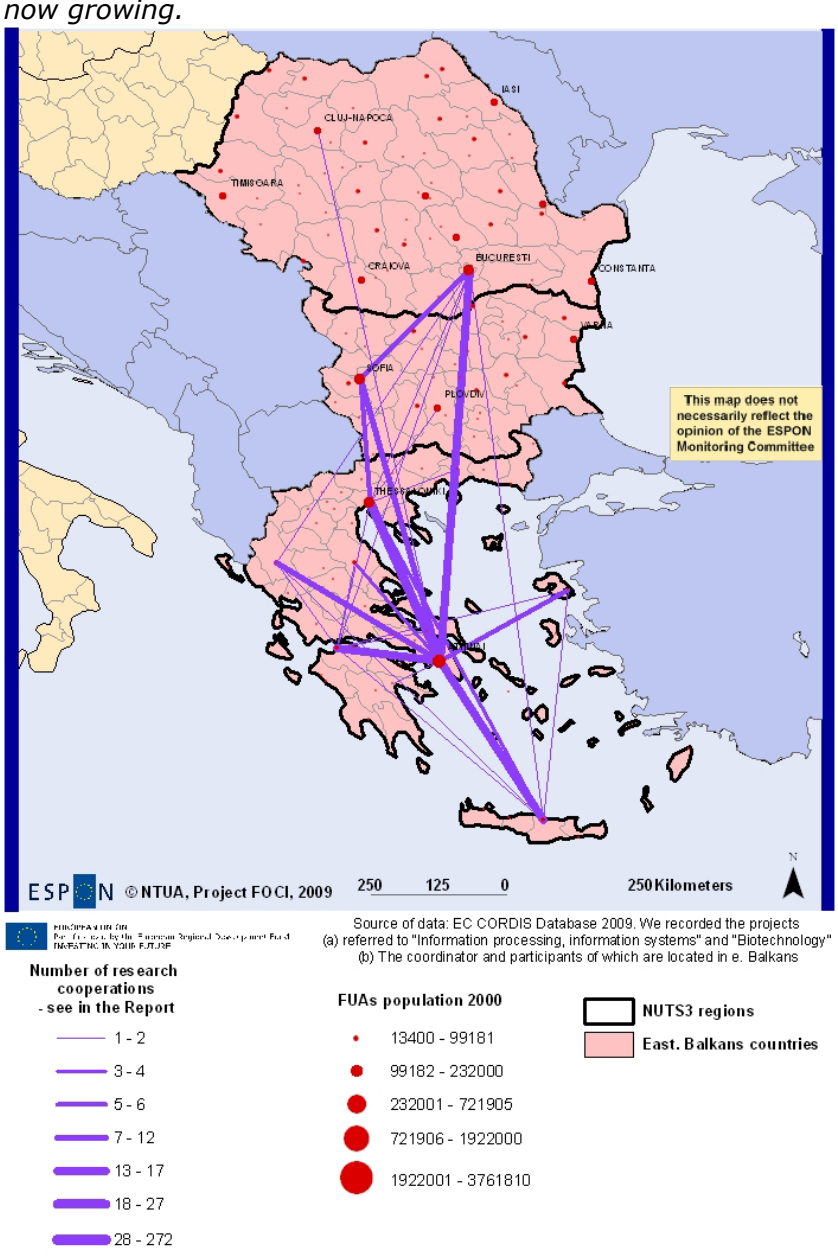


Figure 16: Polycentric cooperation analysis at transnational / national levels: selected CORDIS research projects cooperation in Eastern Balkans

4. The three national urban systems: analysis by "attribute" values

Here we are going to *emphasize on the population, knowledge, decision-making and administrative functions*, as they are analysed in ESPON 1.1.1 project. For the rest functions, see in detail in the above project.

Greece

The average FUA population in Greece amounts (2000) in 154.312 inh. 65% of the inhabitants of the country live in FUAs. Almost all FUAs are growing, with the smallest are growing relatively faster.
Greece is dominated by the metropolitan regions of Athens / Attiki and has Thessaloniki as its second-city. These two metropolitan regions had 3.761.810 and 1.084.000 inh, respectively in 2001. There are not other large cities (with population over 500.000 inh.) and the other cities are medium sized and small functioning mainly as local centres. The most important FUAs are included in the main developmental axis of the country Patras – Athens – Thessaloniki - Kavala which has an S form. Iraklion is clearly the main centre in the island of Kriti.
As for the *Knowledge* function, both Athens and Thessaloniki have universities of European significance. Seven other FUAs have large universities. The total number of FUAs with higher education institutes is 23. The university system is making Greece more polycentric.

Concerning *Decision-making,* Greece has no FUA with a second order role as a business decision-making centre on the European level –see in Chapter 1. The headquarters of top-500 companies are located in Athens and in Thessaloniki. Komotini and Larisa are two other FUAs that boast regional significance.
Administrative function: Athens is the capital city (European significance in administration). The administrative role of some FUAs is strengthening their position in the national urban network, as compared to their position in accordance with mass criterion. 35 FUAs have regional significance in administration.

From the above, we could make the following preliminary estimates:
- Athens and Thessalonica constitute very strong centers of urban networks at supra-regional and regional levels.
- In the majority of the rest regional urban networks, the primary city has a very prominent role: rather monocentric urban networks. There are few cases of morphologically and functionally polycentric urban systems as for example Karditsa-Trikkala- Larisa- Volos in Thessaly and Serrai - Kavala – Komotini – Xanthi - Alexandroupolis in Thraki. The respective FUAs, which are mainly small and medium sized, have today medium intensity inter-links but they could very probably form Potential Integration Areas (see also in next section) as this is although suggested by the Greek planning authorities.

Bulgaria

The average FUA population in Bulgaria amounts (2000) to 155.291 inh. 63% of the inhabitants of the country live in FUAs. All FUAs are declining, with the smallest FUAs losing most of their population from 1991 until 2000 (ESPON 1.1.1 2005 and ESPON 1.4.3 2006).
Bulgaria is rather monocentric. As in some other former socialist countries, the urban network of Bulgaria is characterised by the strong primacy of the capital Sofia (1.174.000 inh. in 2000 according to ESPON 1.1.1) and for the rest by a quite equilibrated pattern of second-level cities, corresponding to the willingness of the former planned economy to disperse industry on the whole country, following the administrative hierarchy.

Plovdiv (722.000), Varna (320.000) and Burgas (209.000) are clearly the most important cities after Sofia. The remaining FUAs have less than 200 000 inhabitants.
As for the *Knowledge* function, Sofia has more than 50 000 students in higher education institutes, which gives the city the status of being a significant knowledge node on the European level. Four other FUAs have large universities. The total number of FUAs with higher education institutes is 11. Three of these 11 FUAs have less than 100 000 inhabitants.
Concerning *Decision-making,* Bulgaria has no FUA with a significant role as a business decision-making centre on the European level. Sofia is a national decision-making centre. Seven other FUAs have 2 to 10 percent of top-500 companies, and 22 FUAs have at least one, but less than 10, top-500 companies.
Administrative function: Sofia is the capital city (European significance in administration). The network of regional capitals is rather dense. There are 26 regional capitals, and only four FUAs do not have a significant role in administration.

From the above, we could make the following preliminary estimates:
- Sofia constitutes a very strong center of urban networks at supra-regional and regional levels.
- In the majority of the rest regional urban networks, the primary city has a medium intensity role: rather polycentric urban networks.

Romania

The average FUA population in Romania amounts (2000) to 144.052 inh. Only 38% of the inhabitants of the country live in FUAs. All but two FUAs were losing population from 1991 until 2000 (ESPON 1.1.1 2005 and ESPON 1.4.3 2006).
Romania is dominated by Bucharest, and has seven FUAs with 280.000 to 320.000 inhabitants. These last design a *quite equilibrated urban pattern*, inherited from the communist period, when the planned economy wanted to disperse industry onto the country, following the hierarchy of the administrative pattern. At the third and the lower levels of the hierarchy, the urban pattern remains weak.
The *knowledge* system is very polycentric. In addition to the capital, eleven FUAs have major universities, distributed over all parts of country. The total number of FUAs with higher education institutes is 29. The knowledge system makes the national urban system more polycentric.
Concerning *Decision-making,* Romania has no FUA with a significant role as a business decision-making centre on the European level. Bucharest is the most important node in national decision - making and also in the private sector. Five other FUAs have regional significance in decision-making, while the top-500 companies are scattered across 32 other smaller FUAs.
Administrative function: Bucharest is the capital city (European significance in administration). 40 FUAs have regional administration functions. The network of regional capitals is rather dense.

From the above, we could make the following preliminary estimates:
- Bucharest constitutes a very strong center of urban networks at supra-regional and regional levels.

- In the majority of the rest regional urban networks, the primary city has a medium intensity role: rather polycentric urban networks.

The above estimates on polycentricity in urban networks served as hypotheses tested in the next section on networking among cities.

5. The three national urban systems: networking analysis

5.1. EB cities networking on research at national / regional level

It occurred that, in the three countries, most of the participant bodies are located in the capital city.
Specifically:
- In Greece:
51,1% of the projects the coordinators of which are located in *Attiki / Athens* (424 projects) include other participants from Attiki. The percentage of the participants from the rest of Greece is smaller, with the significant presence of Kentriki Makedonia (5,1%).
Most of the 79 projects with coordinator located in *Thessaloniki* have participants from Attiki (22,7%). Significant is also the presence of participants from Thessaloniki (15%), too.
- In Bulgaria:
The coordinators of the majority of the projects (13 out of 15 projects, 86,6%) are located in the capital city, Sofia. In these projects the participants are mainly from other cities of Bulgaria (for example Stara Zagora)
- In Romania:
The coordinators of most of the projects are located in Bucuresti (4 projects out of 6, 66%).

Therefore, the role of EB Metropolitan Areas in research networking at national level is much more important than their participation in other sectors of activities. The role of regional capitals at national level as well as their role in regional urban networks / territories was until recently very small; however, it seems that it is gradually growing.

5.2. EB cities networking through the transport system

The basic characteristics of the transport system of EB

The transport system of the area is rather weak. It is gradually reinforced through finance from CSFs and TEN- Transport.

Air transport

Flows per country

In the period 2006-2007 the total number of passengers raised very considerably in Romania -41%- while it raised moderately in Bulgaria -12%- and in Greece: 8,5%. The respective increase rates in the two first countries exceeded the EU-27 average; the raise for Greece was smaller than this average – see in Graph 4.31 in Annex

The air transport traffic between Greece and Romania was in 2007 much higher -275.000 passengers- compared to those between Greece and Bulgaria -118.000 passengers- as well as between Bulgaria and Romania: 31.000 passengers.

Flows per airport /city

The number of *Greek* cities having an airport -38- is much higher than in the two other EB countries –*Figure EB 7.1*- because in Greece there are many islands where air transport is very convenient. Most important airports are those of Athens and Thessalonica while 7 others are important.

There are 15 *Bulgarian* cities having an airport. However, only 5 airports: Sofia, Varna, Plovdiv, Burgas and Gorna oryachovitsa, are really important.

There are 17 airports in *Romania*, located respectively in: Bucharest (2 airports), Timisoara, Cluj Napoca, Sibiu, Iasi, Arad, Bacau, Constantza, Targu Mures and Baia Mare.

The airports of Romania and Bulgaria present very important raise of the traffic of passengers in the interval 2006-2007 (source: Air Passenger Transport in Europe 2007-Eurostat) , the respective raise for the airports of Greece was smaller. Specifically, the passengers traffic raises in 3 Romanian airports were of the most important among the EU-27 airports ones: namely, the airports of Cluj-Napoca: roughly 70% raise –first place considering the increase rate, the Baneasa airport in Bucharest: 45% raise -7th ranking and Otopeni in Bucharest (40%).

