Version 29/02/2012

The ESPON 2013 Programme

TIGER
Territorial Impact of Globalization for Europe and its Regions

Applied Research Project 2013/1/1

Draft Final Scientific Report

Working paper 2

"Urban structures and connectivity in European cities: a typology and comparison with the US"

Isaline Wertz, Gilles Van Hamme, IGEAT-ULB

EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Introduction

Major cities play a central role in the global economy (see WPs 3 and 9) in that they concentrate the major economic functions and are the main gateways between European territories and the rest of the world.

In the context of economic globalization, these gateway functions are also of strategic importance for the European economy as a whole. Hence a large body of literature has developed around cities' connectivity at global level, focused on advanced producer services, including finance (Sassen, 1991; Castells, 1996; Beaverstock *et al*., 2000). However, other gateway functions are crucial for the cities' economy, notably those related to major infrastructures such as ports and airports, in terms of exchange of goods, persons and services across the world.

Taking these dominant trends into account, we will work on two different scales in this paper: European cities and Europe as a whole.

On city scale, the metropolitanization hypothesis (Sassen, 1991; Castells, 1996; Beaverstock *et al*., 2000) has played a central part in the debate on the role of (global) cities in the world economy as well as in the understanding of cities' competitiveness. On the competitiveness issue, the metropolitanization hypothesis argues that in the context of globalization, (global) cities have a decisive competitive advantage (for a full discussion see Lennert *et al.,* FOCI). However, according to Sassen, metropolitanization should not necessarily be understood as global cities performing better than the others but rather as concentrating more and more those strategic functions related to advanced producer services. Another main issue is the size of cities which are supposed to benefit from these major global trends. Previous studies have highlighted the complex relationship between the cities' size/importance and competitiveness since 1995, at least in the European context (Lennert *et al.,* 2011). Undoubtedly, the national context still plays some role and metropolitanization processes are observed within some – but not all – European countries, though not necessarily for Europe as a whole. In contrast, empirical evidences for metropolitanization processes are more solid in the US context. These questions are discussed in depth in WP4.

Furthermore, the role of cities in the global economy is strongly connected to internal structures and infrastructures. The concentration of gateway functions is closely related to education level and economic structures but also to the cities' level of infrastructures ensuring both connectivity with the rest of the world and efficient communication within major cities. We briefly tackle this question here, notably by showing the intense correlations observed between the different types of gateway functions. This issue is also dealt with in a very concrete way in two case studies of London and Paris (WPs 6 and 16).

In this paper, we more particularly address the links between European cities and the global economy, in a comparative perspective with the US, and we provide a classification of cities for both Europe and the US according to the nature and the geography of cities' links to the rest of the world. Different cities have different gateway functions with different parts of the world and only very few cities are truly global. This descriptive approach is in our opinion a

necessary step to understand how European cities compete but also cooperate in the global economy.

At the European level, we raise the question whether the territorial structure of Europe, and in particular the concentration of urban functions, impact its competitiveness. The idea is that in the context of globalization, the wealth of global/major cities is of utmost importance for Europe as a whole, since these cities are the main gateways with the global economy. In a way, the hypothesis is that European wealth depends on the competitiveness of major European cities. However, we believe it is hardly possible to answer such a decisive question in an unambiguous way. The only possible comparison is with Northern America and maybe Japan, because of similar levels of development. This represents only three observations, and many different parameters other than urban structures and hierarchies could explain the respective economic performances of the poles of the Triad. Moreover, the impact of such trends on territorial cohesion is also considerable (see WP5).

In this study we also address the concentration of wealth and gateway functions in Europe, in a comparative perspective with the US. Furthermore, we describe the recent dynamics in the concentration of different types of gateway functions, with a focus on the comparison of urban structures in Europe and in the US, comparing trends in crucial gateway functions, such as advanced producer services, airports, firms' headquarters, ports or stock exchanges. This working paper provides thus a unique descriptive approach of urban structures, notably centred on gateway functions, and highlights the major trends.

1. Data and method

The database is built upon the data and analyses provided by the ESPON 1.1.1 and 1.4.3 projects as well as the FOCI ESPON project. By using the results of WP2.3, especially WP2.3.1, WP2.3.2 and WP2.3.5, we will be able to assess the connections between European cities and the rest of the world and to provide an in-depth analysis on gateways (financial, maritime, air), including the physical assets of these different types of gateways. It will enable us to map the changing urban structures which support connectivity to global service business flows across the European territory. Second, this Euro-centric mapping will be compared with contemporary urban structures in other 'developed' economic regions. Together, these two scales of comparative urban analysis (within Europe, and between Europe and other developed world regions) will inform how contemporary global spaces of business flows map onto the territorial structures of urban spaces of places.

Two major steps have been used to assess Europe's urban structure, also in a comparative perspective with the USA:

The delimitation of cities

In Europe we can find several delimitations of cities. In view of our objective, we will use functional delimitations, which correspond to Large Urban Zones (LUZ) in the Urban Audit. While the basic idea is to consider the influence area of core cities through daily commuting, exact definitions differ across Member States. In order to increase our statistics, we also use the NUTS3 proxy of LUZ, that is the NUTS3 that best fits to the LUZ area defined by the Urban Audit (see FOCI interim report for precisions). Finally, ESPON DB proposes a more homogenous delimitation of European cities based on functional areas (FUAs).

In the USA, the delimitation of Metropolitan Areas has been provided on the same principle, but in a much more homogenous way throughout the US territory. The Office of Management and Budget (OMB) has defined 'Core Based Statistical Areas' all over the country. Metropolitan Areas include all counties which send more than 25% of their workers to the core area. This definition, also used by the US census Bureau and the Bureau of Economic Analysis, facilitates the collection of data for US metropolitan areas.
Delimitations are thus roughly comparable between Europe and the US as long as we use Large urban zones and Metropolitan areas. On this basis, we provide a list of cities including all European and US cities with more than 500000 inhabitants.

The database for large urban zones (Europe) and Metropolitan areas (USA)

From the list of cities and their delimitations, we have built a database that includes:
- basic indicators, such as population, GDP, GDP per sector from 1995 onwards
- more sophisticated indicators allowing us to determine the position of cities in the world networks. Indicators include the number of headquarters, extra-continental flights, GAWC indicators on networks of advanced services… Most of these indicators – though not all of them–, mainly indicators of gateway functions (airports, ports, financial gateways, command centres), will be collected in WP2.3. The weight of the major gateways will be assessed at the global level, but above all we will compare the internal level of concentration of gateways at the macro-regional level. For more details, please refer to WP2.3.2 and 2.3.5.

Table 1 gives the current state of the database.

Table 1. The database on urban structures and connectivity

Themes	Indicators	Time frame	USA	EUROPE	Source
Population	Total population; population growth	1990-2010	Complete from 2000 onwards	Complete	Calculations on Eurostat data; US Census Bureau
GDP	Total GDP, GDP growth, GDP per capita	1995-2007	Complete from 2000 onwards	Complete	Calculation on NUTS3 regional data of Eurostat; Bureau of Economic Analysis
Economic structure	Share of each sector, sectoral growth, evolution of economic structures	1995-2008	Added value in 6 sectors for 1995, 2000, 2004, 2006	Employment in 5 sectors for 1995,2000, 2004, 2008	Calculation on NUTS3 regional data of Eurostat; Bureau of labour Stastitics
Education	Share of low, medium and high diploma	Years 2000	Data for 2000, and average 2005-2009	Only for 2001 in Europe	Census data of Eurostat and Labour Force Survey statistics of Eurostat; US Census Bureau
Advanced service producers	Connectivity indicators	2000, 2004, 2008	Complete	Complete	GAWC
Air services	Number of international flights or destinations outside Europe and inside the area	1990, 1999, 2008, 2010	Complete	Complete	OAG

Transnational headquarters	sales, profits, assets, employees	2008	Complete	Complete	Forbes
Harbour functions	Connectivity for containers to extra-European space	1996, 2006	Complete	Complete	
Real Estate	Transactions (in value) with the extra-European space	2007 to 2010	Complete	Complete	
Financial functions	The number of extra-European firms quoted in the European stock exchanges	2007, 2010	Complete	Complete	

We will assess the urban structure at continental level by mapping and analysing the indicators. Most will be mapped, but we will also compare the level of concentration of urban functions by using simple indicators such as the share of the first, the 5, 10, 20 or 50 most important urban areas/gateways. Using the same indicator we will also show the trends in concentration in both Europe and the US.

This descriptive approach will be completed by the elaboration of typologies classifying cities according to the nature and geography of their international links.

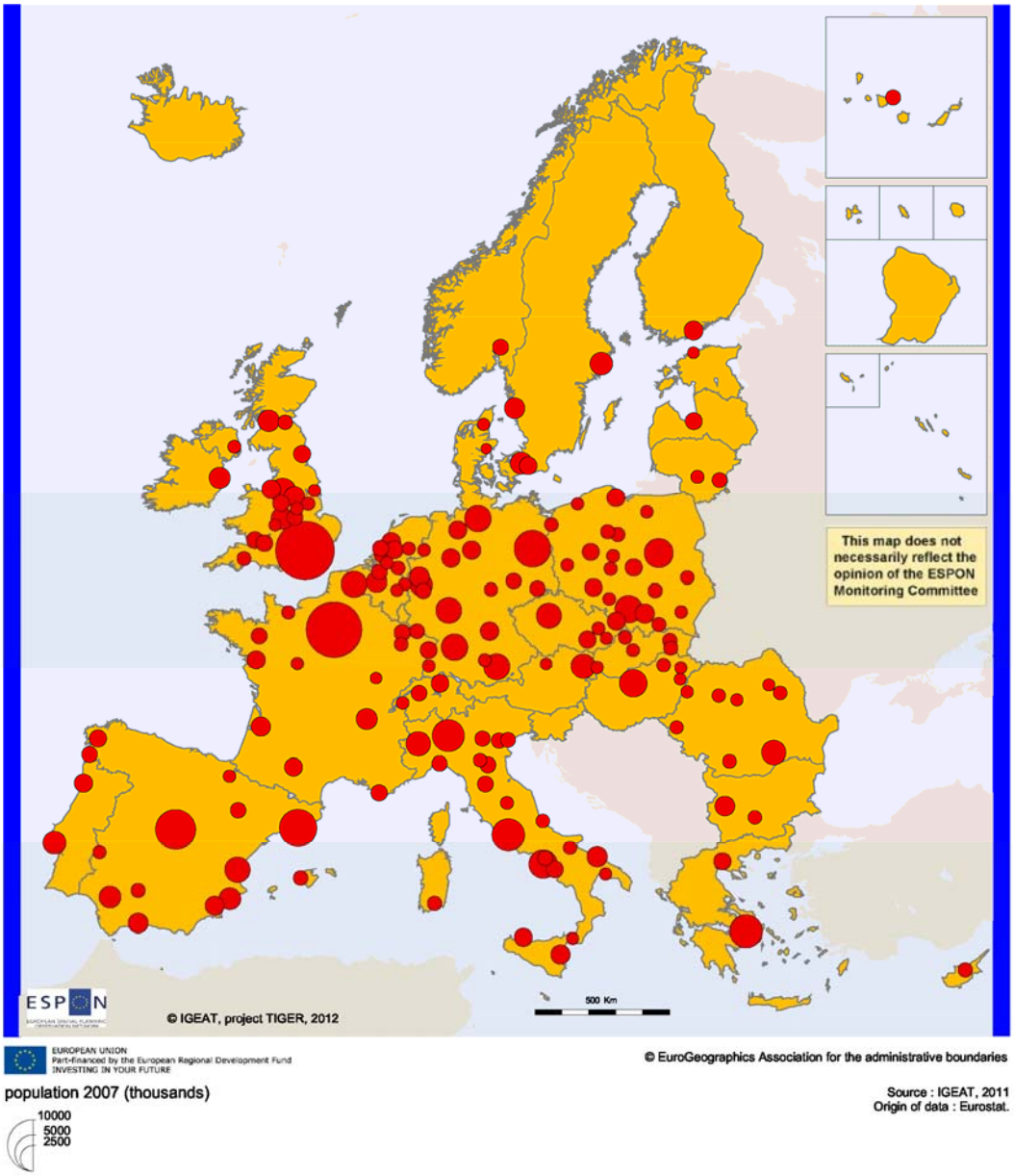
2. Urban structures and gateway functions: a descriptive approach