Rail transport

The rail lines network –*Figure EB4.3.1*- in Romania and Bulgaria is much more developed than in Greece concerning the total length of the ;lines and the number of stations compared to Greece since these two countries had accorded much higher priority to the development of the rail transport than to the road transport during the socialist period.

Cities networking through the transport system

Air transport

(a) A first set of data were gathered from the Transtools package of projects geo-database (2009). We used as main indicator for the air transport of passengers, the *annual number of flights from airport to airport.*

(b) We, also, used *data resulted from our own research* in order to check the validity of the Transtools respective data and expand them to cover some additional airports.

We proceeded in two steps:

- First, we recorded through specific Web software that we have created, the travel schedules of flights from the "expedia.com" site. The recording of the results was done for a specific day (9/9/2009) and includes all flights, direct and no direct. Then we calculated the daily numbers of flights and estimated the respective annual numbers of flights.

From the relevant data we concluded the following:

(a) Linkages between the EB area and the rest of Europe

Significant is the flow between Athens and the rest of Europe: to London (3185 ann. departures), to Rome (2.581 ann. depart.) and to Paris (2.565 ann. depart).
The communication between Athens and other European countries is mainly realized through the airport of Athens and in a much smaller extent through the other airports (for example, Athens- Vienna 698 ann. depart. while Thessaloniki- Vienna 434 ann. depart.).

(b) Linkages inside the EB area

- There is strong air transport linkage between the airports of Athens and, much less, of Thessaloniki and those of Sofia and Bucharest –***see in Figure 4.3.1.***

According to additional data, the number of the relevant annual flights has increased significantly during the last years.
The communication with the rest of the EB area is realized mainly through Athens: the most important flow is to Bucharest OTP (1800 ann. depart, according to our own calculations) while the flow to Sofia is less important (799 ann. dep). The linkages with other cities of Romania and Bulgaria are realized, mainly, with intermediate stops.
Concerning the linkages between Athens and other cities of Romania, there are data resulting from our research: Athens-Timisoara: 11 non direct flights per day and Athens-Iasi: 5 non direct flights per day.
There are, also, flights, mainly with intermediate sops, to some of the largest cities of Bulgaria and Romania. It should be noted that the recently constructed airport of Athens consists the most important air transport node in the Balkan region.

(c) Linkages inside each one of the three EB countries (national / regional level)

- In Bulgaria

The flows from Sofia to other airports of Bulgaria appear limited, for example from and to Varna only 1flight per day.

- In Romania

The flows from Bucuresti to other airports of Romania are more extended: for example from and to Timisoara 4 flights per day, from and to Iasi 4 flights per day.

- In Greece

According to our research, the strongest linkages are between Athens and the rest of Greece and, mainly, from Athens to Thessaloniki (19 direct flights per day), to Kriti (Herakleion 14 flights, Chania 9 flights), to Dodekanisos (Rhodos 11 flights) and to Kyklades (Santorini 7 flights)

Rail transport

We recorded the data on the daily numbers of rail trips among the main Bulgarian and Romanian cities from the official sites of rail transport of these two countries.
A similar work was done for Greece using data of the Rail transport Organisation of Grrece – see in detail in the Chapter 3 on Greece / Athens.
This work is used in the definition of the "regional territories" of the 3 EB countries.

Road transport

The respective work, based mainly on the "Transtools" data is described in the Chapter 1. It is used to estimate the "Territorial attractiveness of cities' in order to define the extent of the "regional territories" -see in extent in the Part 1.

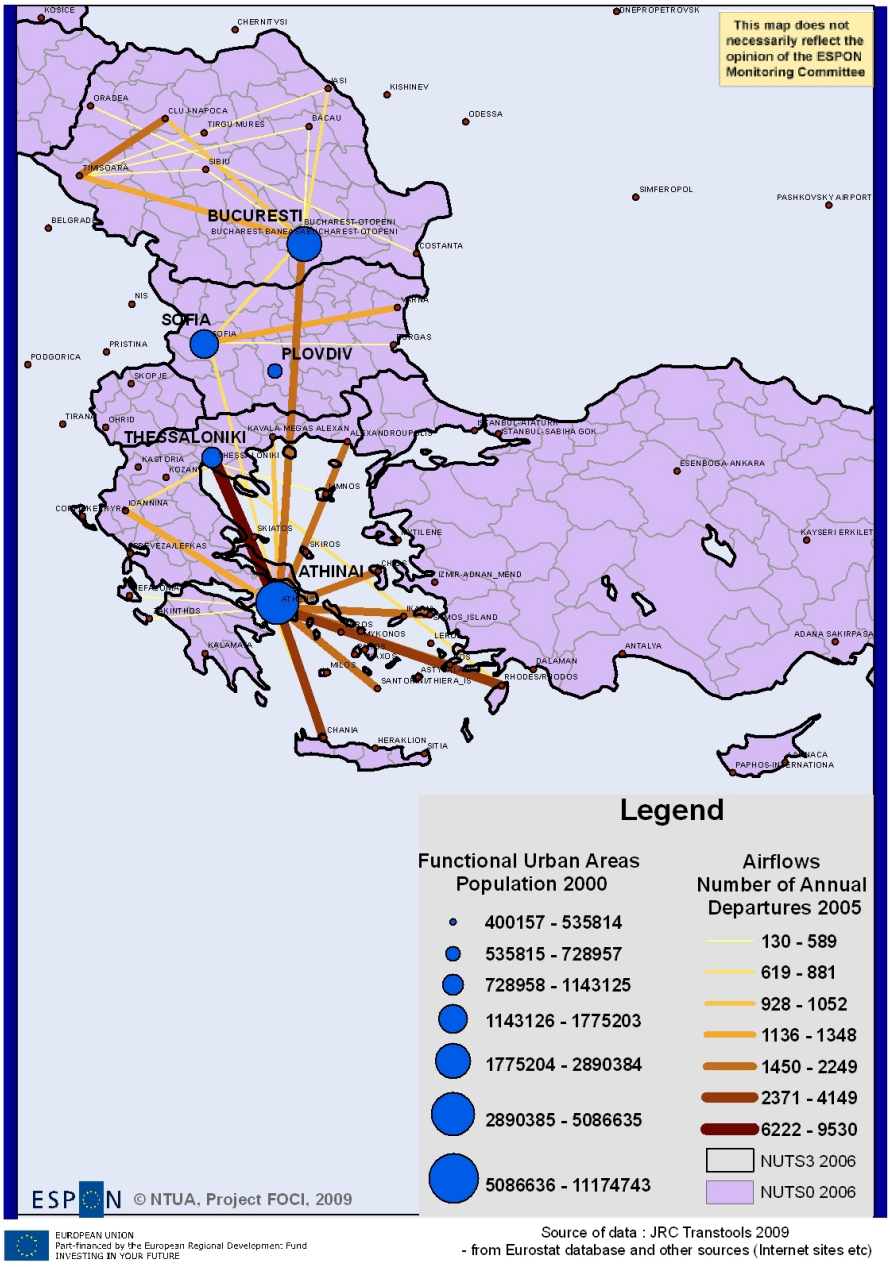


Figure 17: Air travel flows in the EB area: Numbers of Annual departures 2005

6. Identification and analysis of "regional" territories in the three countries

This work concerning the EB area is presented in the Chapter 1.

We finally discerned the urban networks, corresponding to "regional territories" in the three countries. See the Figure 18 for the case of Romania (the primary cities are marked in bold) and in Annex the list of cities included in each "regional" urban system / territory.

We made analyses of these regional urban systems / territories both by attribute and networking data and evaluated the degree of their complementarity using employment

per sectors data (at LAU1 level for Greece and Romania). The respective results will be presented in June.

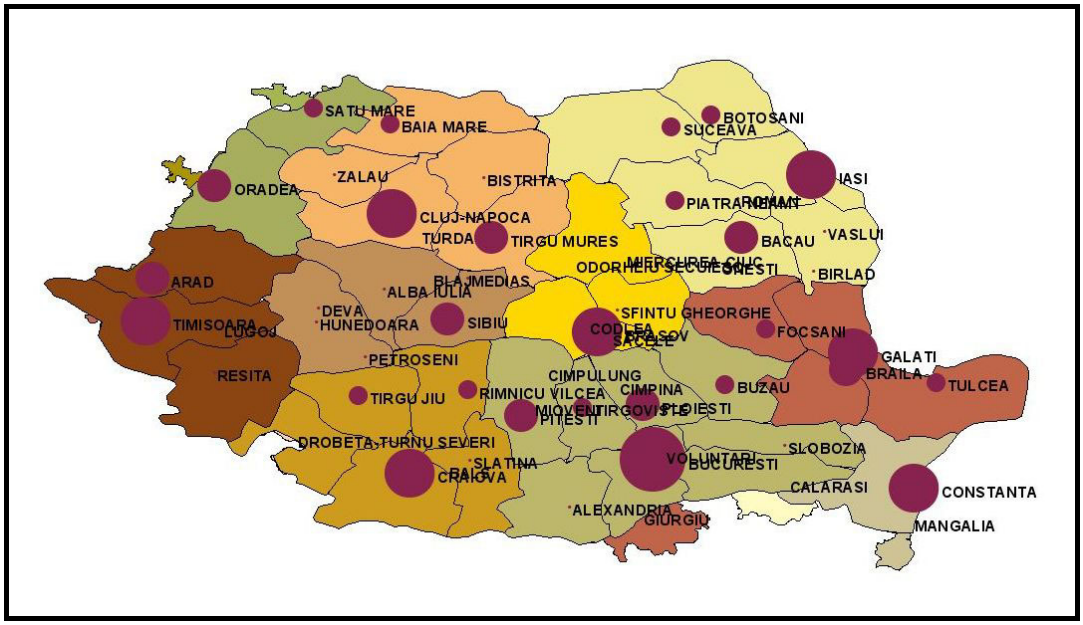


Figure 18: The "regional" polycentric potential urban systems and the "regional territories" in Romania

7. Preliminary conclusions for the "mega-region" / transnational level of polycentric integration in the EB area

Our goal was to examine the higher level polycentric relationships in the EB area focusing on the trans-national ones. Further on, we made the hypothesis that the EB urban system acts as an accelerator of polycentric territorial integration in the entire Eastern Balkans area.

We could conclude, based on the "attribute data" analysis and even more on the economic networking through the cities one, the following:

- The economic networking has progressed very fast from the beginning of '90s and it is accelerated before and even more after the accession of Bulgaria and Romania in the EU (2007).
- The economic networking among cities has most progressed in the case of the three capitals: Athens, Sofia and Bucharest: the headquarters of the majority of Greek companies that have invested in the 2 other countries have been installed din the capitals, the research networking concerns mainly the capitals and air transport flows are much higher among the three capitals.
- During the decade of 2000, economic relationships among the second order cities have been intensified. This concerns: (a) the expansion of Greek banking and commerce units in second order cities (regional capitals) of Bulgaria and Romania (and even –in as smaller extent- in third order cities). This movement is going partly through the headquarters of the respective companies installed in Sofia and Bucharest (b) the

intensification of the research relationships among second order cities (mainly regional capitals) of the three countries [to be further checked].
- In more general, the fast growing territorial integration in the EB area is guided mainly by the intensification of the networking among the three capitals and secondly (and more recently) by the intensification of the relationships among the respective regional capitals. The urban network of the three capital cities of the respective countries is functionally "more monocentric" as the power centre of the respective "trans-national" companies remains in Greece; however as, according to the relevant documentation, the "local" Bulgarian and Romanian branches of Greek companies are expended and acquire a certain degree of autonomy.

Part B 2. The Greece / Athens case study

Some aspects of the "regional polycentric integration" for the three EB countries have been examined in more depth in the framework of the case study Greece / Athens. Further on, a first analysis of Athens from the scope both of the polycentricity in a metropolitan area and the relationships among a capital city and its national territory has been done. The results of this work will feed the work on case studies in FOCI and will be presented in a separate working paper towards the final report.

Bibliography- Sources

EU cohesion and territorial policies

ESDP (1999), *European Spatial Development Perspective: Towards balanced and sustainable development of the territory of the EU*, CEC, Luxembourg.

European Commission [1], 2008, *Green Paper on Territorial Cohesion; Turning territorial diversity into strength*, COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, {SEC(2008) 2550}, COM(2008) 616 final, European Commission, Brussels

European Commission, 2008, *COMMISSION STAFF WORKING DOCUMENT a*ccompanying the Green Paper on Territorial Cohesion Turning territorial diversity into strength {COM(2008) 616 final, SEC(2008), European Commission, Brussels.

EU / Regional Policy, 2007, *Growing Regions, growing Europe: Fourth report on economic and social cohesion*, Communication from the Commission, Office for Official Public. of the EC,Luxembourg.

ESPON 2006 projects

ESPON TPG, 2004, *project 1.1.1: Potentials for polycentric development in Europe*, Nordregio, Stockholm.

ESPON TPG, 2005, *project 1.1.2: Urban-rural relations in Europe*, Helsinki University of Technology - Centre for Urban and Regional Studies, Helsinki.

ESPON TPG, 2005, *project 1.1.3: Enlargement of the European Union and the wider European Perspective as regards its polycentric spatial structure*, KTH, Stockholm.

ESPON TPG, 2006, *project 1.4.1: The role of small and medium sized towns (SMESTO)*, ÖIR, Wien.

ESPON TPG, 2007, *project 1.4.3 Study on Urban Functions*, Free University of Brussels – IGEAT, Brussels.

ESPON TPG, 2007, *project 1.4.4: Study on Feasibility on Flows Analysis,* Spiekermann & Wegener, Dortmund.

ESPON TPG, 2005, *project 2.1.1: Territorial impact of EU transport and TEN policies*, Christian Albrecht University of Kiel, Institute of Regional Research, Kiel.

ESPON TPG, 2006, *project 3.4.2: EU economic policies and location of economic activities*, Université Libre de Bruxelles, Brussels.

ESPON TPG, 2007, *project 3.2, Spatial scenarios and orientations in relation to the ESDP and Cohesion Policy,* IGEAT, Brussels.

Polycentricity: analytical and policy aspect, service provision, transport, territorial complementarities

Baudelle G. - Castagnède B., 2002, *Le polycentrisme en Europe*, Editions de l'aube, DATAR, Paris.

Castells M. (1996), *The Information Age: Economy, society and culture: Volume 1 – The rise of the network society*, Blackwell Publishers, Massachusetts - Oxford

CEMAT, 2006, *13 Final RESOLUTION N° 1 on Polycentric development: promoting competitiveness, enhancing cohesion*. .

Clausen, S-E., 1998, *Applied correspondence analysis: an introduction,* Sage University Papers Series on Quantitative Applications in the Social Sciences, 07-121. Thousand Oaks: Sage.

Davoudi. S., 2003, *Polycentricity in European Spatial Planning: From an analytical tool to a normative agenda*, European Planning Studies, Vol. 11(8), pp. 979-999.

Dijkstra L. – Poelman H., 2008, *Remore rural regions: how proximity to a city influences the performance of rural regions,* Regional Focus No 01/2008, EU / Regional Policy, Brussels.

Eskelinen Heikki & Matti Fritsch, 2007, *Polycentricity in the northeastern periphery of the EU territory,* Paper prepared for the Regional Studies Association Conference "Regions in Focus" Lisbon.

ESPON, 2005, *In search of territorial potentials*, Midtern results by spring 2005.

Faludi A., 2005, *Polycentric territorial cohesion policy,* Town Planning Review, 76 (1), pp. 107–118.

Gabi Simone –A. Thierstein –Chr. Kruse –L. Glanzmann, 2005, *Sustainable Management of the polycentric European Metropolitan Region of Northern Switzerland*, Raumentwicklun.

Glanzmann L., Grillon N., Kruse Chr., Thierstein A., 2004, *Polycentricity and metropolitan governance. A Swiss case study,* ERSA.

Goebel Viktor, Alain Thierstein, Stefan Lüthi, 2007, *Functional polycentricity in the Mega-City Region of Munich*, Technical University of Munich.

Greenacre, M.J., 1993, *Correspondence analysis in practice*, London, Academic Press Limited.

Hague, C., and K. Kirk, 2003, *Polycentricity Scoping Study,* London, Office of the Deputy Prime

Halbert, L., Convery, F., Thierstein, A., 2006, *Reflections on the Polycentric Metropolis* in Built Environment, vol. 32, pp 110-113.

Minister.Halbert Lud., Kathy Pain, Alain Thierstein, 2008, *European Polycentricity and emerging Mega-City-Regions - "one sizes fits all" policy?*, Built Environment, 32 (2), pp. 206-218.

Hall P. - Pain K., 2006, *The Polycentric Metropolis - Learning from Mega-City Regions in Europe*, Earthscan Publications Ltd, London.

Hall, Peter, 2003, *In a lather about polycentricity,* Town and Country Planning.

Lacour Cl. –Puissant S., 2000, *La Metropolisation croissance diversite fractures*, Anthropos.

Nordregio, 2004, Mountain Areas in Europe: Analysis of mountain areas in EU member states, acceding and other European countries, Final report / January 2004, European Commission.

Mathian - Pumain - Rosenblat (GDR LIBERGEO – Equipe PARIS) in Study Programme on European Spatial Planning (SPESP) Chapter 2 p. 25, 2000.

Meijers E., 2009, *Synergy in Polycentric urban Regions: complementarity, organising capacity and critical mass (Ph. D. Thesis)*, Delft Centre for Sustainable Urban Areas, Delft.

Meijers E. - Sandberg K., 2008, *Reducing Regional Disparities by Means of Polycentric Development: Panacea or Placebo?*, FrancoAngeli.

Meijers E., 2008, *Summing Small Cities Does Not Make a Large City: Polycentric Urban Regions and the Provision of Cultural, Leisure and Sports Amenities,* in Urban Studies, Vol. 45, No. 11, 2323-2342 (2008)

Meijers E.J., B. Waterhout and W.A.M. Zonneveld, 2007, *Closing the Gap: Territorial Cohesion through Polycentric Development*, European Journal of Spatial Development, 24.

Meijers E. – K. Sandberg, 2006, *Polycentric Development to Combat Regional Disparities? the Relation Between Polycentricity and Regional Disparities in European Countries*, ERSA.

Meijers E., 2006a, *The notion of complementarity in urban networks: definition, value, measurement and development,* paper presented at the 10th UNECE Conference on Urban and Regional Research, May 22-23 2006, Bratislava.

Meijers E., 2006b, *Polycentric Urban Regions and the Quest for Synergy: Is a Network of Cities More than the Sum of the Parts?* In Urban Studies, Vol. 42, No. 4, 765-781 (2005)

Rheinisch-Westfδlisches Institut fὸr Wirtschaft sforschung, German Institute of Urban Affairs – DIFU, NEA Transport research and training, Policy Research & Consultancy – PRAC, 2010, *Urban Audit Analysis II, Final Report, Second Draft (Preliminary Version),* March 2010, Research Project for the European Commission, DG Regional Policy

Rich J., Bröcker J., Hansen C.O., Korchenewych A., Nielsen O.A., Vuk G. (2009): *Report on Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, taking into Consideration the External Dimension of the Union – TRANS-TOOLS version 2; Model and Data Improvements*, Funded by DG TREN, Copenhagen, Denmark.

Sandberg K. – E. Meijers, 2006, *Polycentric development: panacea for regional disparities in European countries?*, paper presented at the 10th UNECE Conference on Urban and Regional Research.

Sassen S., 2002, *Global networks, linked cities*, Routledge, New York - London.

Shaw D. - Sykes O., 2004, *The concept of polycentricity in European spatial planning: reflections on its interpretation and application in the practice of spatial planning,* International Planning Studies, 9 (4).

Turok Ivan, 2005, *Polycentric Development: the key to regional competitiveness and cohesion?*, Town and Country Planning.

Vandermotten, Christian et al, 2008, *European Planning and the Polycentric Consensus: Wishful Thinking,* Regional Studies, Vol. 42.8, pp. 1205-1217.

Waterhout, Bas., 2002, *Polycentric development: what is behind it?*, in Faludi, A. (ed.) European Spatial Planning, Cambridge, MA: Lincoln Institute of Land Policy, pp. 83–103.

Waterhout Bas, Wil Zonneveld and Evert Meijers, 2005, *Polycentric Development Policies in Europe: Overview and Debate*, in Built Environment, 31 (2), pp. 163-173.

Zonneveld W. et al (Guest Editors), 2005, *Polycentric development policies across Europe*, Revue Built Environment- Volume 31, Number 2 (Special issue), Alexandrine Press Editors: P. Hall- D. Bannister, London

Polycentricity: mainly analytical aspect (firms / activities networks, urban networks etc)

Aguilera A., 2005, *Growth in commuting distances in French polycentric metropolitan areas: Paris, Lyon and Marseille*, Taylor Francis, Routledge.

Amiel, M., Mélançon G., Rozenblat C., 2005, *Réseaux multi-niveaux: l'exemple des échanges aériens mondiaux de passagers*, http://mappemonde.mgm.fr/

Castells M., 1999, *The Information Age: Economy, Society & Culture, Vol I, The Rise of the Network Society*, Blackwell Publishers.

Chevalier J., 1999, *Réseau urbain et réseau de villes dans l'Ouest de la France*, Anthropos.

Green N., *Functional Polycentricity: A Formal Definition in Terms of Social Network Analysis*, Urban Studies, 44 (11), pp. 2077-2103.

Institut de l'économie urbaine (IEU) / nexialis coref, 1992, *L'internationalité des villes françaises,* IEU.

Offner J.-M. & Pumain D., 1996, *Réseaux et territoires: significations croisées,* Editions de l'aube, Paris.

Rozenblat C., 2009, *European urban polycentrism: a multi-scale typology*, Geographica Helvetica.

Rozenblat C. & Pumain D., 2007, *Firm linkages, innovation and the evolution of urban systems* in Taylor et al. (eds), *Cities in Globalization: Practices, policies and theories*, Routdledge, pp.130-156.

Rozenblat C. & Pumain D., 2004, *Articulated modes of integration: the structuring of the european urban system* in M. Pacione: *Changing cities: international perspectives*, IGU Urban Commission and Strathclyde University Publishing, pp.91-105.

Simmie J. (ed.), 2001, *Innovative Cities,* Spon Press, London & New York.

Taylor, P. J., 2003, *European Cities in the World Network,* in Dijk, H. van (ed) T*he European Metropolis 1920–2000*, Rotterdam: Erasmus Universiteit.

Future of polycentric urban systems

Ascher F., 1995, *Métapolis - ou l'avenir des villes,* Odile Jacob.

Hall P. - Pfeiffer U., 2000, *Urban Future 21: A global agenda for twenty-first century cities,* E & FN Spon London.

Layard A. -Davoudi S. -Batty S., 2001, *Planning for a sustainable future,* Spon Press, London.

Leclerc R. - Wachter S., 1996, *Les régions au futur,* Editions de l'aube, Paris.

PwC Big Cities Network, 2005, *Cities of the future: global competition, local leadership,* Pricewaterhouse Coopers.

Reginster I. - Rounsevell M., 2006, *Scenarios of future urban land use in Europe,* Environment and Planning B, 33 (4), pp. 619 – 636.

Polycentrism: territorial governance

ESPON TPG, 2007, *project 2.3.2, .Governance of territorial and urban policies,* Univsrsity of Valencia.