2.1. Population and GDP

2.1.1. Population

Urban hierarchies and urbanization processes differ considerably in the US and in Europe. Though in both territories, urbanization is ancient and concerns most of the population, the concentration in a few major cities is much higher in the US for obvious reasons. In Europe, we find 4 cities with more than 5 million inhabitants (plus the Ruhrgebiet), while in the US 9 cities reach this level of population. As shown in Table 2, the biggest five US cities concentrate 18% of the population vs. 8% only for Europe. The reasons are historical: Europe is a mosaic of Nation-states with their own urban system and hierarchy and only a few big and centralized countries have made the emergence of very large cities possible (Paris in France and London in the UK). On the contrary, the US is one very large country, with a unified market and a high internal labour mobility where agglomeration effects have encountered no borders in contrast to Europe. As a consequence, as in other big nations (Brazil, China, India etc.), very large cities dominating the urban hierarchy have appeared.
The European urban structure is a historical legacy which will not change. Unlike in most parts of the world, it is characterized by a dense network of medium or large cities, and only two very large cities. We will however show that gateway functions can still be highly concentrated in Europe, in the context of both globalization and European integration.

Map 1: Population in 2007 – EU



Map 2: Population in 2009 – US

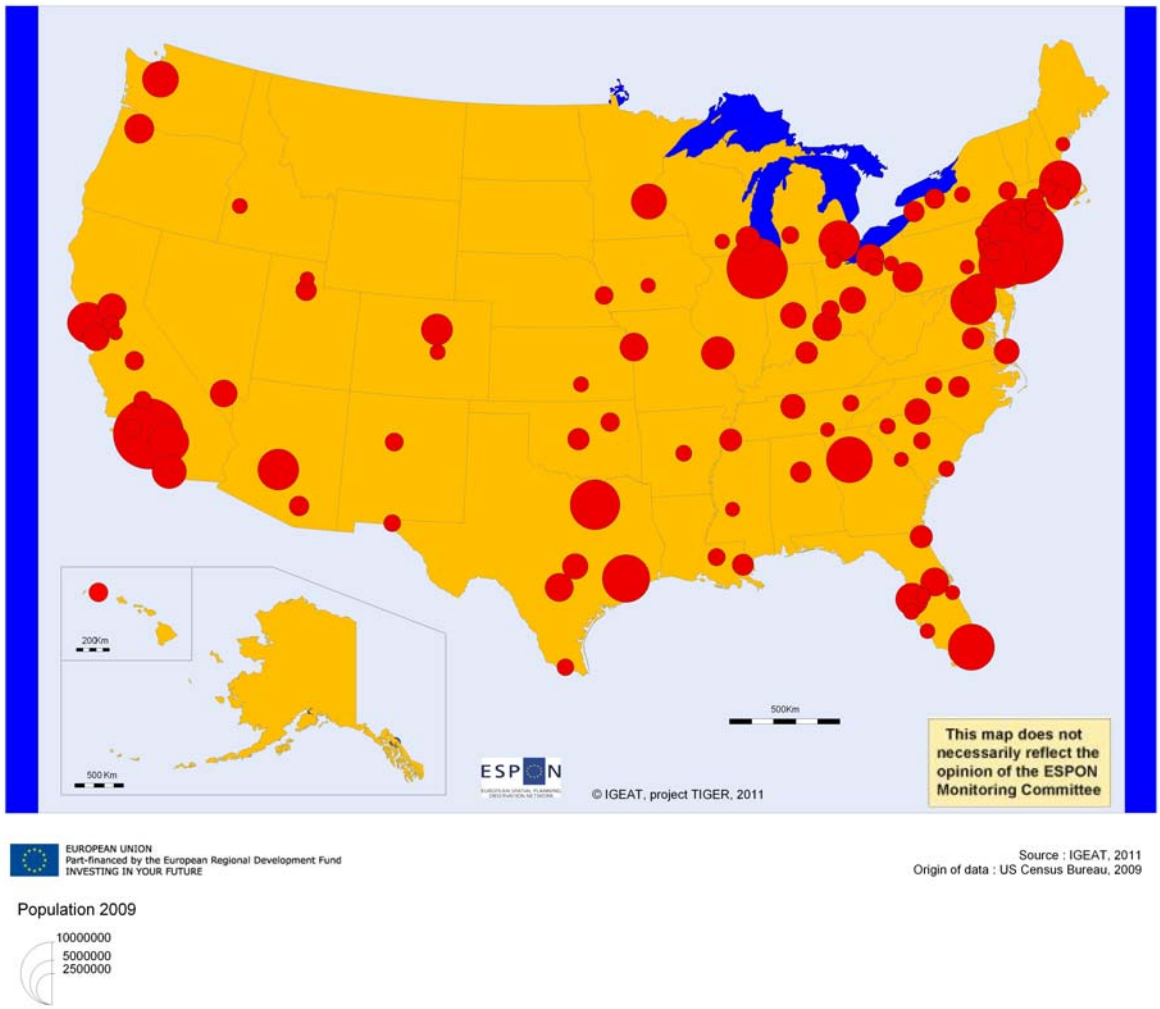


Table 2: Concentration of population in major cities – in the EU in 1999/2007 and in the US in 2000/2009

Population (in % of ESPON space)				Population (in % of total US)			
1999		**2007**		**2000**		**2009**	
1 to 5	7.93	1 to 5	8.16	1 to 5	18.0	1 to 5	17.6
London	*2.56*	*London*	*2.57*	*New York*	*6.5*	*New York*	*6.2*
Paris	*2.22*	*Paris*	*2.31*	*Los Angeles*	*4.4*	*Los Angeles*	*4.2*
Ruhrgebiet	*1.09*	*Madrid*	*1.21*	*Chicago*	*3.2*	*Chicago*	*3.1*
Madrid	*1.05*	*Barcelone*	*1.04*	*Philadelphia*	*2.0*	*Dallas*	*2.1*
Berlin	*1.01*	*Ruhrgebiet*	*1.03*	*Dallas*	*1.8*	*Philadelphia*	*1.9*
1 to 10	11.80	1 to 10	12.15	1 to 10	26.3	1 to 10	26.3
1 to 20	17.15	1 to 20	17.44	1 to 20	37.5	1 to 20	37.8
1 to 50	27.20	1 to 50	27.74	1 to 50	53.4	1 to 50	54.2

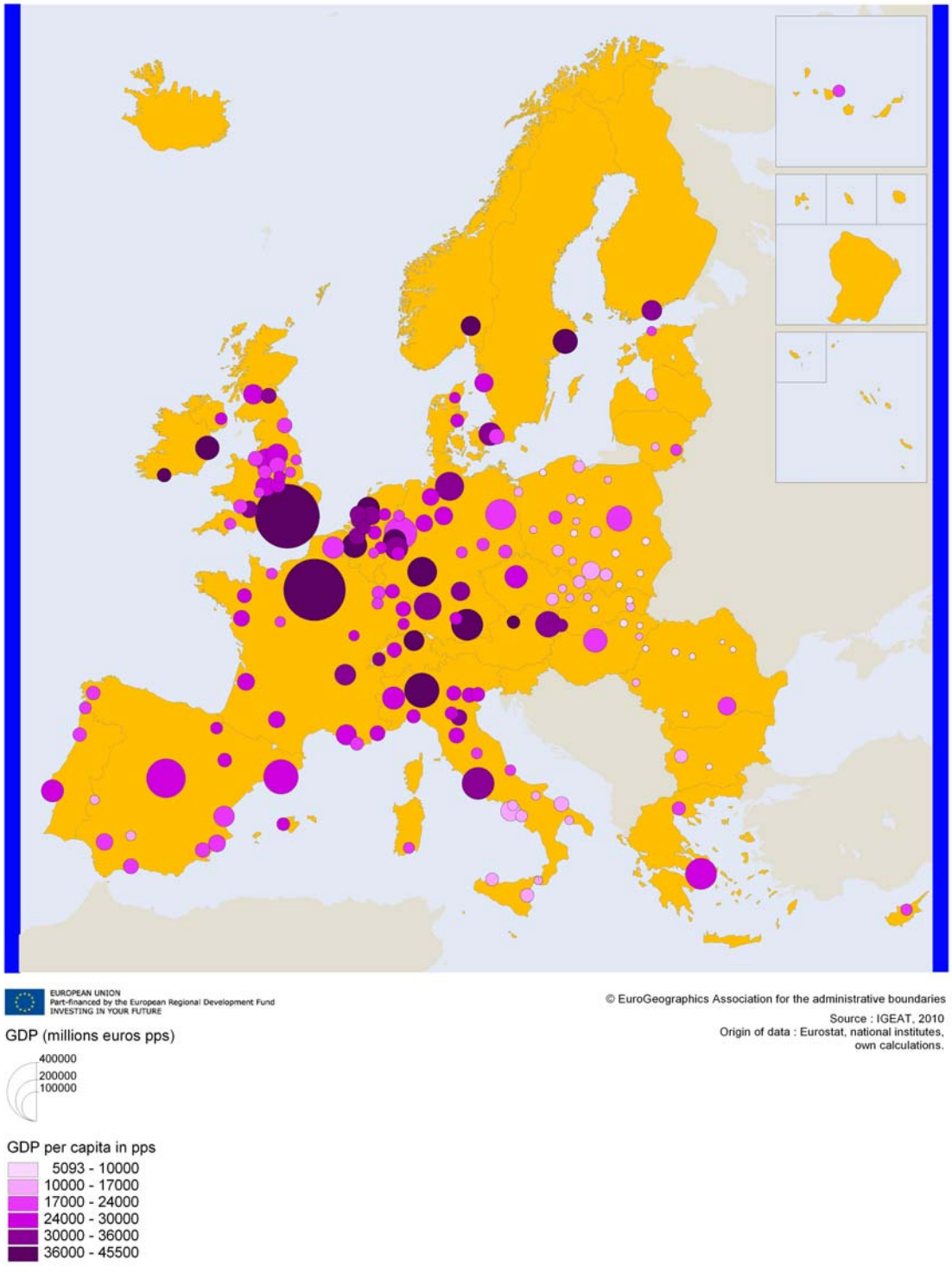
Source: Eurostat, ESPON DB and personal calculation; BEA for the US