ESPON INTERACT Transnational Project Group, (2007) Polycentric Urban Development and Rural - Urban Partnership – Thematic Study of INTERREG and ESPON activities FIR, OTB Delft, the Netherlands

Relevant INTERREG III programmes

METREX documents

Transnational cooperation

TERSYN (France) in co-operation with EureConsult S.A. (Luxembourg) and ECOSYSTEMS (Belgium), 2007, Ex-ante Evaluation of the Interregional Cooperation Programme (INTERREG IVC) Objective 3 European Territorial Cooperation 2007 – 2013, Final Report,.

Regional Policy Inforegio, European Commission (http://ec.europa.eu/regional_policy/index_en.htm)

European Commission, *Regional Policy* - *Atlas* - *Transnational co-operation* - *Northern Periphery* , Cohesion Policy 2007 – 2013 (http://ec.europa.eu/regional_policy/atlas2007/transnational/northern_periphery_en.htm)

– *Baltic Sea*, Cohesion Policy 2007 – 2013

– *North West Europe* Cohesion Policy 2007 – 2013

– *North Sea*, Cohesion Policy 2007 – 2013

– *Atlantic Coast,* Cohesion Policy 2007 – 2013

– *Alpine Space,* Cohesion Policy 2007 – 2013

Annex

List of cities included in each "regional" urban system / territory of Bulgaria, Romania and Greece.

In Bulgaria:
Burgas territory*:* **Burgas**, Sliven
Plovdiv territory: Plovdiv, Karlovo, Pazardzhik, Asenovgrad
Ruse territory: Razgrad, **Ruse**, Veliko Tarnovo
Sofia territory: Blagoevgrad, Kyustendil, Lovech, Montana, Pernik, Petrich, Pleven, **Sofia,** Vidin,Vraca.
Stara Zagora territory*:* **Stara Zagora,** Dimitrovgrad, Gabrovo, Kazanlak, Kardzhali, Haskovo, Yambol
Varna territory*:* Shumen, Silistra, Dobrich, **Varna,** Targovishte, Vraca
In Romania:
Bacau territory: Bacau, Onesti, Piatra, Neamt
Brasov territory: **Brasov,** Codlea, Miercurea-Ciuc,Odorheiu Secuiesc, Sacele, Sfintu Gheorghe
Bucuresti territory: Bucuresti, Buzau, Calarasi, Cimpina, Ploiesti, Slobozia, Tirgoviste, Alexandria,Giurgiu,Voluntari
Cluj Napoca territory: Baia Mare, Bistrita, **Cluj-Napoca,** Tirgu Mures, Turda, Zalau
Constanta territory: Tulcea, **Constanta,** Mangalia
Craiova territory: Bals, **Craiova,** Slatina, Tirgu Jiu, Drobeta-Turnu Severi
Galati territory: Braila, Focsani, **Galati**
Iasi territory: Birlad, Botosani, **Iasi,** Roman, Suceava, Vaslui
Oradea territory: Oradea, Satu Mare
Pitesti territory: Cimpulung, **Pitesti,** Rimnicu Vilcea, Mioveni
Sibiu territory: Alba Iulia, Blaj, Deva, Hunedoara
Medias, Petroseni, **Sibiu**
Timisoara territory: Arad, Lugoj, Resita, **Timisoara**

In Greece:
Achaia territory: Agrinio, Aigio, Amaliada, Kalamata, **Patras,** Pirgos, Tripoli.
Attiki territory: Argos, **Athens,** Ermoupolis, Chalkida, Chios, Korinthos, Lamia, Levadia, Mitilini, Rodhes, Thiva.
Ioannina territory: Arta, Corfu and Ioannina
Irakleio territory: Ierapetra, Chania, Irakleio and Rethymno. Irakleio is the primary city.
Kavala territory: Alexandroupolis, Drama, Kavala, Komotini, Orestiada, Serres and Xanthi.
Larisa territory: Karditsa, Larisa, Trikala and Volos with
Thessaloniki territory: Edhessa, Giannitsa, Katerini, Kilkis, Kozani, Naousa, Ptolemaida, Thessaloniki and Veroia.

Chapter 10 – FOCI Scenarios on the future of European cities and settlement systems

1. Scenario base

1.1. Long-term aspects of the urbanisation process

The long-term aspects of the urbanisation process in Europe have to be analysed at two different scales:

- considered at macro territorial scale, the urbanisation process appears as a secular trend which started in the 19th century in north-west Europe to reach certain parts of southern Europe in the 1980s. Observed on a shorter timescale, starting roughly at the end of the fordist period in the 1970s, a new paradigm related to the development of functional networks between metropolitan areas was added to the traditional Christallerian hierarchical networks. The metropolitan networks are largely shaped by multinational firms. In the knowledge society, global players organise "global value chains" which determine the spatial division of labour as well as the control of knowledge within certain privileged places. Trade flows, FDI, the international fragmentation of production processes made possible by telecommunications, trade liberalization and increasing specialisation are driving the global economic integration, while shaping the settlement systems, especially the upper level entities. The concentration of modern activities and skilled population in metropolitan areas at the expense of less urbanized regions can also be explained by the need felt by employees and enterprises to reduce risks (related to employment and to the availability of skilled labour force) and to optimise their access to services and facilities (business services, education, culture etc).

  The development of metropolitan networking throughout Europe has not been homogeneous in time and in intensity. Metropolitan networking started earlier in north-west Europe and, more generally, in the European "pentagon" London-Paris-Milan-Munich-Hamburg, so that its intensity is particularly high in these regions. It reached more recently the metropolitan areas of the southern and eastern peripheries, where multifunctional networking is less intense and advanced. The urban systems of the European peripheries are often characterised by a stronger hierarchy between cities and towns, according to their size and by much lower interactions and synergy within the urban system. With regard to Central and Eastern Europe, the contrast has been particularly strong between the settlement policy which prevailed during communist times, which favoured (at least in the first decades of the regimes) the medium-sized and small towns at the expense of larger ones, and the powerful, rather uncontrolled development of capital cities and other metropolitan areas which has taken place since the mid-1990s.

- considered at intra-regional scale, the long-term urbanisation process reveals a succession of phases[54] (in reality a cycle) which were not homogeneous in time throughout Europe. The first phase, generally called "urbanisation phase", was driven by rural-urban migrations and industrialisation. In north-west Europe and parts of central Europe, this phase was largely over before the Second World War and continued somewhat during the reconstruction phase after the war. In southern and south-eastern Europe, this phase went on until the late 1980s. It was followed by the "suburbanisation phase", in which the suburbs of

[54] K. Kunzmann, M. Wegener : « The pattern of urbanisation in Western Europe ». Ekistics.NR 350/351. 1991

agglomerations grew faster than the core. Residential functions in the core were pushed further away by the service economy and by increasing prices. Back office jobs moved also to the outskirts of agglomerations. During the third phase, called the "de-urbanisation phase", the shifts took place to the urban periphery and beyond towards the small and medium-sized towns of less urbanised metropolitan surroundings. The core cities lost more people and jobs than the suburbs gained. By 1990, counter- or de-urbanisation tendencies could be found primarily in the highly urbanised countries of the North West and Central Europe as well as in northern Italy, whereas in the Mediterranean basin the urbanisation phase was still sustained by higher birth rates and rural-to-urban migrations. The concerns raised by the de-urbanisation process called in numerous cities for active re-urbanisation policies. The revitalization of inner cities through restoration programs, "pedestrianisation" schemes and new public transport systems became a general priority. In numerous cases, such as in the cities of the Netherlands, Germany, Scandinavia as well as in Italian cities such as Bologna and Florence, the revitalization strategies were successful and the exodus from the inner cities could be stopped, while a reverse trend, however a more qualitative one, started. The re-urbanisation phase has to be considered in the wider macro-economic context. It started precisely when the macro-economic paradigm moved from the fordist-keynesian model to the neo-liberal model in the 1980s. In numerous cases, the urban revitalization strategies were deeply market-oriented, bearing the risk of excessive short-term strategies of investors in the most attractive parts of urban areas, associated with growing social problems in less favoured neighbourhoods.

Networking activities between metropolitan areas, already observed at macro-scale, largely driven by multinational firms, have also emerged from the 1980s onwards at intra-regional scale, between metropolitan areas and the surrounding medium-sized and small towns as well as between medium-sized towns themselves in a number of regions without significant metropolitan area. Such networking activities have mainly been driven by local and regional authorities and supported in a number of cases by the national authorities. The objective has been to increase their critical mass and their competitiveness in the Single European Market and, more generally in the context of growing globalization, through stronger specialization of individual towns and the sharing of infrastructure and service facilities.

Such networking activities at intra-regional scale are more common in Western Europe than in Central and Eastern Europe. Networking between cities at intra-regional level is however not limited to the public sector. Enterprises contribute also to the strengthening of ties between urban nodes, especially there, where economic clusters exist. Similarly, it has been observed that the diffusion of innovations from large cities concentrating multiple networks occurs preferably towards smaller ones, a trend which reinforces larger economic nodes like mega city-regions. Cross-border networking activities are progressing in a number of cross-border regions, either in the case of metropolitan areas, the functions of which are stretching over the border (for example Lille, Geneva, Basel, Luxemburg) or in the case of a number of significant neighbouring cities located on both sides of the border (MHAL Maastricht-Hasselt-Aachen-Liège; Upper Rhine metropolitan region stretching from Basel to Karlsruhe, including Freiburg, Mulhouse, Colmar and Strasbourg; Öresund metropolis Copenhagen-Malmö).The case of gateway cities, bridging worldwide networks with the European territory deserves special attention. They are mainly large port and airport cities and are particularly subject to the dynamics of worldwide integration, in terms of trade and migration flows, but also of FDIs and exchange of knowledge. Their worldwide interface functions favour their intra-European networking at macro-scale as well as at intra-regional level.

It becomes therefore more and more obvious that the prosperity of cities and the dynamics of urban systems depend upon the level of connections of urban nodes to

multiple networks as well as upon changes taking place within the networks. Networks are generating cumulative effects on specific nodes and poles. The issue of stability/volatility of economic, technological and social networks is therefore a crucial one with regard to the future of European settlement systems.

Networks are diverse in nature, comprising intangible and physical ones. Looking at the second category, it can be observed that in numerous European countries, the territorial organisation, in terms of visions and policy objectives, is based explicitly or implicitly on nodal-axial systems. Concepts such as development axes or "eurocorridors" etc. resulted from such approaches. A particularly important aspect, in this respect, has been the need to ensure the profitability of expensive transport infrastructure. It can also be observed that the nodal-axial systems, as policy objectives and backbone of the territorial organisation, have crossed various economic paradigms (keynesian-fordist, , post-fordist economy, information society, global economy) and have maintained a rather high level of continuity.

1.2. Polarisation, densification and suburbanisation during the pre-crisis period

The long-term analysis of urbanisation processes shows a succession of polarisation/contraction and dispersal/depopulation processes. Looking more carefully at this evolution, it can be recognized that the nature of processes very much depends upon the scale at which they are observed. It frequently happens that polarisation/contraction processes observed at macro-territorial scale are simultaneous of dispersal processes observed at intra-regional scale.

Metropolitan areas have been, during the past two decades, the main beneficiaries of the polarisation/densification processes considered at macro-scale. Densification/contraction processes have also been observed in other territorial categories, such as coastal areas and numerous mountain valleys. Dispersal trends, which counteract contraction processes, are dominating the territorial evolution in the surroundings of metropolitan areas, where the progress of suburbanisation is still significant. Other territorial categories also benefit from dispersal trends, such as attractive rural areas with their small and medium-sized towns, which are more and more favoured by the migration of retirees and self-employed.