2.1.2. GDP

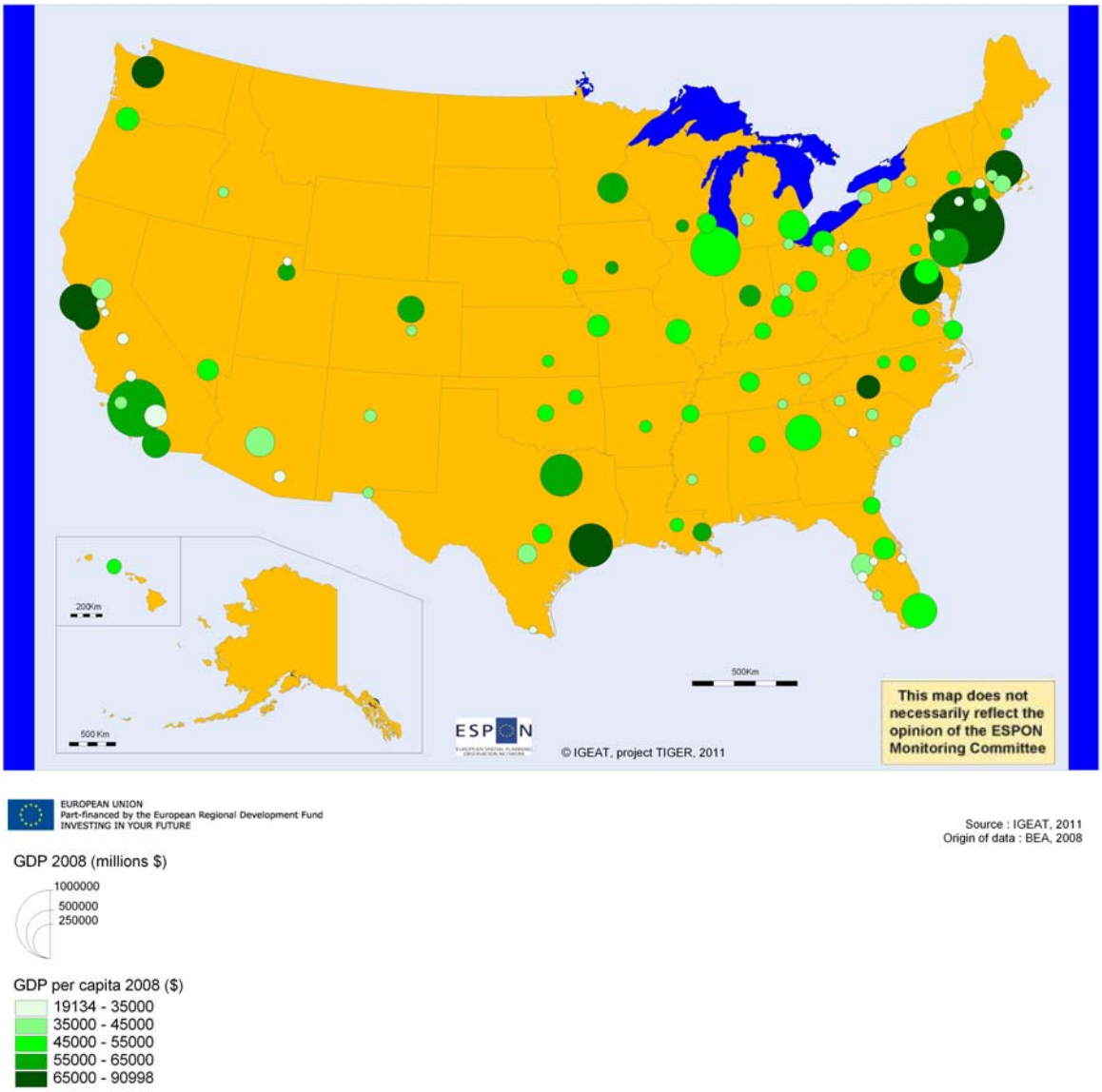
On the maps below, the GDP per capita is represented by the colour gradient whereas the size of the dots depends on the total amount of GDP in millions euros/dollars. For both Europe and the US, we find that the GDP per inhabitant is to some extent related to the economic size of the cities. In Europe, the pattern is more complex since this relation plays a role at both European and national level: London is a big and rich city playing a major role in the global,

European and UK economy; while much less wealthy, Warsaw is still a much richer city than any other Polish city. The difference between Western and Eastern Europe is mainly visible by the fact that in Eastern Europe, only capital cities emerge as important and wealthy economic poles, while in Western Europe, we can observe a very dense urban network of large and medium wealthy cities in the European core, from England to Northern Italy.

Map 3: GDP and GDP per capita in 2008 – EU



Map 4: GDP and GDP per capita in 2008 – US



As observed for population, the concentration of production is much higher in the US, where the biggest cities account for 23% of the national production, while this figure is only 12% in Europe. In both Europe and the US, we notice that the share of the biggest cities has slowly increased in the economy, a sign of a moderate metropolitanization process at continental level.

Table 3: Concentration of production in major cities – in the EU in 1999/2008 and in the US in 2000/2008

GDP (in % of EU27)				GDP (in % of total US)			
1999		**2008**		**2001**		**2008**	
1 to 5	11.7	1 to 5	12.1	1 to 5	22.6	1 to 5	23.1
Paris	*3.9*	*London*	*4.2*	*New York*	8.7	*New York*	8.9
London	*3.9*	*paris*	*3.9*	*Los Angeles*	4.9	*Los Angeles*	5.0
Milan	*1.4*	*Madrid*	*1.6*	*Chicago*	3.9	*Chicago*	3.6
Madrid	*1.3*	*Barcelone*	*1.3*	*Washington*	2.6	*Houston*	2.8
Ruhrgebiet	*1.2*	*Milan*	*1.1*	*Dallas*	2.5	*Washington*	2.8
1 to 10	16.9	1 to 10	17.2	1 to 10	33.6	1 to 10	34.2
1 to 20	23.6	1 to 20	24.2	1 to 20	46.4	1 to 20	46.8
1 to 50	35.8	1 to 50	36.4	1 to 50	63.7	1 to 50	64.4

Source: Eurostat, ESPON DB and personal calculation; BEA for the US

2.2. Gateway functions

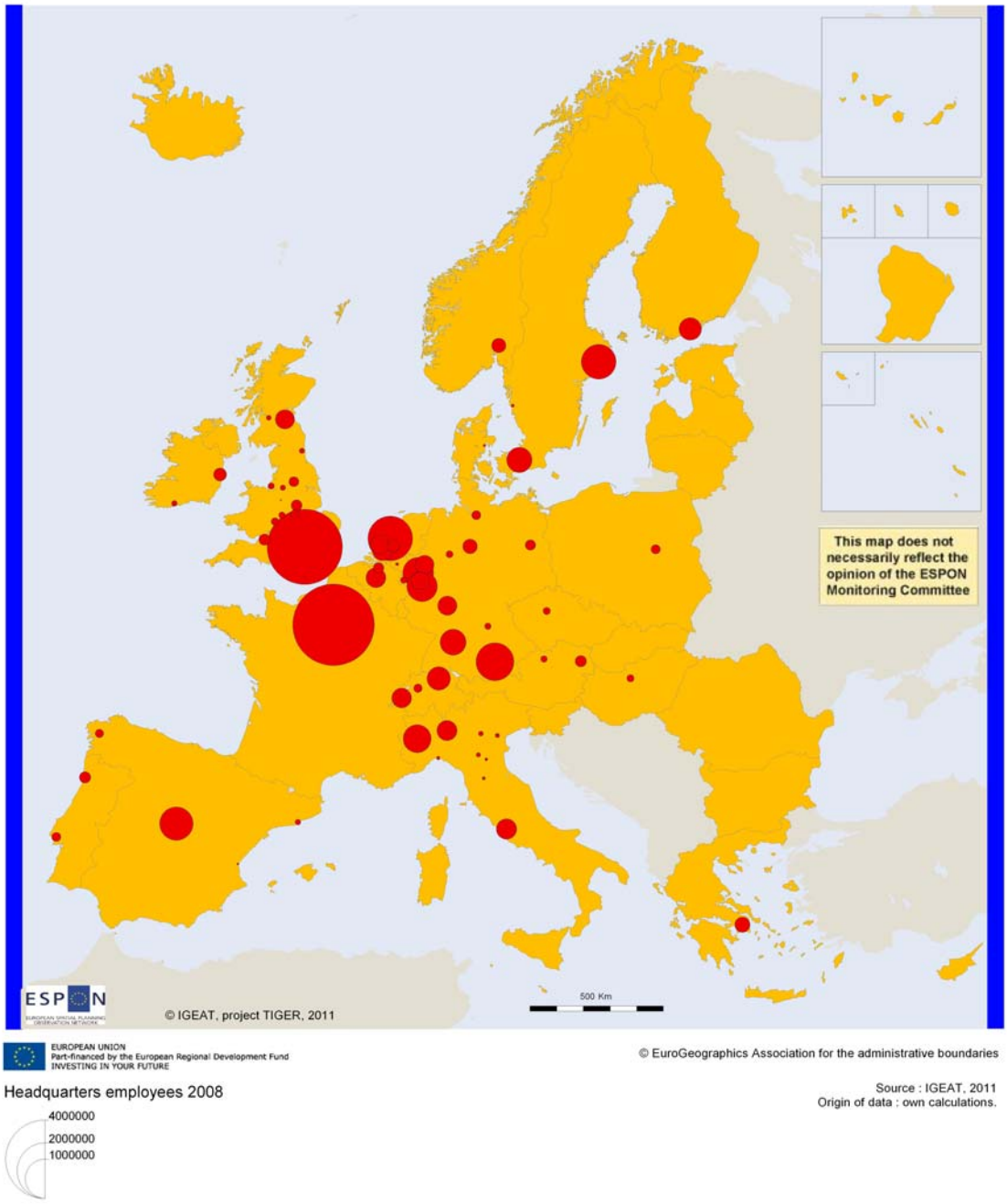
2.2.1. Transnational headquarters

Transnational headquarters reflect the importance of command functions in cities. They are based on the Forbes figures on the top 2000 world companies. The map indicates those having their headquarters in the city, and we use the companies' staff numbers as indicator.