Considered at macro-territorial scale, the European pentagon, although far from being homogeneous, comprises the leading European urban functions. It includes also major centres of technological excellence, developing, among others, the converging technologies (biotechnologies, nanotechnologies, information and communication technologies), such as Cambridge, Oxford, Louvain, Heidelberg. The pentagon has been tending to expand along major corridors in various directions: towards the East, as a consequence of the EU enlargements, especially along the corridors leading to Vienna/Bratislava, Budapest, Prague and southern Poland, to Berlin and Warsaw, but also towards the north (Copenhagen and southern Sweden) and towards the south (Rhône Valley and connection to the metropolitan areas of the "Latin Rim"). In England, the pentagon progresses towards the Midlands.

Remarkable macro-territorial disparities can be observed in the field of technological competitiveness (measured by the number of patents declared), which is generally high in most prosperous cities, especially in the pentagon, but also relatively high in some capital and non-capital cities of central and eastern Europe, while it is low in more peripheral and remaining convergence regions.

Considered at intermediate scale[55], the population and GDP share of metropolitan regions have not increased substantially between 2000 and 2006 in the average. Five EU member countries saw their population share in the metropolitan regions shrink (among them Ireland and the UK), while some countries did see an increase in the population share of their metropolitan regions (Bulgaria, Austria, Finland, Sweden). In most EU countries, economic activity did not shift to metropolitan regions between 2000 and 2006. It was however the opposite which prevailed in some of the less developed EU countries, with a significant shift in economic activities towards their metropolitan regions, and especially their capital region (Baltic States, Bulgaria, Hungary, Greece). In several more developed countries, growth is higher outside the metropolitan regions. More than half of the metropolitan regions have suffered significant decline in their GDP/head relative to the country as a whole, but in several large countries, the GDP shares of metropolitan regions in the national context did not change at all (Germany, Spain, UK, France). In central ad eastern Europe, the economic higher growth of the capital region with respect to other metropolitan regions reflects differences in the business environment and confirms that agglomeration economies are more important in less developed countries. In the EU-15, seven capital regions faced between 2000 and 2006 a relative decline of their GDP/head (Brussels, Paris, Stockholm, Madrid, Helsinki, Berlin, Vienna).

Considered at local/regional level, the observation of the urbanisation process during the 1996-2001 period shows that two thirds of cities in the EU experienced population growth, , while the remaining third experienced a decline[56]. There was a major trend towards suburbanisation. In 90% of urban agglomerations, population in the suburbs grew more than in the core city. In only a few cases — such as Lefkosia, Copenhagen, Brussels, London and Ljubljana — did population in the core expand more than in the suburbs and in a significant number, population in the core declined despite growing overall. Moreover, even where population declined overall, there were only a small minority of cities where there was also suburban decline. This, however, was the case in many second-tier cities where heavy industry is, or used to be, located (such as Glasgow, Newcastle, Manchester, Liverpool, Sheffield, Birmingham in the UK, Bremen in Germany, Łódź, Katowice, Bydgoszcz in Poland, Ostrava in the Czech Republic, Miskolc in Hungary, Liepaja in Latvia, Maribor in Slovenia, and Brăila, Sibiu, Călăraşi, Giurgiu and Alba Iulia in Romania). Relative decline of population in the core coupled with growth in the suburbs was particularly marked in Dublin, Lisbon, Berlin, Munich, Vienna, Rome, Athens, Prague, Bratislava, Budapest and Warsaw. Population growth around second tier cities with population loss in the centres is evident in most cases in Austria, Poland, Slovakia and Italy. This was also the case in cities in eastern Germany, while in the western part, suburban population growth was associated with either little change in the centre or some increase. There is also evidence that population growth in the suburbs is being accompanied by the suburbanisation of economic activity. In 16 of the 20 cities in which GDP can be measured at NUTS 3 level in the core and suburban areas, the share generated in the latter increased between 1995 and 2003, in some cases, substantially, especially in the new Member States (in Budapest, Prague, Sofia and Warsaw), though also in Munich.

After the year 2000, suburbanisation trends have changed, mainly in the most densely urbanised regions of Europe, along an axis stretching from northern England towards northern Italy, with some eastwards extensions. There, it can be observed that in numerous large metropolitan areas, the core cities experienced stronger population growth than the suburbs[57]. This applies in particular to numerous cities in the UK, to

[55] This section is based on « Metropolitan regions in the EU » by Lewis Dijkstra. Regional Focus N°01/2009. European Union. Regional Policy. Metropolitan regions are defined as NUTS3 regions or a combination of NUTS3 regions which represent all agglomérations of at least 250 000 inhabitants. These agglomerations were identified using the Urban Audit's Larger Urban Zones.
[56] European Commission. Fourth Cohesion Report. 2007.
[57] Core cities and Larger Urban Zones according to the Urban Audit's definition.

some large German cities, to Vienna as well as to the two large cities of northern Italy (Milan and Torino), excluding however Amsterdam and the Hague. Various factors are likely to explain this new trend: the fact that the suburbanisation phase started there much earlier and has progressively come to slowing down, being replaced by a process of re-urbanisation supported by public policies (urban renewal, rehabilitation and regeneration) and strengthened by immigration and population ageing. It remains however true that the suburbanisation process maintains its dominance in other parts of Europe, especially in most of Mediterranean, Irish and central and east-European cities.

In Europe, cities have traditionally been compact, developing a dense historical core shaped before the emergence of modern transport systems. However, European cities were more compact and less sprawled in the mid 1950s than they are today[58]. Historical trends, since the mid-1950s, show that European cities have expanded on average by 78 %, whereas the population has grown by only 33 %. Over the past 20 years the extent of built-up areas in many western and eastern European countries has increased by 20 % while the population has increased by only 6 %. During the ten year period 1990–2000 the growth of urban areas and associated infrastructure throughout Europe consumed more than 8 000 km2. Significant contrast can however be observed: in Munich and Bilbao population has grown more rapidly than the built-up area. Palermo with 50 % growth in population generated more than 200 % growth in the built-up area. Moderate increases of population accompanied by a large expansion of urban areas can be observed in Spain, Portugal, Ireland and the Netherlands. The urban areas particularly at risk are in the southern, eastern and central parts of Europe. Southern European cities have a long urban tradition in which the urbanisation process has been slower, with fewer periods of rapid growth and the cities have been very compact. In recent decades, however, urban sprawl has started to develop at unprecedented rates. Clusters of compact cities are also evident in the former socialist countries of central and eastern Europe. Recently, these cities have been facing the same threats of rapid urban sprawl as the southern European cities as the land market is liberated, housing preferences evolve, improving economic prospects create new pressures for low density urban expansion, and less restrictive planning controls prevail. Along the coastal regions of Europe major population growth is accommodated by continuous sprawling development. During the period 1990–2000, urbanisation of the coast grew approximately 30 % faster than inland areas, with the highest rates of increase (20–35 %) in the coastal zones of Portugal, Ireland and Spain.

Rather diverse situations can be observed with regard to the economic relationships between cities and their hinterland. The main determining factor seems to be the macro-territorial situation of the respective cities. In the highly industrialized regions, especially of north-west Europe, the spillover from the large cities into their hinterland has created rather integrated and homogenous economic spaces of quite large dimension. It is however observed that the process of adaptation to the knowledge economy, which is rather selective and territorially concentrated, reduces somewhat this homogeneity. On the opposite, in less developed contexts, especially in the countries of central and eastern Europe and also in the case of regions with smaller cities in peripheral locations, the ties between cities and their regional hinterland tend to be broken. The large cities of central and eastern Europe join rapidly the mainstream of an open networked economy. They create and strengthen ties with other European and non-European metropolitan areas, while the links with their regional hinterland, which is often characterized by low productivity in agriculture and declining traditional industries, is weakening. In the present phase of the cycle, the city-hinterland relationships in central and eastern Europe is more of a backwash/aspiration type. Spillover effects can however be expected to some extent in the future.

[58] « Urban sprawl in Europe – the ignored challenge ». EEA Report N°10/2006.

More generally, city-hinterland or urban-rural relationships are heterogeneous in nature. They concern in particular the commuter flows from rural residential areas to urban employment and service areas, the flows of urbanites towards rural recreation and leisure areas, the supply of cities with food products and water, the development of second homes in rural areas and numerous other processes. Suburbanisation is only but one aspect of the intensification of urban-rural relationships. The arrival in rural areas of increasing numbers of people from towns and cities can alter the rural character of areas. While it might push up income and tax receipts and so help to maintain public services and expand the local market, it can lead to widening social disparities and new tensions by increasing house prices to levels that locals cannot afford.

During the past decade, the issue of social polarization, especially in cities, has been growing in importance. A number of factors converge in relation to this issue, including the transformation of the economy (transition towards the knowledge-based economy which increases professionalization) and increasing immigration of low qualified people (regrouping of families, new economic demand in the field of personal services favouring the immigration of women). The situation is not uniform in all parts of Europe with regard to social polarization and socio-economic integration. A first difference can be made between the size and location of cities. Low-qualified people seem to benefit from more job opportunities in large cities than in the rest of the country. This is also true for large world cities like London, Paris, Amsterdam, Frankfurt or Milan, but it does not apply to Madrid and Barcelona and some large East-European cities. Considering the whole urban population, the situation with regard to unemployment is rather similar. In numerous cities, especially the large ones of the most peripheral countries of southern, northern and eastern Europe, unemployment rates are lower than national averages. In some of the richest European cities, however, like London, Vienna, Brussels, Paris, Amsterdam, unemployment rates are often higher than national average, a fact that reflects a decoupling between economic welfare and social cohesion. Social disparities at the intra-urban scale are generally very significant, but heterogeneous among countries. With regard to the unemployment rates, the highest levels of intra-urban disparities are reached in France, the UK, Belgium and in some cities of southern Europe. The lowest levels are found in Eastern-European cities (except Poland), in the Nordic countries, in western Germany and northern Italy. During the period 2001-2004, intra-urban income disparities in Europe as a whole have not significantly increased, while income disparities between various types of cities and between various macro-territorial contexts seem to have changed more substantially.

2. Drivers and perspectives for the coming 15 to 20 years

Demography

On the background of a number of general, Europe-wide trends, future demographic situations in European regions and cities also depend upon national and regional peculiarities. The background factors include the stabilization of fertility rates at low levels, including a number of Mediterranean regions (northern Italy, northern Spain), with slight increase in some countries (France, Sweden), the regular increase of life expectancy (which reaches high values also in some Mediterranean regions (for example Greece) and is still lower than average in major parts of central and eastern Europe and the probable continuation of immigration. Mediterranean countries and Ireland became also countries of mass immigration at the end of the 1990s, until the economic crisis. Immigration trends have also started before the crisis in various countries of central and eastern Europe, although at a rather modest level. For the future, it must be considered that the push factors in the countries of outmigration remain important and that new economic demand for immigration in Europe has started, especially in the field of

personal services. On the background of the ageing process, this new demand is likely to grow.

The number of European regions where population will stagnate and then decline will be growing. Population ageing will accelerate and dependency rates as well as mortality rates will increase in most regions. The increasing number of "oldest old" (aged 75 and over) will generate a significant demand of health care. The size of the population of working age will further diminish in most regions. There are however regions in Europe where the demography is still dynamic, with strong cohorts of young people. Winners will be more and more the regions capable of attracting qualified manpower and/or well off retirees. An open question is the amount of external in-migration towards Europe.

At urban and metropolitan level, changes will primarily reflect the respective national and regional trends, especially when not considering the very large cities. Large cities generally attract more migrants and expulse more inactive population groups (retirees in particular). This process occurs at different scales, according to the position of the cities in the urban hierarchy. Despite population ageing in numerous European cities and population decline in a growing number of them, the number of households is generally still growing, while their size diminishes. This puts pressure on specific segments of the housing market. In addition, in the West-European countries with a long tradition in low fertility rates (for instance Germany), population ageing is reaching the suburban areas built in the 1960s and 1970s. The corresponding segments of the housing market will become soon affected.

Economy

The global economic context will continue to be of great importance for the future of European cities. With regard to possible changes in the features of the globalization process, the progress of large-scale economic integration is likely to become stronger inside the various large world regions than between them, consolidated by the possible emergence of new common currencies (Asia, Gulf States) and by the possible concentration of FDIs within these world regions, rather than at intercontinental scale. With regard to Europe, however, the impacts of the economic crisis on a number of businesses and the weakening of the Euro, combined with the accumulation of capital outside Europe (BRIC, energy producing countries, sovereign funds) may facilitate the taking over of an increasing number of European enterprises by non-European groups looking for good investment opportunities, advanced technologies and short-term profits. This may endanger the long-term prosperity of increasing segments of the European economy. It is also likely that wages will increase and technology will significantly progress in the emerging economies. Their comparative advantage of low labour costs will progressively be replaced by a competitive advantage, challenging the European economies on world markets in segments of significantly higher added value. The likely increase of wages and related production costs in emerging economies (especially Asian countries) may induce inflation likely to spread throughout the world economy. The emergence of higher interest rates and progressing inflation is not improbable during the recovery from the economic crisis and also for a longer period.

Being the most volatile factor of territorial development, the economy may follow rather different paths, each having its own territorial impacts in Europe. In this respect, the most strategic issue is the way, how Europe will position itself at global scale after recovering from the economic crisis. Will the emerging economies (BRIC) become stronger competitors and bring Europe into a defensive attitude or will Europe be boosted by the shock of the crisis and invest massively in new technologies in order to gain largest shares of external markets? Will the internal EU market of 500 million consumers be more efficiently used to let new forms of endogenous growth emerge, taking advantage of the complementarities existing between European regions? Will the political

priority to curb down climate change be utilized to change massively the energy paradigm and to generate economic growth through a "Green New Deal"?

In addition to issues related to the global and macro-economic context, intra-European issues are also relevant, such as the future extent of the catching up process of central and eastern Europe. The engine behind this process has largely been up to now the substantial amount of western FDIs in these countries. Will the flow of FDIs continue with the same intensity and in the same direction after the recovery from the crisis or will western FDIs be significantly re-directed towards countries outside EU borders, farther in the East and in the eastern and southern parts of the Mediterranean Basin? Will the countries of central and eastern Europe generate sufficient endogenous growth in order to compensate for a likely reduction of FDIs?

With regard to more regional/local economic issues, a number of questions remain open, especially with regard to the further concentration or not of investments and wealth in metropolitan regions. Is the knowledge economy compatible with stronger growth outside rather than inside metropolitan regions, as it was observed after the year 2000 in a number of West-European regions? Are centres of technological excellence, especially those developing converging technologies, necessarily included in metropolitan regions or can they generate an autonomous expansion and growth process? Is an economic overspill process from metropolitan areas towards more distant small and medium-sized towns likely to emerge in the countries of central and eastern Europe? Will the requirements on the qualification of human resources become so demanding that business investors will more and more overlook small and medium-sized towns in remote locations? In how far will European regions become handicapped by the decline of the working age population and by the scarcity of qualified manpower? Will the residential/tourist economy, driven by the acceleration of the ageing process, benefit in future to a larger number of regions? Is it likely that it will also benefit significantly to non-metropolitan regions in central and eastern Europe?

Energy

In the present context, energy prices are very closely related to the level of global economic growth at world scale. Despite strong price fluctuations in recent years, the general trend is upwards. Recovery from the crisis and further development of the BRIC countries are likely to strengthen this trend. The energy sector is largely globalised because of the concentration of large fossil energy resources in a small number of countries. The external dependency of Europe in terms of energy supply will remain high in the 15 years to come and therefore subject to the inelastic relation between global supply and demand. Possible depletion of oil resources in some large oilfields could generate a process of oil peaking (declining supply in a context of growing demand) which would result in extremely high energy prices.

The possible scarcity and depletion of uranium resources should not be underestimated in the context of growing demand related to the construction of numerous nuclear power plants at world scale. Coal will remain a significant energy source for the transition period between the old and the new energy paradigm. Thanks to new technologies (CO2 capture), it will be possible to reduce considerably the air pollution generated by coal-fuelled power plants.

The development speed of renewable energy sources will depend both upon the price evolution of conventional fossil energy sources and from the political willingness to depart from carbon-related energy and to promote the new energy paradigm. The introduction of substantial carbon taxes would play a major part in this respect.

Transport and accessibility

The main critical issues for the future in the transport sector are the elimination of congestion, the impact of transport on climate change and improvement of the accessibility of less favoured areas. The likely change of energy paradigm in relation to climate issues and the possible scarcity of oil resources, are major challenges for the transport sector. They will significantly affect transport costs and therefore locations (households, businesses) and mobility patterns. New transport technologies will emerge in the coming decade. The speed of their diffusion and generalization is however uncertain. If significant carbon taxes are introduced, the present modal split patterns will be affected to the benefit of more environmentally friendly transport modes. They will also have an impact on the mobility of people, favouring even more the development of ICT services, as a substitute to physical mobility. Public transport networks and services are likely to be strengthened, both in urban regions and between them. High-speed train networks will continue their expansion, with new cross-border connections.

A major problem remains that of the accessibility of small and medium-sized towns in remote regions. The probability of high speed rail services in future is relatively low if the regions concerned are not crossed by a HST line servicing metropolitan areas. Low-cost airlines generally use medium and small size airports, but these are servicing intermediate cities and are not a universal solution for all cities in remote regions. Growing differences in relative accessibility are a serious handicap for the less favoured cities.

Values and socio-cultural expectations

A number of factors contribute to changes in the systems of values and socio-cultural expectations within the European society. Population ageing brings with it new ways of life and of consuming, with a much stronger accent on qualitative aspects. With regard to the ways of life, the elderly appreciate quiet environments, but expect a good accessibility (without using cars) to a large variety of services. This will raise a number of issues for the future of weakly serviced suburban areas, where the population is likely to decline both because of ageing and of insufficient attractiveness. The increasing preference for a higher level of urbanity in the living environment is likely to boost new policies of urban redevelopment aiming at shaping high-quality multi-functional urban areas.

Various other factors also contribute to changes in values and behaviours such as the high energy prices in the period 2006-2008 and the risk of oil depletion, the increasing awareness about issues related to the environment and to climate change as well as the impacts of the economic crisis of 2008/2009. All these factors have impacts on mobility patterns (decreasing use of cars, preference for small, less polluting cars; increasing demand for public transport etc.) as well as on consumption in general (increasing attitude towards savings, more intangible consumption etc.).

Immigration remains an important issue, not only because of the important shares of immigrated population in numerous European cities, but also because the perspectives of significant flows of immigrants into Europe in the coming decades are far from negligible. Lessons from the past show that the successful integration of immigrants is a long-term process, driven by the existence of cultural problems for the immigrants themselves and by necessary delays for the attenuation of xenophobia within the indigenous European population. The experience shows that xenophobia is more important in southern European countries where immigration is recent than in more northern countries (UK, Netherlands, Nordic countries), which have a longer experience in this field.

Public policies

Numerous public policies have impacts on the evolution of cities and urban systems. A first distinction can be made between "sectoral" macro-policies of the European and national levels, which are not territorially targeted (although their impacts are territorially not neutral) and the more specific territorial development policies which can be applied at various scales.

The first category includes macroeconomic, energy, innovation, social and environmental policies. Trade policies (liberalization / protection) strongly influence the attitude of enterprises in terms of investments, location and relocation. Further liberalization and globalization, especially in the field of services, may significantly influence the economy of cities. The monetary stability of Europe has been affected by the economic crisis. Decisions related to the recovery of the stability or to the further expansion of the Eurozone are likely to affect the parity with foreign currencies, and therefore trade flows and the future of manufacturing cities. The creation of sovereign funds in Europe may protect European enterprises from being taken over by non-European groups. Strengthening the control of the banking system aimed at preventing new large-scale financial collapses, may, directly or indirectly, make the access of enterprises, especially of SMEs, to credit much more difficult and may restrict productive investments. Macroeconomic policies influence also, especially through fiscal measures, the level of employment and the real income of households. National social and cultural policies have significant impacts on the level of social integration, on the lower segments of the housing market, on the level of education and qualification of human resources as well as on the welfare of families.

A particularly important aspect for the future of the European economy is related to the possible move towards the "green economy" (introduction of carbon taxes, promotion of renewable energy sources and of energy savings, development of new transport systems and vehicles). If ambitious strategies are adopted at international level, new economic growth could be generated at Europe-wide scale.

Territorial development policies are applied at various geographical scales and often involves several governance levels, from the European level down the local one. Macro-territorial policies are strongly dependent upon EU structural policies (support to less developed regions; co-financing of major infrastructures etc). Several issues are important for the future: the level and territorial criteria of a EU support after 2013, the dilemma about the promotion of metropolitan areas as an essential element of global competitiveness versus support to least developed regions to ensure territorial cohesion. A related issue is the policy to be applied to small and medium-sized towns outside metropolitan regions and, more specifically, the strategies concerning the improvement of accessibility, the qualification of human resources, the promotion of the residential economy and the maintain of services of general interest.

At intermediate scale, the networking of cities is becoming a crucial issue for ensuring both the polycentric development of metropolitan regions (cooperation networks between a metropolitan area and the surrounding medium-size cities) and the competitiveness of non-metropolitan regions (co-operation networks between medium-size cities).

At more regional/local level, various territorial policies contribute to shaping the future of cities: land-use policies (containment of urban sprawl; influence on the real estate market), transport policies (public transport; facilities for new vehicles like electric cars), urban renewal and regeneration policies, housing, socio-cultural and integration policies (reduction of urban deprivation and of social segregation, integration of ethnic and marginal groups, improvement of security etc), environmental policy (greening of cities; improvement of the living environment, reduction of noise and emissions), economic

policies (supports to clusters; improvement of the embeddedness of exogenous businesses), development of facilities and services for the elderly. Local/regional policies often benefit from the support of national policies (housing, transport, energy, urban renewal, social integration etc) and, in the eligible areas, of the EU structural policies.

In the present context, public policies of the national, regional and local levels are seriously handicapped by the very high level of public indebtedness which results from the economic crisis and from the policies applied to re-boost the economy.

Perspectives for cities and urban systems

Cities and urban systems will be facing a number of challenges during the coming decades. Some are the results of trends continuation, others will be generated by the emergence of exogenous factors and new global priorities, especially those related to climate change.

Trend-related challenges concern the rebalancing of urban systems there where capital cities and large metropolitan areas have largely captured growth in the past. This is a particular challenge for the countries of Central and Eastern Europe. Most challenges are however to be found at the scale of metropolitan regions and urban entities. The continuation of urban sprawl in the surrounding of numerous cities and growing social polarization with all related impacts (security, riots, social segregation, ethnic tensions etc) within cities are growing concerns in numerous European towns.

Population ageing issues will in general less affect cities than the countryside because of the presence of larger groups of young population. The needs for additional health care services for the elderly will nevertheless increase.

Policies addressing climate change are likely to have significant impacts on cities, especially in the field of transport systems and mobility, building and construction, urban planning, greening of the urban environment etc. In case energy price will substantially increase and/or carbon taxes will be sufficiently high, changes towards more compact cities, especially with stronger concentration of settlements around the stations of public transport networks can be expected.

Municipal finances are particularly affected by the economic crisis and its impacts. Municipalities will face increasing difficulties to meet the above-mentioned challenges with more limited resources. It is likely that local taxes will increase in a number of countries.