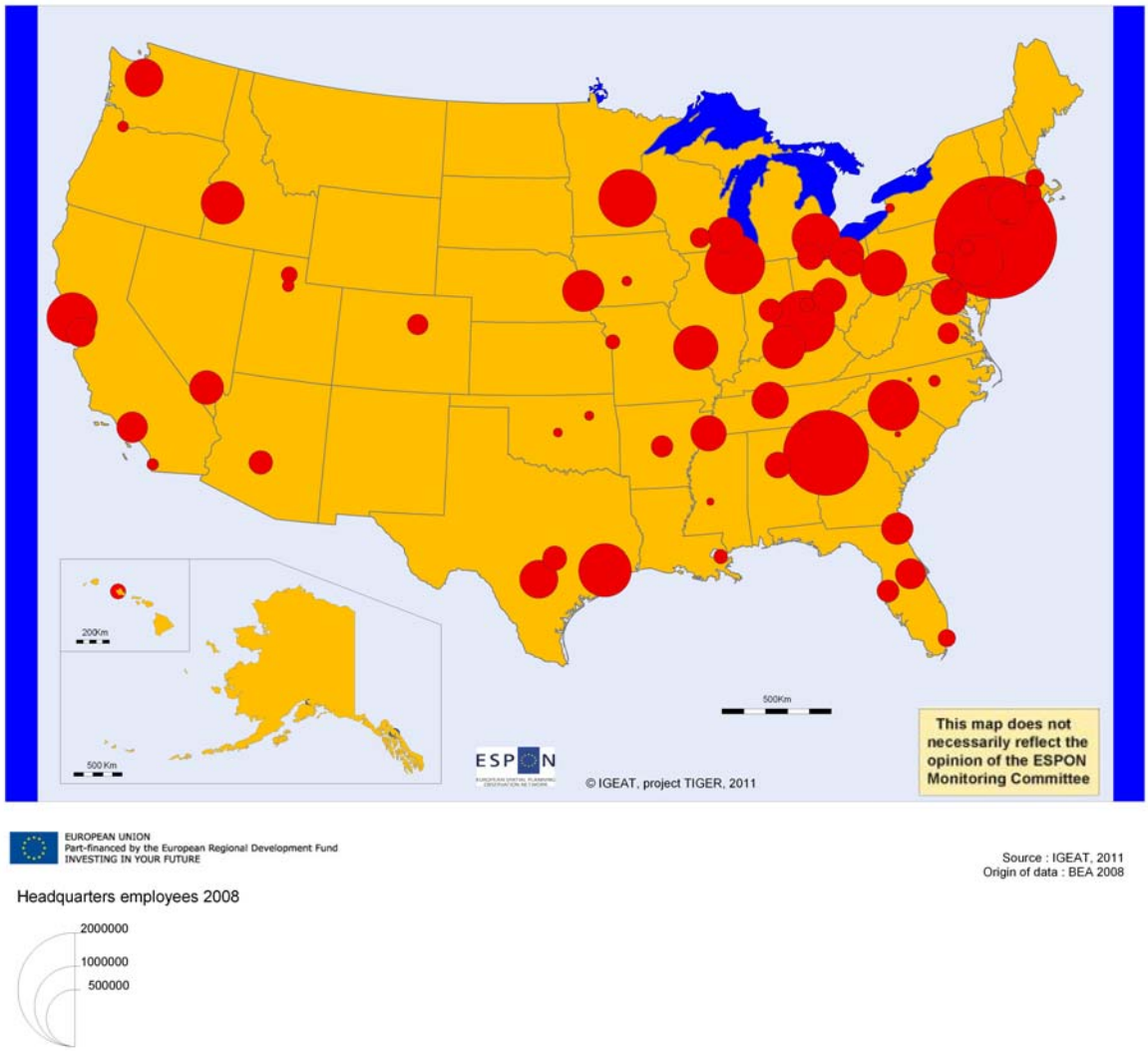
First of all, the maps show that this indicator is highly concentrated. In Europe, headquarters of transnational firms are concentrated in a limited number of cities in the European core from England to Northern Italy. In comparison to the US, the command functions of major world firms are more concentrated in a few cities in Europe than in the US. This would not have been possible without a certain level of integration within the European economy, resulting in the shift of major national firms into major European firms.

In contrast to most indicators of command and gateway functions, Paris is here more important than London. If Paris is a major command city, it has a more moderate role than London as a node in networks, notably in advanced producer services. As to London, it is not only a command city playing an essential role in global finance, it is also the main gateway between global and European economies: London is indeed chosen by many firms in numerous different areas as the centre of their European operations (Lennert *et al.*, FOCI, 2010). Few cities outside this axis have important command functions: Nordic capitals, Rome and Madrid essentially. In US, cities of the North Eastern part have, one more time, the highest values.

Map 5: Number of employees in transnational headquarters, in 2008 – EU



Map 5: Number of employees in transnational headquarters, in 2008 – US



This important concentration on the maps is confirmed by the analysis of Table 4. The 5 main cities account for 57.2% and 40.1% of the employees in transnational headquarters, for EU and US respectively. Thus, this concentration is even higher for EU, where Paris and London both play a major role, while in US New York is alone in the lead.

Table 4: Concentration of firms' headquarters in major cities – for EU and US in 2008

Transnational headquarters : employees (in % of cities) - EU	
2008	
1 to 5	57.2
Paris	*22.5*
London	*19.2*
Amsterdam	*6.7*
Munich	*4.8*
Stockholm	*4.1*
1 to 10	72.1
1 to 20	87.0
1 to 50	99.2

Transnational headquarters : employees (in % of cities) - US	
2008	
1 to 5	40.1
New York	18.2
Atlanta	8.8
Cincinnati	4.6
Chicago	4.4
Minneapolis	4.0
1 to 10	55.8
1 to 20	76.2
1 to 50	98.6

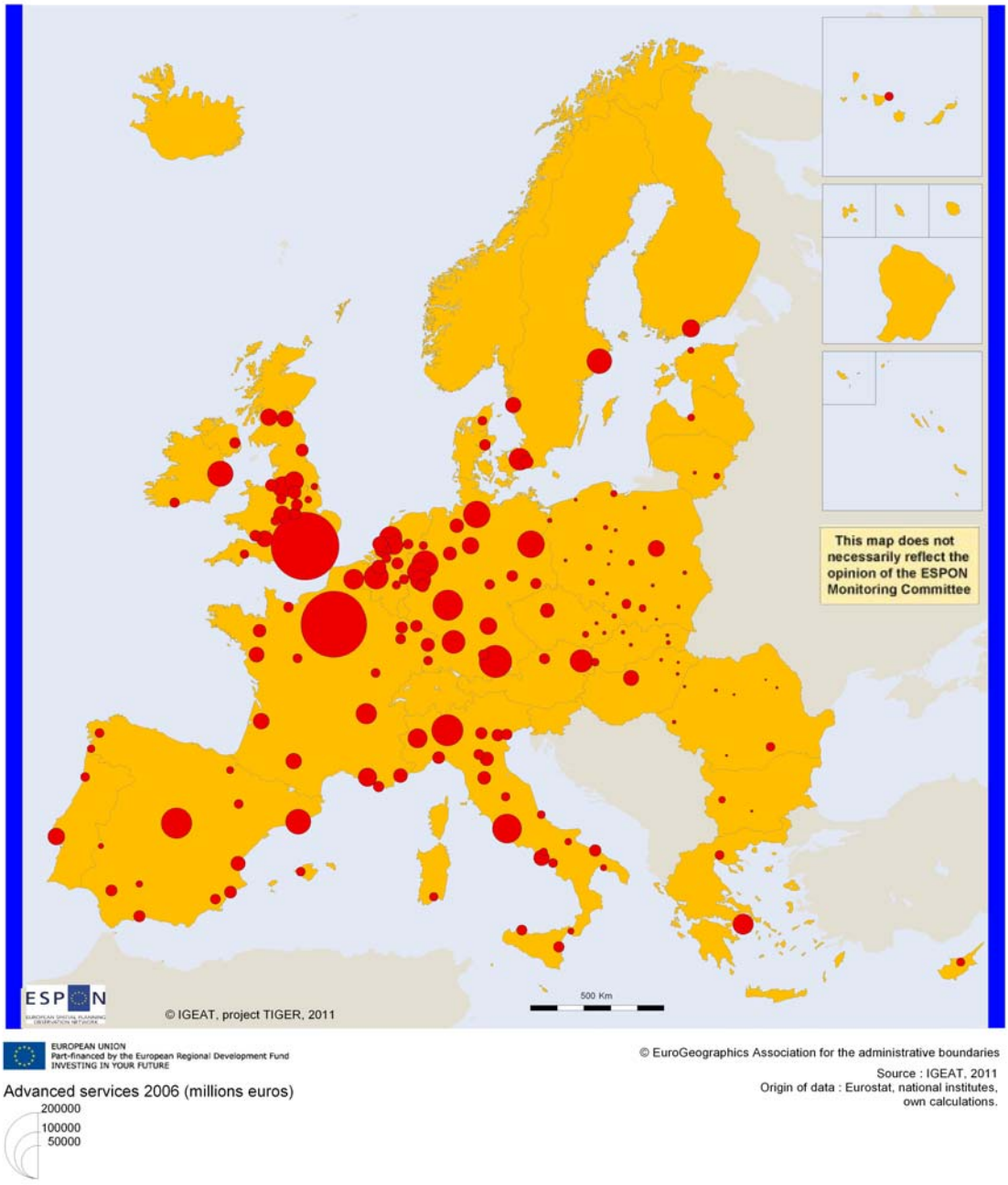
Source: Forbes, 2009

2.2.2. Finance and business services

The weight of cities in finance and business services is analysed by examining the added value of these economic sectors for each US/European city.

In absolute terms, the added value or employment in finance and business services in the EU or the US have considerably increased between 1995 and 2006/2008. Yet this rise has not been accompanied by concentration on the main financial centres, with the exception of London whose share in the European finance has spectacularly increased.

Map 7: Added value in finance and business services, in 2006 – EU



Map 8: Employment in finance and business services, in 2008 – US

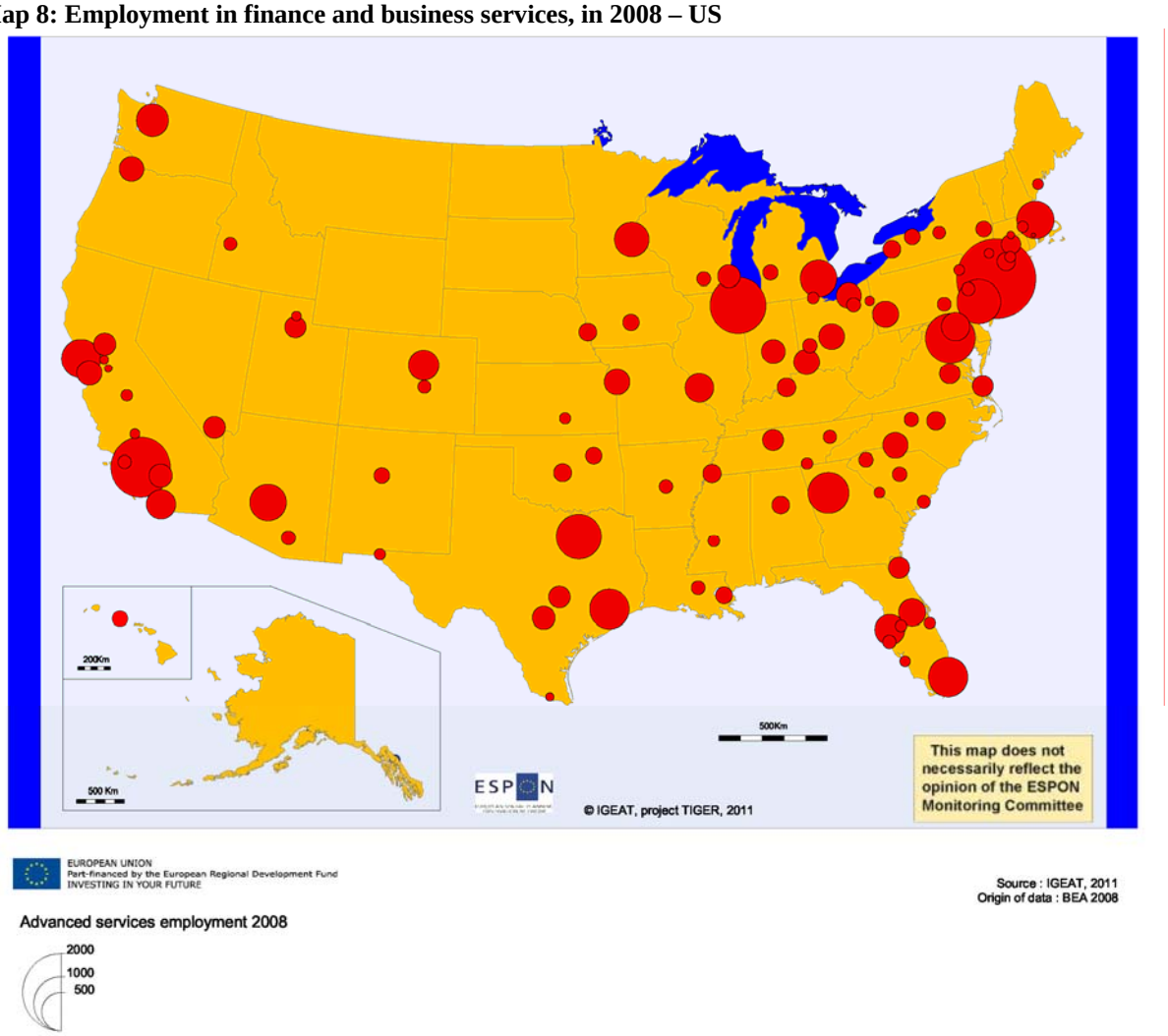


Table 5: Rank of cities in finance and business services, and evolution – for EU and US in 1995 and 2008