3. Scenarios of urban development in Europe

3.1. Logic of scenarios

The destiny of European cities is much too dependent upon the global context and upon macro-policies to envisage credible alternative scenarios of urban development, which are derived only from different urban development policies. This is why the two scenarios proposed hereafter have each its own logic in terms of global background and of macro-policy mix. The territorial development policies defined at each level pursue in each scenario specific objectives, but have to cope with the respective impacts of global factors and more general policies.

In this respect, the positioning of the scenarios with regard to the Europe 2020 Strategy, proposed by the European Commission and adopted by the European Council in March 2010, is a relevant issue. With regard to the global context, the Europe 2020 Strategy

recognizes that significant changes are underway (increasing global competition, risks in the financial system, challenges related to climate and resources), but leaves room for various possible situations, especially in relation to the impact of the economic crisis and the world economic stability in the coming decade. Although it militates in favour of economic recovery and stability, it does not (and cannot) exclude the emergence of new serious problems.

In terms of policies, the Europe 2020 Strategy accentuates a number of existing policies (innovation, education, industrial development, resource efficiency, social and economic inclusion) and insists on some new policies (like the de-carbonisation of the economy and related modernization of the transport sector) on the background of the climate change issue. The Strategy remains however balanced and the policy measures are , at this stage, only outlined. In case of significant changes in the global context, it is likely that the Europe 2020 Strategy will be revised. As awareness raising tools, scenarios can therefore highlight the impacts for cities and urban systems of further changes in the global context or of more accentuated policies targeting specific challenges, without being in complete contradiction with the Europe 2020 Strategy.

Although the hypotheses chosen for the two scenarios widely differ in many respects, a number of assumptions for the future are valid for both scenarios. They are elements of common reference. They include the European demographic stagnation and decline on the background of population ageing, the regionalisation, up to a certain extent, of the globalization process at the scale of world macro-regions, possibly with the emergence of new joint currencies (Asia, Gulf states), growing disparities in the productivity of the main economic sectors as well as the emergence, during the coming 15 to 20 years, of a number of new technologies, especially in the fields of energy production, nanotechnologies, biotechnologies, transport systems, communication technologies etc, which will, directly or indirectly, affect territorial development.

The very significant changes, which have been occurring since 2008 with the emergence of the economic/financial crisis and the new policies applied in this respect, strongly reduce the relevance, for the awareness raising process, of a trend or baseline scenario. This is why two sets of hypotheses for the scenarios were selected, which differ mainly through the characteristics of the global context and the nature of policy responses to the most significant challenges. Territorial development policies are part of the global policy responses and are adapted to the respective comprehensive strategies. Both scenarios are strongly policy oriented, but assume rather different global contexts.

The first scenario ("Green economy") aims at sustained recovery from the economic crisis, while addressing in priority the challenge of climate change. It requires a high level of stability in the global context and is based on the assumption that the massive adoption of new technologies aiming at drastically curbing down greenhouse gas emissions may generate significant growth and open new markets at world scale;

The second scenario ("Enhancing the European potential") is generated primarily by the emergence of new serious economic/financial troubles in the global context, with various large, but strongly indebted countries (USA, Japan etc) having lost their capacity of debt reimbursement. In this highly unstable and threatening environment, Europe adopts a more protective strategy and puts the priority on the enhancement of its own potential (500 million consumers; skilled manpower and technological excellence in various fields).

Both scenarios have a time horizon of 15 to 20 years, divided into two periods, the first being of 7 to 10 years.

3.2. The "Green Economy" scenario

The scenario is based on the assumption that the decisions adopted at international level aiming at curbing down the speed of climate change are efficiently used as an opportunity to generate significant economic growth throughout Europe. The realization of the scenario requires not only substantial, courageous and well-coordinated public policies (such as the introduction of high carbon taxes), but also the active involvement of economic actors and of the civil society in a global context of economic recovery and stability. The large emerging countries are pulling up the world economy while moving towards more technology-intensive activities. The international financial order is stabilized by the diversification of currency reserves.

The economic post-crisis economic development is encouraging and involves also the USA and Asia. The more developed economies and also the BRIC invest in the less-developed countries in order to develop local markets and to create demand, especially in Africa and south America.

In Europe, the strategy consists of increasing significantly technological investments boosting productivity, but generating in a first stage higher unemployment rates. Only after a period of 5 to 7 years, employment is growing again. Higher skills and qualifications are required, which doesn't mean that Europe's employment is mainly composed of managers. The race for stronger tertiarisation is being attenuated thanks to a rapid development of the "green economy" which creates jobs both in R&D and in manufacturing activities. Services move towards higher added value segments. In the context of a more regional globalization, higher financial services are being re-centered on Europe. Through higher competitiveness and stronger public support, European enterprises are less in danger of being taken over by non-European groups or external sovereign funds.

The concretisation of the "Green Economy" is far from being an easy task, especially in the medium range, as long as the benefits are not tangible. The introduction of significant taxes in the context of declining purchase power and high unemployment levels is not popular at all. Numerous local authorities choose to take action in relation to climate change, but their resources are limited by the impacts of the economic crisis. The potential investments of SMEs are constrained by difficulties in obtaining bank credits. The transition from carbon-related energy systems towards a new energy paradigm based more largely on renewable energy sources is affected by the levels of necessary investments and by constraints of profitability. The international harmonization of policies is also a difficult issue which generates distortions.

The progressive emergence of new economic growth and the creation of significant amounts of new jobs after a few years generate however trust in the strategy related to the "Green Economy", so that more and more businesses and households invest, with encouraging returns on investment. This leads to a mass effect that ensures sustained economic growth and strengthens social cohesion.

In the demographic sector, fertility rates are subject to a revival, boosted by the positive economic evolution, but their impact remains a long-term one. The shortage of population of working age in a growing number of regions favours the immigration of qualified manpower.

Impacts of the scenario on the evolution of cities and city networks

a) Cities' positioning in economic development

The territorial impacts of the scenario change somewhat over time. During the first phase (5 to 7 years) growth is concentrated on metropolitan areas, especially in Western Europe, because of significant investments in advanced technologies. In a second stage,

while advanced activities continue their expansion in metropolitan areas, production activities related to the "green economy" diffuse towards cities of second and third level and also towards regions of central and Eastern Europe as well as towards the more peripheral regions of Western Europe. The scenario enables intra-regional polycentricity to the benefit of regional cities.

The general development of the "green economy" at global scale favours the emergence of large-scale, specialised cooperation networks, based on R&D, technological development and industrial production. Integration is not limited to the individual European macro-regions. It takes place at Europe-wide scale, favouring however the links and flows between the large metropolitan areas, especially of the pentagon. Gateway cities with intercontinental functions are also efficiently involved in the process. A number of medium-sized and small cities in more rural areas, distant from metropolitan regions, benefit from new income sources originating from both the production of renewable energy and from the residential economy, including soft tourism.

b) Cooperation and competition

The promotion of the "green economy" will generate both new competition and increased cooperation. Competition is not only intra-European in nature. It also intensifies between Europe, North-America, Asia as well as other emerging economies. At intra-European scale, cities in competition are those with important clusters related to the "green economy" (solar and wind energy, automotive industries etc.). The EU institutions will however promote transnational cooperation, so that cooperation networks will stretch over numerous cities at EU-wide scale. Cooperation will also intensify both at the scale of European macro-regions (similarities of natural conditions in relation to the exploitation of renewable energy and to climate change; East-West division of labour in some transnational cooperation areas) and at the intra-regional scale (organization of the city-regions; division of work between metropolitan areas and medium-sized and small cities).

c) Sustainability

The development of the "green economy" has important impacts on the morphology and organization of cities. More compact urban forms are being developed in order to take advantage of the expansion of public transport networks. The use of electric cars is increasing, but more slowly than expected, because of limited autonomy and technical issues. Hybrid cars appear as a more flexible option, despite higher fuel price. Urban expansion, driven by economic development, benefits to the various levels of the urban hierarchy, but remains rather compact. The greening of cities and the further development of ICT limit the motorized mobility for working and leisure purposes.

Macro-economic policies that aimed at boosting the economy during and after the economic crisis, were conceived centrally and sectorally, so that they were not optimal with regard to sustainability. Boosting the demand for new motorcars has in fact promoted conventional technologies (although somewhat more environmentally-friendly) and has not primarily benefitted to new ones (electric cars, fuel cells engines etc.), which were not yet sufficiently advanced in their development. The rapid progress of these technologies, strongly supported by public policies, limits however the negative impacts on sustainability of some macro-economic measures.

South- and East European cities are more challenged by sustainability issues (strong suburbanization trends; less developed modern public transport systems; more polluting cars, busses and trucks; lower amount of green areas; less public resources for improving the environment etc.). EU policies target especially these cities with the aim of implementing efficient measures against climate change.

d) Inequalities and tensions

The period following the economic crisis of 2008/2009 is characterized by a continuation of unemployment growth in numerous European regions and cities, especially those with less performing manufacturing activities, a fact which has significant impacts on social cohesion. After a few years, however, the improvement of the economic situation favours again employment, including the provision of jobs with medium-level qualifications. This has positive impacts on the reduction of social inequalities and enables the integration into the regional labour markets of less skilled labour force. The social polarization in cities increases during the first period, but is attenuated afterwards.

e) Promoting growth through a more efficient territorial organisation of city-regions and settlement networks

The continuation of the globalisation process makes the pyramid of urban hierarchy steeper, with an over-proportional concentration of advanced activities in very large metropolitan areas. This trend is somewhat attenuated by the fact that the « green economy » does not only concentrate on activities of R&D and technological development, but includes also the implementation of new techniques at large scale in a wide diversity of fields (manufacturing activities, building and planning activities etc.) which benefits also to lower rank urban entities. Territorial development policies contribute to the optimisation of this process through the promotion of compact and sustainable forms of metropolitan development (stronger coordination between public transport systems and urban development/redevelopment ; improvement of the quality of life, of security and social cohesion in urban neighbourhoods) and through an efficient networking between metropolitan areas and the surrounding lower-rank urban entities, enabling also better regional connections between the medium-sized and small towns themselves. The intra-regional interactions between urban entities increase the efficiency of the « green economic paradigm ». The territorial development strategies are however adapted to the peculiarities of the respective regional contexts. In a number of regions with unbalanced urban pattern and with a macrocephalitic capital city (there are numerous examples in central and eastern Europe as well as in various West-European regions), it proves more difficult to spread economic activities throughout a regional network of cities. Efforts are then concentrated on the rational development/redevelopment of the main city, looking for a compromise between densification and quality of life.

3.3. The Scenario "Enhancing the European potential"

In this scenario, the recovery from the economic/financial crisis is not sustainable at world scale. In the very short term, a number of large, developed countries, having accumulated an enormous amount of debts (before and after the crisis) are no more in a position to reimburse or refinance their loans and bonds. Various central banks being threatened by bankruptcy, a new large-scale crisis emerges and expands, which affects both public budgets, banks, enterprises and individuals. In addition, inflation is growing worldwide, driven by the highly indebted countries.
Although some European countries are deeply involved in the new financial turmoil (UK in particular), the problems outside Europe are of a much larger dimension (USA, Japan) and affect lastingly the global expansion process. The central banks of various Asian countries (China etc.), which had bought large quantities of American bonds, are particularly affected also. The global context being highly unstable and risky for trade and investments, Europe chooses the strategy of enhancing its own potential and to concentrate external cooperation on neighbouring countries and on few others, non-problematic ones. The strategy comprises both the promotion of the internal European potentialities (know-how and technologies, qualified human resources, large-scale market of 500 million consumers, regional specialisations and complementarities, well-developed infrastructures in numerous countries) and stronger protection against

exacerbated external competition (strengthening of anti-dumping measures and preference for European products, incentives for the relocation of businesses, which had left Europe, protection against the taking over of European companies by non-European groups, strengthening of the specialisations by regions or groups of regions, more strict control of technology transfers to emerging economies).
During the first decade, characterized by strong instability in the international environment, the main objectives of the European strategy are to safeguard jobs, while increasing the qualification of human resources and to increase the purchase power of European citizens, especially of the medium and low segments of the social hierarchy, in other to boost domestic demand. The strategy prevents Europe to be subject to a new, deeper recession. Specific programmes are implemented, such as the speedy realization of infrastructures (mainly on PPP basis in order to limit further public borrowing), the promotion of endogenous resources and local products (less subject to external competition), the creation/strengthening of European leading companies in strategic sectors (to overcome the fragmentation of European production structures), the constitution of European sovereign funds (aiming at protecting European businesses and at avoiding the growing external appropriation of European technologies), the development of venture capital and seed money and the facilitation of access to credit for SMEs (aiming at the transformation of new knowledge into advanced products and services). During the first decade, the structural transformation of the European economy is slow but sustained. It takes place through stronger regional specialisation and promotion of territorial capital. Growing domestic demand makes increasing productivity compatible with job creation, especially in more qualified segments of the labour market.
After one decade, when the global context has improved and stabilized and external demand is growing again, the European economy has been consolidated and more efficiently integrated and is in a better position than it was in 2010 to face the more global context and to draw benefits from it. The necessary structural adjustments generally do not have dramatic consequences.

Impacts of the scenario on the evolution of cities and city networks

a) Cities' positioning in economic development

The economic crisis of 2008/2009 has generated slowing down of the expansion of towns and cities, especially in regions with traditional manufacturing industries as well as in Central and Eastern Europe, where the flows of FDIs, which had fuelled the expansion of metropolitan regions before the crisis, have significantly diminished.
The Europe-centred strategy favours a more balanced settlement pattern than it was the case during the pre-crisis period. The mobilization of territorial potential in most regions does not favour only metropolitan areas, but also medium-sized and smaller cities. Intra-European competition is increasing. National capital cities play an important part as network centres of national markets. In a few countries (such as Germany or Italy) other large cities have also leading functions in intra-European transactions. The structural adjustments, which take place at the expense of obsolete manufacturing industries and of sectors with over-production capacities (motorcar Industries in particular), are often compensated by the creation of new SMEs. The slowing down of relocations outside Europe stabilizes the settlement systems of intermediate manufacturing regions and also of larger cities as far as services are concerned. Stronger regional specialization and the strengthening of advanced clusters favour intra-European FDIs. The residential economy benefits increasingly small and medium-sized towns in attractive regions. Migrations of retirees intensify, also at transnational level within Europe. The development and modernization of infrastructures and facilities increases the accessibility and attractiveness of numerous medium-sized and small towns, also in rather remote locations. Labour related immigration is rather strictly controlled and oriented towards regions with manpower shortage. Disfavoured regions are those where large amounts of technologically obsolete activities are affected by intra-European competition as well as those with rapidly ageing and declining population.

b) Cooperation and competition

Both cooperation and competition intensify within Europe. Networking activities are strongly promoted at Europe-wide scale and within transnational macro-regions, especially between clusters, higher education and research institutions, technology development and transfer centres etc. Not only metropolitan areas are involved in the cooperation networks, but also numerous medium-sized cities with universities, research centres and other scientific institutions. EU support to cooperation networks is organized on the basis of ambitious, applied projects with direct use for productive activities and commercialisation. Cooperation networks are also developed with the EU neighbouring countries, especially with the Russian Federation, the southern and eastern Mediterranean countries, the Balkan area and Ukraine, where markets are expanding.
Competition between the most advanced European metropolitan areas, progresses, especially for attracting investments, qualified labour force and international events. It is strengthened by the creation of new large European enterprises generated by the integration (mergers and acquisitions) of national enterprises, contributing to the reduction of the productive fragmentation in Europe and increasing the global competitiveness.
At intraregional scale, cooperation is efficiently organized in order to increase the profitability of infrastructures and facilities and to promote the territorial capital. Networks of regional SMEs are created, connected with R&D institutions and marketing organisations, in order to provide higher profile to regional specialisations.

c) Sustainability

The context of the scenario is one of huge challenge for the European economy in a global context severely and lastingly affected by financial and economic troubles in the public as well as in the private sector. The first European priority is to avoid the collapse of the European economy in drawing all possible benefits from the European potentialities. Environmental aspects are not at the highest place on the agenda. The curbing down of greenhouse gas emissions requires worldwide consensus, which is not possible in the context of the scenario. This does not mean, however, that the objective of sustainability is neglected. On the contrary, various factors contribute to limiting possible damages to the environment. The rate of economic growth being modest and economic development favouring a rather balanced evolution of urban settlement systems, the strong trends of metropolitan expansion and related suburbanization which characterized the pre-crisis period, have been significantly slowing down. The strengthened development of infrastructures, aiming at increasing the accessibility of cities while safeguarding employment, pay significant attention to environmentally friendly transport modes. Among the EU-supported programmes of technological development, several address issues related to sustainability and lead to concrete applications.
The trend towards stronger population growth in the core areas of cities, observed in the pre-crisis period in various cities of the European pentagon, expands further to concern a large number of cities throughout Europe. More extensive programmes of urban regeneration are implemented, which benefit to the improvement of living conditions in cities.
A number of areas are however subject to problems of sustainability. These are, on the one hand, the large urban regions handicapped by strong traffic congestion and, on the other hand, the towns and settlements experiencing serious population decline caused by ageing, emigration and loss of employment opportunities. In both cases, public resources are not sufficient to improve significantly the living conditions.

d) Inequalities and tensions

Various factors contribute to the limitation of inequalities and tensions between social groups, especially in large cities. The macro-economic policies aiming at improving the

purchase power of the medium and lower segments of the social hierarchy, contribute, up to a certain extent, to the reduction of inequalities. The more strict control of labour-related immigration and its orientation towards regions with manpower shortage does not cause excessive concentration of immigrants in large cities. Programmes aimed at developing housing at affordable conditions are likely to facilitate the integration of less favoured social groups.

While the worsening of inequalities and tensions is not likely to happen in the context of the scenario, large cities characterized by severe problems in this field (strong concentration of immigrants and marginal groups, low level of integration, urban violence, social segregation etc) do not however experience a drastic improvement of the situation. Social inequalities related to unemployment are likely to increase in areas characterized by a strong concentration of obsolete economic activities. Poverty may also continue to be significant in a number of remote rural areas, subject to emigration or with strong concentrations of deprived ethnic groups.

e) Promoting growth through a more efficient territorial organisation of city-regions and settlement networks

The general strategy of the scenario, which has a strong economic orientation, converges with a more efficient organisation of settlement systems. Networking of cities is a priority for the scenario. In intermediate and less urbanised regions, networking will be applied primarily to medium-sized towns with the aim to share infrastructures, increase their productivity and generate economies of scale. In metropolitan regions, networking will strengthen the links and synergies between the metropolitan area and the medium-sized towns in the surroundings, with the aim to favour a more polycentric settlement pattern and to increase the competitiveness and international attractiveness of metropolitan systems. The scenario will however contribute only weakly to the development of overspills from metropolitan areas towards their respective hinterlands in the countries of Central and Eastern Europe. The growth process will be too modest and resources in the wider hinterlands of large cities insufficient for this purpose.

3.4. Comparison of the outcomes of the two scenarios

As the future is relatively open, especially with regard to the global/international context, the basic hypotheses of the scenarios in this field are diametrically opposed. While the first assumes a global economic recovery after the crisis of 2008/2009, the second is facing a worsening context with considerable financial/economic problems outside Europe (especially in the USA and Asia). Both scenarios are strongly policy-oriented and the policy orientation is, in each case, closely related to the global context. In the first scenario, the promotion of the "green economy" requires general economy growth and stability and above all – a solid international consensus on the reduction of greenhouse gas emissions. The rapid development of the "green economy" is understood as a strategy capable of combating climate change while enabling economic growth through a radical change of the economic paradigm. The strategy assumes further that no restrictions are placed on the globalisation process and that Europe will compete successfully at world scale thanks to its massive investments in all sectors related to the "green economy". In the second scenario, the concentration of the strategy on Europe itself is both a response to the rapid deterioration of the international environment and a new awareness of the fact that numerous potentialities in Europe are not fully exploited. Macro-economic strategies aiming at boosting domestic demand in Europe and at protecting the European economy for a while from exacerbated external competition make the mobilisation of numerous endogenous resources possible while favouring the further integration and modernisation of the European economy and increasing its competitiveness.
Although starting from opposed context hypotheses and based on very different strategic policies, the territorial outcomes of both scenarios are less extremely dissimilar than

expected, even if differences are more than simple nuances. The territorial outcomes are however not uniform throughout Europe. They depend largely from territorial and urban development policies, which vary from city to city.
With regard to metropolitan expansion, the first scenario is likely to generate more economic growth, which may benefit, at least during the first phase, large cities. Territorial policies will however promote compact cities and channel metropolitan expansion in such a way as to minimise its environmental footprint, especially in concentrating new settlements along public transport taxes. The second scenario will generate less economic growth, at least during the first phase, and ensure a rather balanced settlement pattern. The scenario does not exclude however the continuation of classic suburbanisation trends around a number of cities. As far as the core areas of large cities are concerned, the first scenario will promote more greening and improvement of the living environment. This may cause some increase in the gentrification process, first in the West European cities and, later on, in central and east European ones. The second scenario, although pursuing primarily economic objectives, has also a strong social orientation. It will promote the development of social housing in cities and the regeneration of derelict and deprived urban area.
The first scenario is more prone to generate overspills from metropolitan areas, which may benefit to the medium-sized and smaller towns of their respective hinterlands, especially in Western Europe. A number of large cities' hinterlands in Central and Eastern Europe are also likely to benefit from this process, but mainly in the second phase. In the second scenario, which is more driven by the availability of endogenous resources, the economic development of the wider hinterlands of large cities mainly depends upon their endowment with resources (skills, insertion in value chains, local specialisations etc.) and infrastructures.
Having its justification in a prosperous global context, the first scenario will favour the European gateway cities at the interface with other continents (cities with major ports and airports). The second scenario, which is more Europe-centred, is of advantage for European trade hubs (which are frequently capital cities, but also in some cases other large cities) as well as for cities along major transnational corridors, including those connecting the EU with neighbouring countries.
Territorial integration within the European macro-regions, although progressing in the first scenario, is likely to be stronger in the second one, but mainly in the second phase. It will benefit from strong efforts aiming at supporting and encouraging the productive networking of cities.
With regard to medium-sized and smaller towns outside of metropolitan influence, the first scenario favours those with good accessibility, facilitating the attraction of external investments as well as those located in regions with strong potential in renewable energy (biomass, wind, solar, geothermal etc). In the second scenario, the improvement of the accessibility of more remote medium-sized and small towns is an explicit part of the strategy, aiming at facilitating the exploitation of local and regional potentials. The economic performance of the towns concern depends however more from the regional endogenous resources than from external investments. The progress of the residential economy is likely to benefit to attractive areas in both scenarios.
In the case of depressed, remote and landlocked rural regions prone to emigration and population ageing, the first scenario is only helpful if significant amounts of renewable energy resources are exploitable. The second scenario, which has a stronger social orientation, may provide some support in the field of infrastructures and services of general interest. In both cases, the situation will however remain problematic in many respects.
The two scenarios may also exhibit some differences in their impacts on social integration and possible pensions, especially in large cities. The first scenario is more open to further immigration. According to the logic of the scenario, urban policies generally put their priorities on environmental issues, more than on social ones, so that further social segregation in the core areas and outskirts of cities is not excluded. In the second scenario, immigration is more limited and more strictly controlled. It should not lead to an increase of the number of unemployed immigrants in large cities. In addition,

measures are taken to facilitate the integration of disfavoured groups through the promotion of social housing and related infrastructures.