Added value in finance and business services - EU				Employment in finance and business services - US			
1995		**2006**		**1995**		**2008**	
1 to 5	18.1	1 to 5	18.8	1 to 5	31.6	1 to 5	29.7
Paris	*7.5*	*London*	*7.3*	*New York*	11.9	*New York*	10.7
London	*4.6*	*Paris*	*6.8*	*Los Angeles*	6.8	*Los Angeles*	6.0
Frankfurt	*2.1*	*Munich*	*1.7*	*Chicago*	5.9	*Chicago*	5.3
Munich	*2.0*	*Milan*	*1.6*	*Washington*	3.6	*Washington*	4.2
Berlin	*1.9*	*Madrid*	*1.5*	*Philadelphia*	3.4	*Dallas*	3.5
1 to 10	25.5	1 to 10	24.9	1 to 10	45.8	1 to 10	43.7
1 to 20	35.0	1 to 20	33.6	1 to 20	63.0	1 to 20	61.8
1 to 50	48.0	1 to 50	47.2	1 to 50	86.8	1 to 50	86.8

Source: Eurostat and personal calculation; BEA for the US

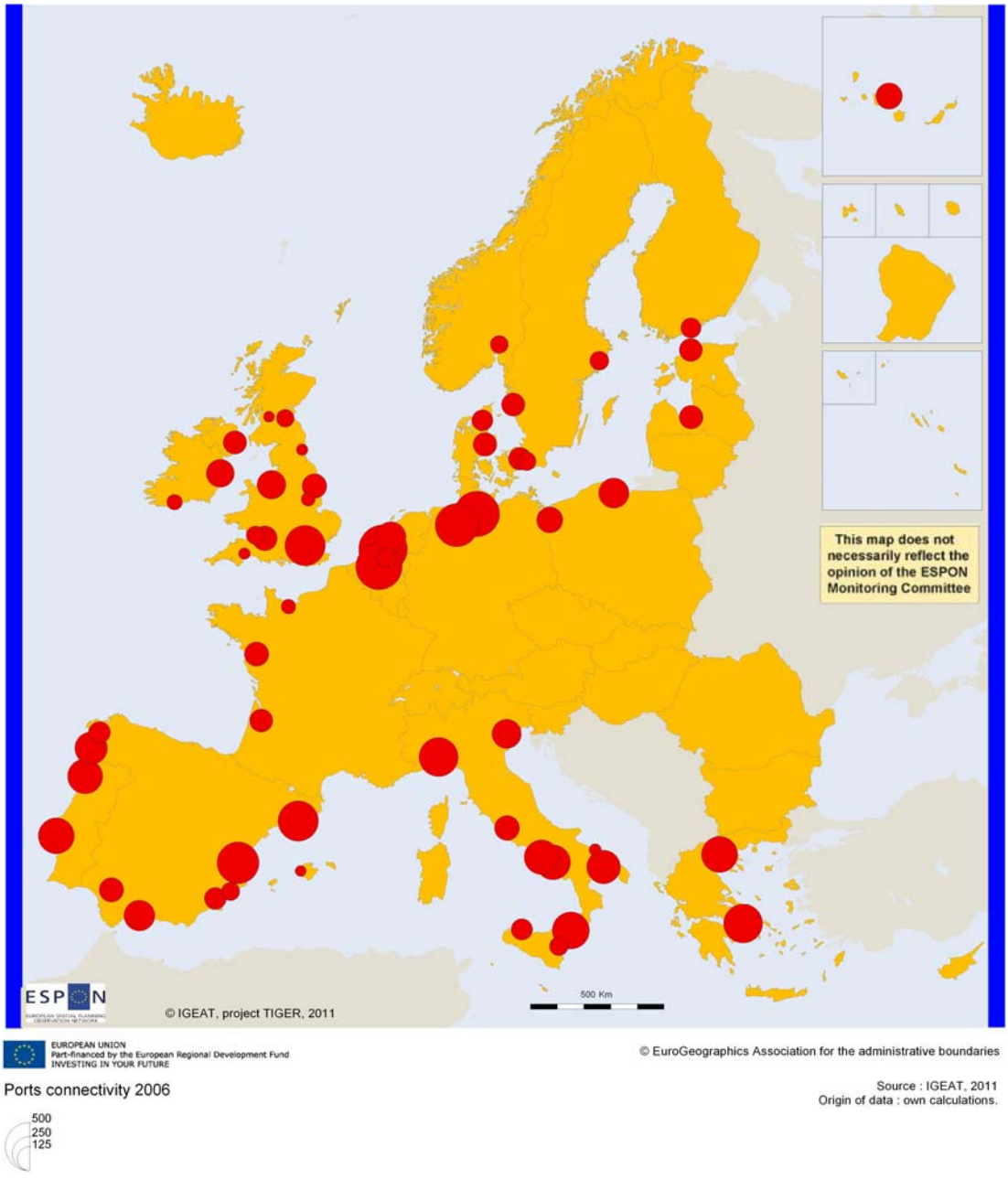
2.2.3. Harbour functions

The harbour functions of a city are assessed as the containers' connectivity of its port with all ports in the world. The indicator is the number of connections with extra-European ports.

In the US, a limited number of large ports of similar size dominate the harbour gateway functions. In Europe, harbour functions are more dispersed into a large number of ports. In both territories, concentration to the benefit of the most important gateway functions has decreased.

A noticeable difference between the US and Europe is that in Europe, port gateways are highly specialised cities with very limited other gateway functions (Rotterdam, Antwerp, Bremen etc.). Hence, in the EU, the containers' connectivity concentrates on cities which are almost exclusively specialised in this field. That is less often the case in the US, where New York and Los Angeles are major cities concentrating most of the gateway functions.

Map 9: Degree of connectivity, in 2006 – EU harbours



Map 10: Degree of connectivity, in 2006 – US harbours

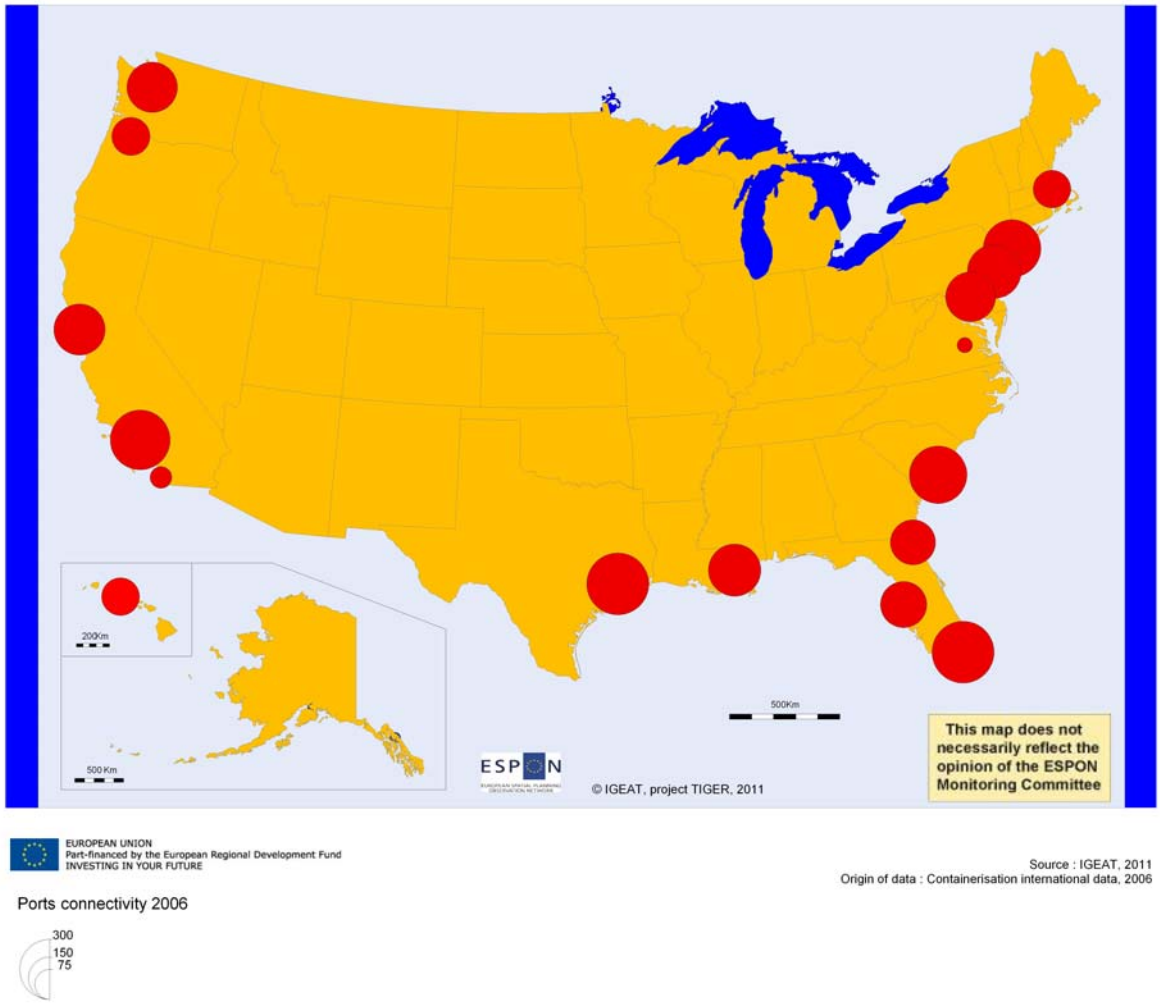


Table 6: Concentration of containerisation through port connectivity – for the EU and the US in 1996 and 2006

Containers connectivity (in % of cities) - EU				Containers connectivity (in % of cities) - US			
1996		**2006**		**1996**		**2006**	
1 to 5	24.7	1 to 5	22.1	1 to 5	48.9	1 to 5	44.7
Rotterdam	*5.6*	*Rotterdam*	*5.1*	*New York*	*11.1*	*Miami*	*9.6*
Hamburg	*5.4*	*Antwerp*	*4.7*	*Charleston*	*9.7*	*Houston*	*9.6*
Antwerp	*5.2*	*Hamburg*	*4.5*	*Miami*	*9.5*	*Los Angeles*	*8.9*
Bremen	*4.4*	*Bremen*	*4.1*	*Houston*	*9.4*	*New York*	*8.3*
Barcelone	*4.1*	*Valence*	*3.8*	*Los Angeles*	*9.2*	*Charleston*	*8.3*
1 to 10	43.7	1 to 10	38.8	1 to 10	86.5	1 to 10	77.9
1 to 20	67.4	1 to 20	63.3	1 to 20 (15)	100.0	11 to 20 (17)	100.0
1 to 50	98.7	1 to 50	97.2	1 to 50	100.0	1 to 50	100.0

Source: LVMH

For 5 indicators (Harbours, Air traffic, GaWC, Real estate and Stock exchange), data allow us to distinguish the 'extra-continental'[1] flows from the total. Below, Table 7 shows the concentration of extra-continental harbour functions. It is interesting to notice that

[1] By "extra-continental", we mean that intra-EU flows are excluded. For the US, we mean either extra-US or extra-NAFTA, depending on the data.

concentration is barely higher when we consider only the extra-continental traffic. This situation, as we will see, is not observed for the other indicators (except for advanced services). It means that no harbour is specialised in intercontinental, nor in intra-European connections. This is even truer for US than for EU. Moreover, in the US connections are predominant outside the country.

Table 7: Concentration of containerisation through port extra-continental connectivity – for the EU and the US in 1996 and 2006

Containers connectivity extra-EU (in % of cities)				Containers connectivity extra-US (in % of cities)			
1996		2006		**1996**		**2006**	
1 to 5	32.22	1 to 5	29.23	1 to 5	50.02	1 to 5	45.54
Rotterdam	*7.15*	*Rotterdam*	*6.67*	*New York*	*11.56*	*Miami*	*9.85*
Hamburg	*7.08*	*Antwerp*	*6.59*	*Charleston*	*10.11*	*Houston*	*9.71*
Antwerp	*6.71*	*Hamburg*	*5.89*	*Miami*	*9.62*	*Los Angeles*	*9.16*
Barcelone	*5.70*	*Bremen*	*5.06*	*Houston*	*9.57*	*New York*	*8.50*
Valence	*5.59*	*Valence*	*5.03*	*Los Angeles*	*9.17*	*Charleston*	*8.32*
1 to 10	55.62	1 to 10	51.35	1 to 10	87.64	1 to 10	78.56
1 to 20	81.28	1 to 20	81.31	1 to 20 (15)	100.00	11 to 20 (17)	100.00
1 to 50	100.00	1 to 50	99.92	1 to 50	100.00	1 to 50	100.00

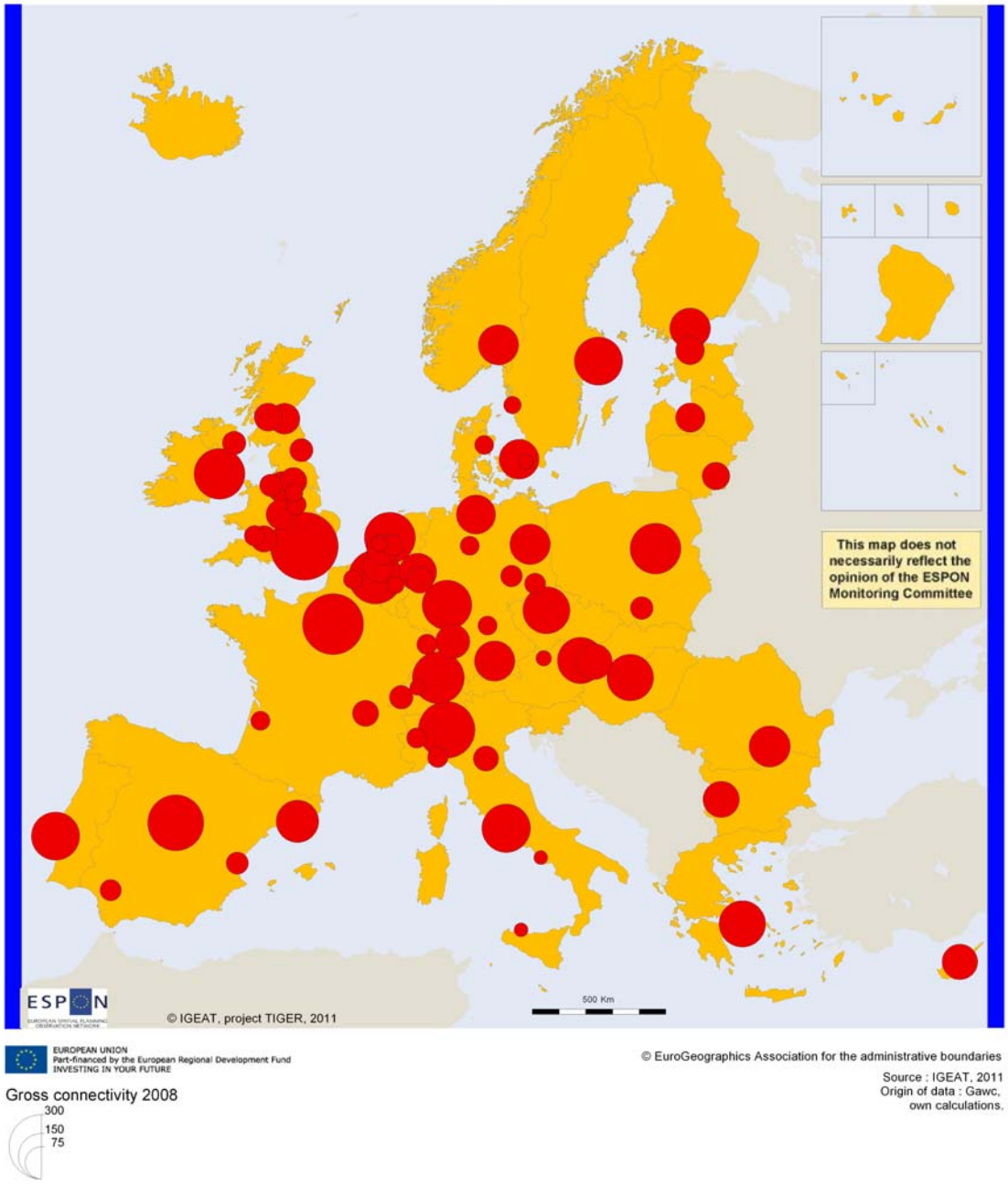
Source: LVMH

2.2.4. Advanced producer services

This indicator, created by the 'Globalization and World Cities Research Network' from Loughborough University, ranks cities according to their connectivity in four sectors of advanced producer services: accountancy, advertising, banking/finance, and law (Beaverstock et al., 1999). Two cities are connected if they belong to the networks of the same company. Connectivity is the sum of all these connections for a given city.

Here again, the level of concentration of connectivity in advanced services is much higher in the US than in Europe. We can observe a small increase in concentration for both regions, but in the US this increase is principally related to the growth of New York, while in Europe London has slightly decreased. The profiles of concentration are similar if we consider extra-continental traffic only (see table 9).

Map 11: GaWC connectivity in 2008 – EU



Map 12: GaWC connectivity in 2008 – US

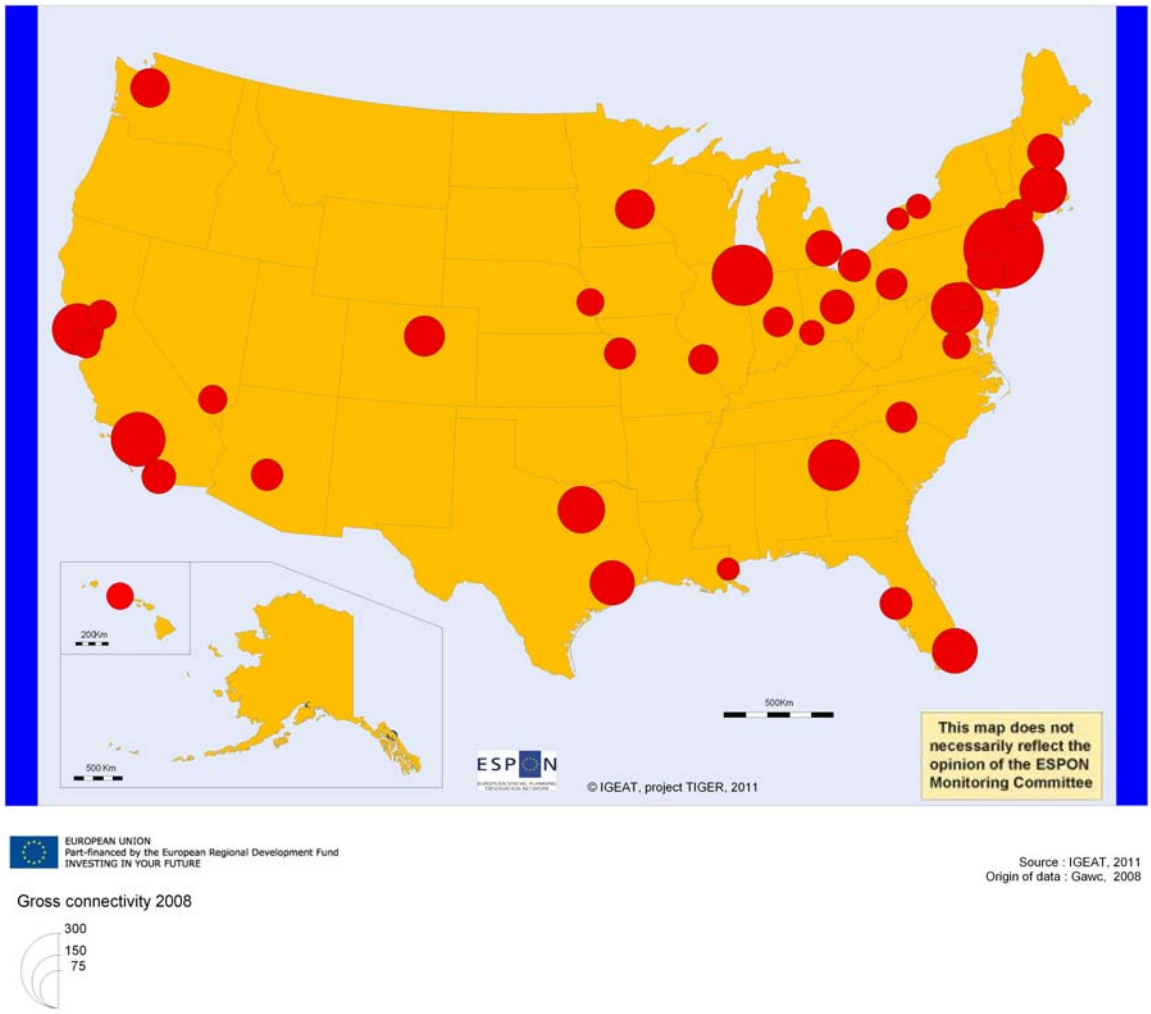


Table 8: Concentration of gateway functions in advanced producer services – connectivity in firms of advanced producer services, 2000-2008 for the EU and the US

GAWC standardized (in % of cities) - EU			
2000		**2008**	
1 to 5	19.7	1 to 5	19.9
London	*5.6*	*London*	*5.2*
Paris	*4.0*	*Paris*	*4.2*
Milan	*3.4*	*Milan*	*3.6*
Madrid	*3.4*	*Madrid*	*3.5*
Amsterdam	*3.2*	*Bruxelles*	*3.3*
1 to 10	33.7	1 to 10	34.6
1 to 20	55.9	1 to 20	58.2
1 to 50	89.1	1 to 50	91.0

GAWC standardized (in % of cities) - US			
2000		**2008**	
1 to 5	31.6	1 to 5	32.2
New York	*9.8*	*New York*	*11.2*
Chicago	*6.2*	*Chicago*	*6.5*
Los Angeles	*6.0*	*Los Angeles*	*5.2*
San Francisco	*5.2*	*Washington*	*4.7*
Miami	*4.4*	*San Francisco*	*4.6*
1 to 10	50.4	1 to 10	51.6
1 to 20	74.4	1 to 20	74.8
1 to 50	100.0	1 to 50	100.0

Source: GawC, 2010

Table 9: Concentration of functions in advanced producer services – extra-continental connectivity in firms of advanced producer services, 2000-2008 for the EU and the US

GaWC extra-EU (in% of cities)	
	2008
1 to 5	18.24
London	*4.96*
Paris	*3.81*
Milan	*3.35*
Madrid	*3.14*
Bruxelles	*3.00*
1 to 10	31.38
1 to 20	53.71
1 to 50	87.03

GaWC non-NAFTA (in % of cities)	
	2008
1 to 5	27.00
New York	*9.54*
Chicago	*5.31*
Los Angeles	*4.29*
Washington	*4.00*
Atlanta	*3.86*
1 to 10	43.09
1 to 20	62.67
1 to 50	95.95

Source: GaWC

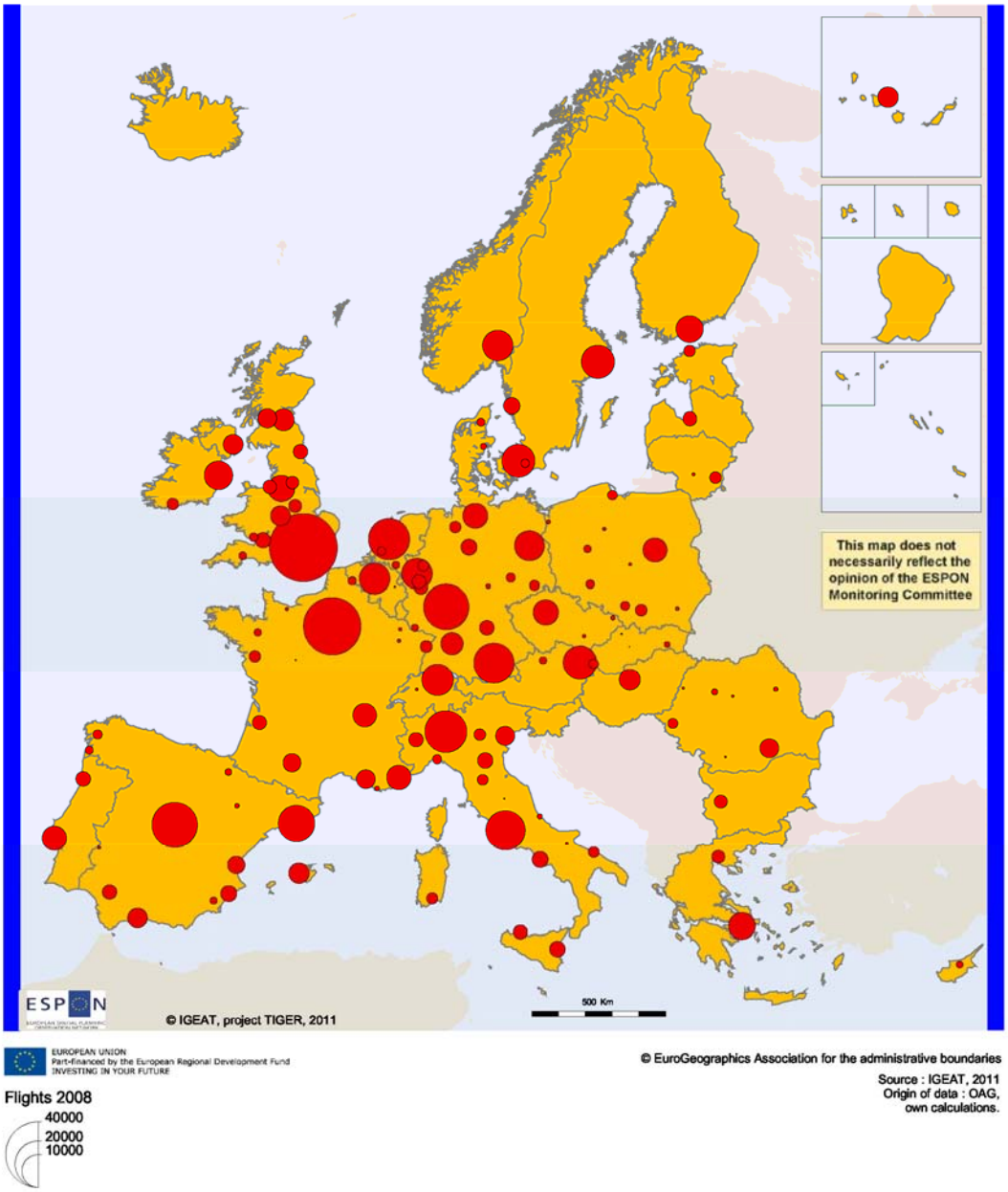
2.2.5. Air service

The indicator is based on the number of connections of cities within an average month (see WP17). All the airports of an urban area are added together.

Air service is well distributed through space: almost each city of our sample of major cities has air connections. Of course, the latter largely depend on the city size and economic importance, which makes London and Paris the first airports for the EU and New York, Los Angeles and Chicago for the US. However, some cities stand out in an unusual way, especially in the US, because they are more isolated so that air travel is the principal means of transport for people there. The most striking example on the map is Denver, Colorado.

Despite this relative dispersion, between one quarter and one third of air traffic are concentrated in the 5 first cities (table 10). The trend over time (almost 20 years), though not really marked, differs between the EU and the US in that the latter shows a rise in concentration and the EU a decrease, except for London.

Map 13: Number of flight connections in 2008 – EU



Map 14: Number of flight connections in 2008 – US

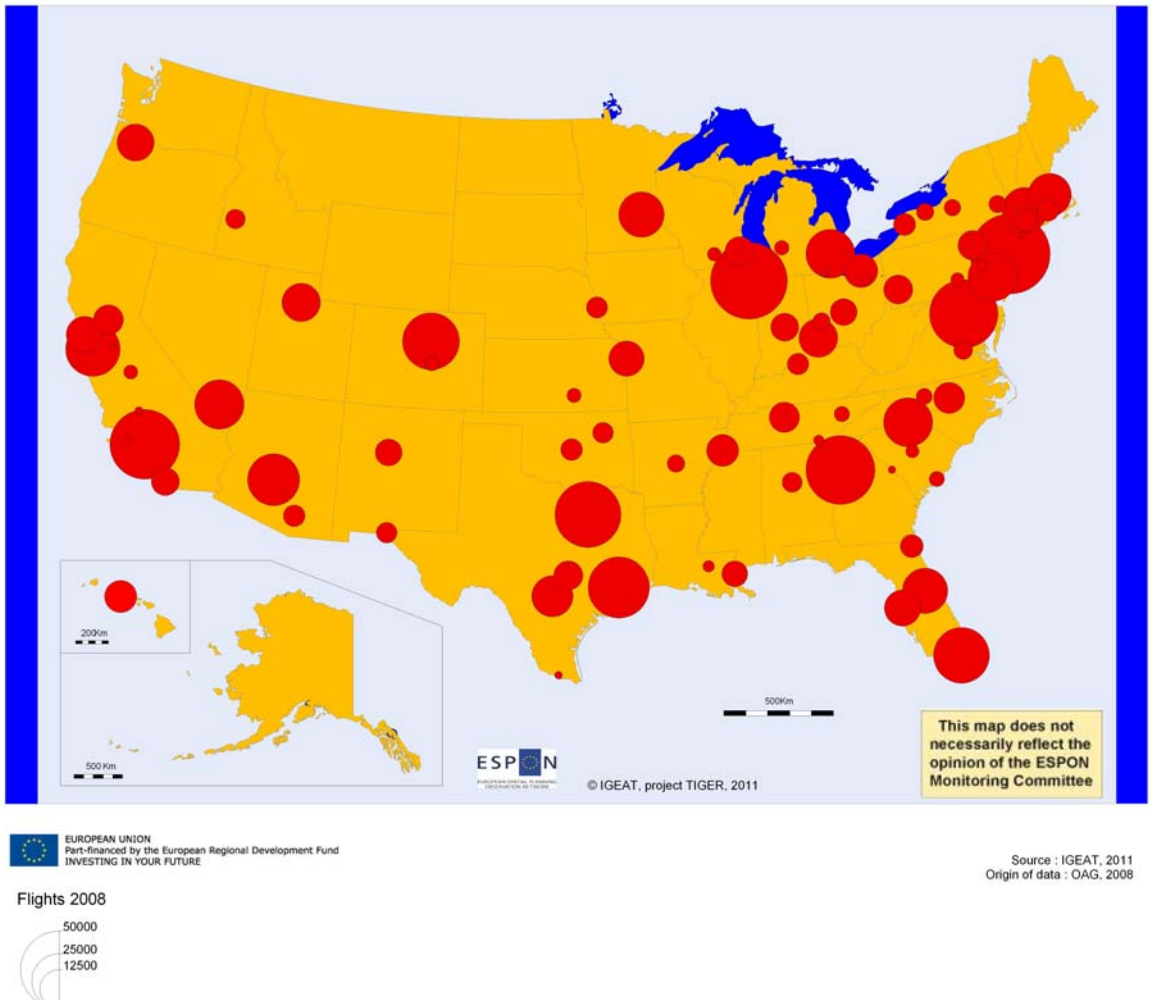


Table 10: Concentration of air connections in cities – for the EU and the US in 1991, 1999 and 2008

Flights (in % of cities) - EU					
1991		**1999**		**2008**	
1 to 5	33.1	1 to 5	31.6	1 to 5	30.5
London	*10.5*	*London*	*10.1*	*London*	*10.1*
Paris	*8.3*	*Paris*	*7.8*	*Paris*	*7.3*
Frankfurt	*5.5*	*Barcelone*	*4.8*	*Madrid*	*4.9*
Stockholm	*4.8*	*Frankfurt*	*4.6*	*Frankfurt*	*4.4*
Amsterdam	*3.9*	*Amsterdam*	*4.4*	*Milan*	*3.8*
1 to 10	50.4	1 to 10	48.3	1 to 10	46.3
1 to 20	72.6	1 to 20	70.5	1 to 20	66.6
1 to 50	93.7	1 to 50	92.9	1 to 50	91.7
Flights (in % of cities) - US					
1991		**1999**		**2008**	
1 to 5	26.6	1 to 5	26.9	1 to 5	27.3
Chicago	*6.0*	*New York*	*5.8*	*New York*	*6.6*
New York	*5.9*	*Los Angeles*	*5.7*	*Chicago*	*6.1*
Los Angeles	*5.8*	*Chicago*	*5.6*	*Los Angeles*	*5.0*
Dallas	*4.8*	*Dallas*	*5.2*	*Atlanta*	*4.9*
Washington	*4.2*	*Washington*	*4.7*	*Washington*	*4.8*
1 to 10	41.6	1 to 10	43.1	1 to 10	45.1
1 to 20	62.5	1 to 20	65.9	1 to 20	67.8
1 to 50	91.4	1 to 50	93.0	1 to 50	94.0

If we consider extra-continental connections only, concentration is much higher – more than two thirds concern the 5 first cities in both the EU and the US. Comparing tables 10 and 11 is interesting for two reasons. First, we observe fewer changes in the rank of cities over time for extra-continental flows: we find the four major EU hubs (London, Paris, Frankfurt and Amsterdam), as well as New York and Los Angeles. These cities are thus specialised in inter-continental flights, and this remains true over the years. Second, unlike what we observe for total flows, the evolution is negative in the case of US and positive in EU, meaning that hub functions are getting more concentrated in Europe compared to the US.

Table 11: Concentration of extra-continental air connections in cities – for the EU and the US in 1991, 1999 and 2008

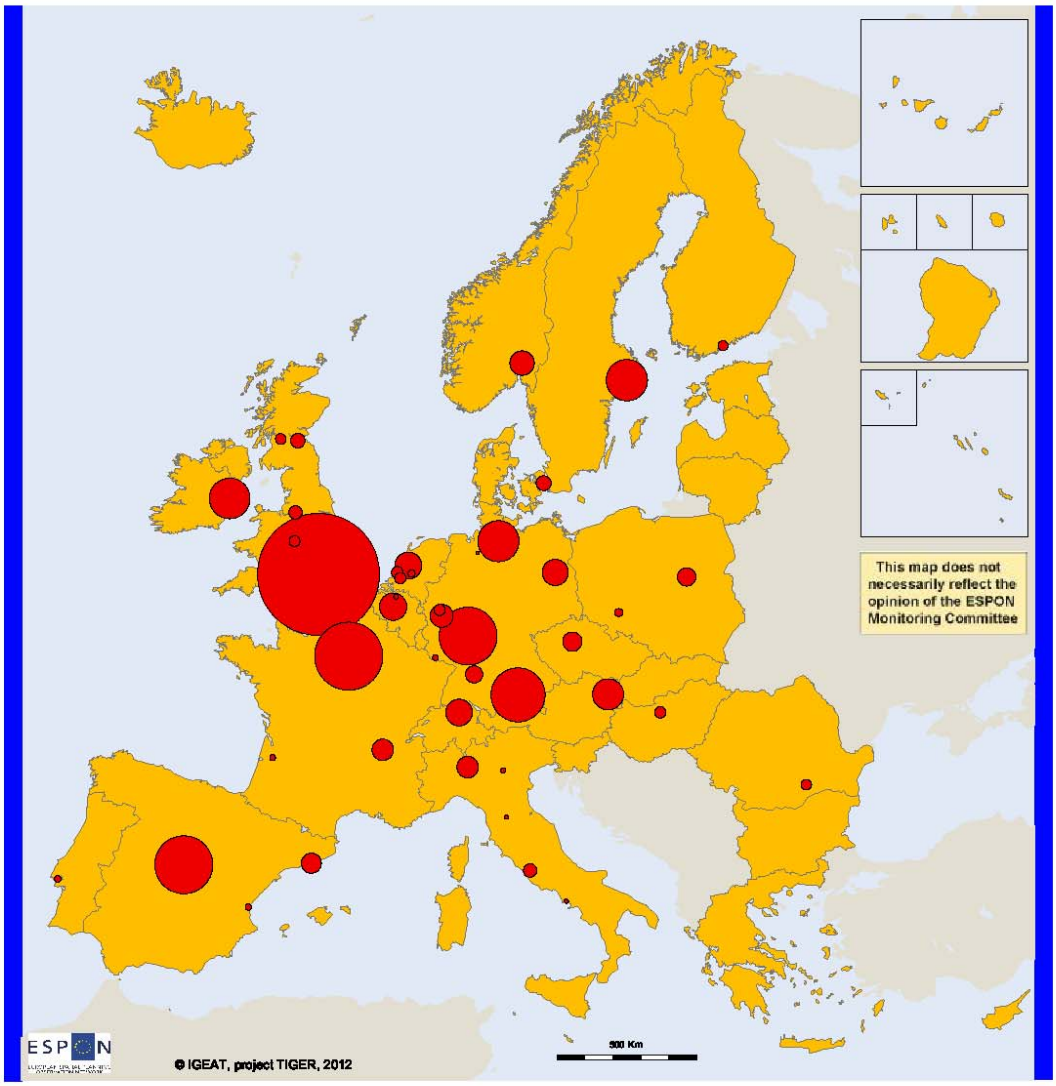
Flights Extra-EU (in % of cities)					
1991		**1999**		**2008**	
1 to 5	67.33	1 to 5	69.19	1 to 5	70.66
London	*24.78*	*London*	*27.31*	*London*	*27.92*
Paris	*14.91*	*Paris*	*14.17*	*Paris*	*14.78*
Frankfurt	*14.89*	*Frankfurt*	*13.11*	*Frankfurt*	*12.72*
Amsterdam	*6.80*	*Amsterdam*	*9.49*	*Amsterdam*	*9.04*
Zurich	*5.96*	*Zurich*	*5.11*	*Madrid*	*6.21*
1 to 10	85.34	1 to 10	85.67	1 to 10	85.70
1 to 20	95.86	1 to 20	96.76	1 to 20	96.96
1 to 50	100.00	1 to 50	100.00	1 to 50	100.00
Flights Extra-US (in % of cities)					
1991		**1999**		**2008**	
1 to 5	66.38	1 to 5	65.79	1 to 5	64.38
New York	*27.26*	*New York*	*27.54*	*New York*	*30.70*
Los Angeles	*13.70*	*Los Angeles*	*14.37*	*Los Angeles*	*11.44*
Honolulu	*10.51*	*Miami*	*9.00*	*Chicago*	*9.55*
San Jose	*7.53*	*Chicago*	*7.89*	*San Jose*	*6.69*
Miami	*7.38*	*San Jose*	*6.99*	*Washington*	*6.00*
1 to 10	85.01	1 to 10	85.14	1 to 10	85.73
1 to 20	97.24	1 to 20	98.01	1 to 20	98.79
1 to 50	100.00	1 to 50	100.00	1 to 50	100.00

Source : OAG, 1991, 1999, 2008

2.2.6. Real estate

The indicator is the total amount of in- and out- flows.

Map 15:


This map does not necessarily reflect the opinion of the ESPON Monitoring Committee
ESPON
© IGEAT, project TIGER, 2012
500 Km
EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE
© EuroGeographics Association for the administrative boundaries
Real estate (millions euros)
60000
30000
15000
Source : IGEAT, 2011
Origin of data : own calculations.

Map 16:

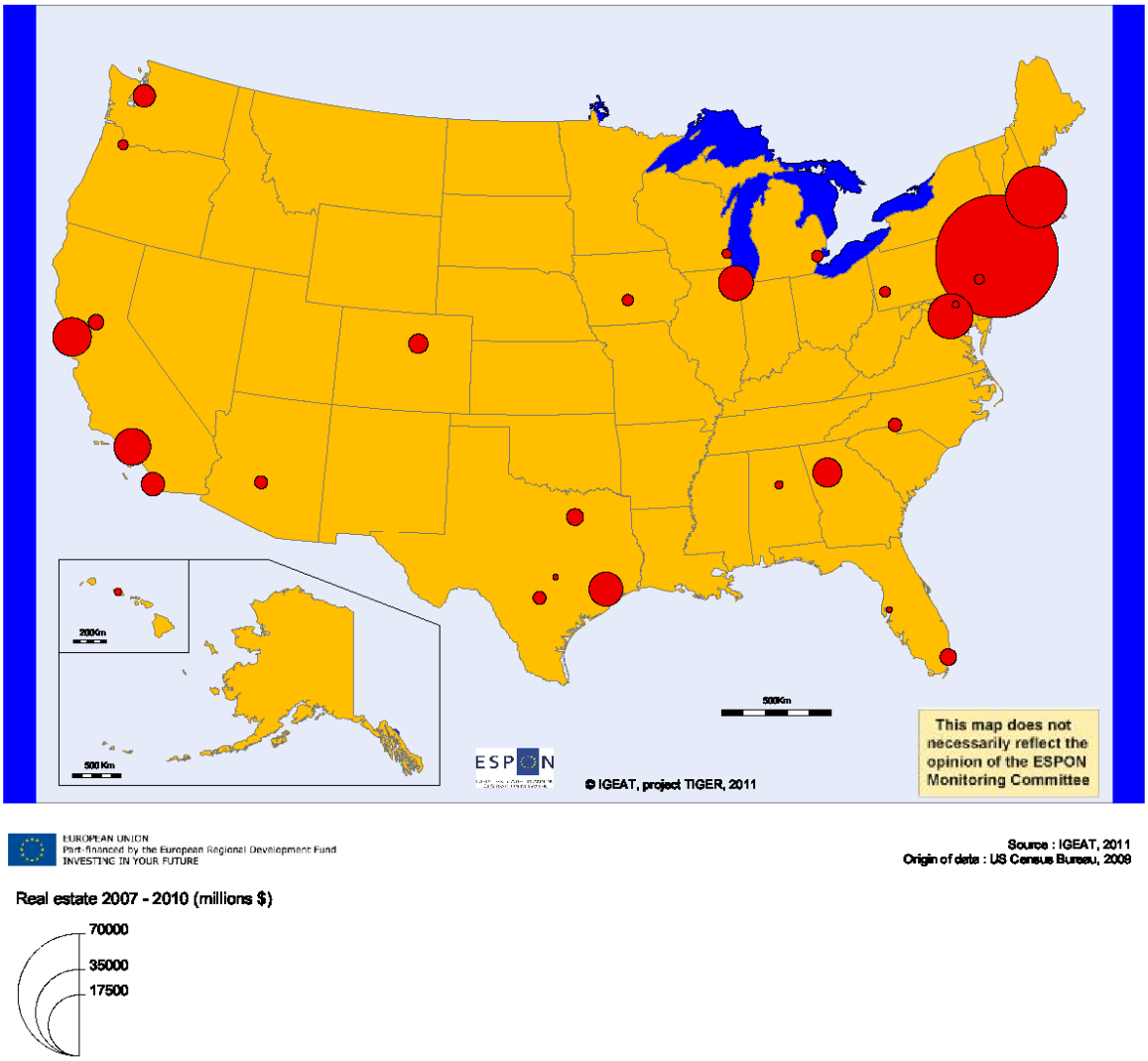


Table 12: Concentration of investments in office real estate in cities – average figures for the EU and the US, 2007-2010

Real estate (in % of cities) - EU	
2007-2010	
1 to 5	66.55
Londres	*33.97*
Paris	*10.58*
Madrid	*7.67*
Frankfurt	*7.67*
Munich	*6.66*
1 to 10	81.99
1 to 20	94.06
1 to 50	100.00

Real estate (in % of cities) - US	
2007-2010	
1 to 5	77.74
New York	*49.51*
Boston	*12.37*
Washington	*6.60*
San Francisco	*4.86*
Los Angeles	*4.40*
1 to 10	91.63
1 to 20	98.31
1 to 50 (28)	100.00

Table 13: Concentration of extra-continental investments in office real estate in cities – average figures for the EU and the US, 2007-2010

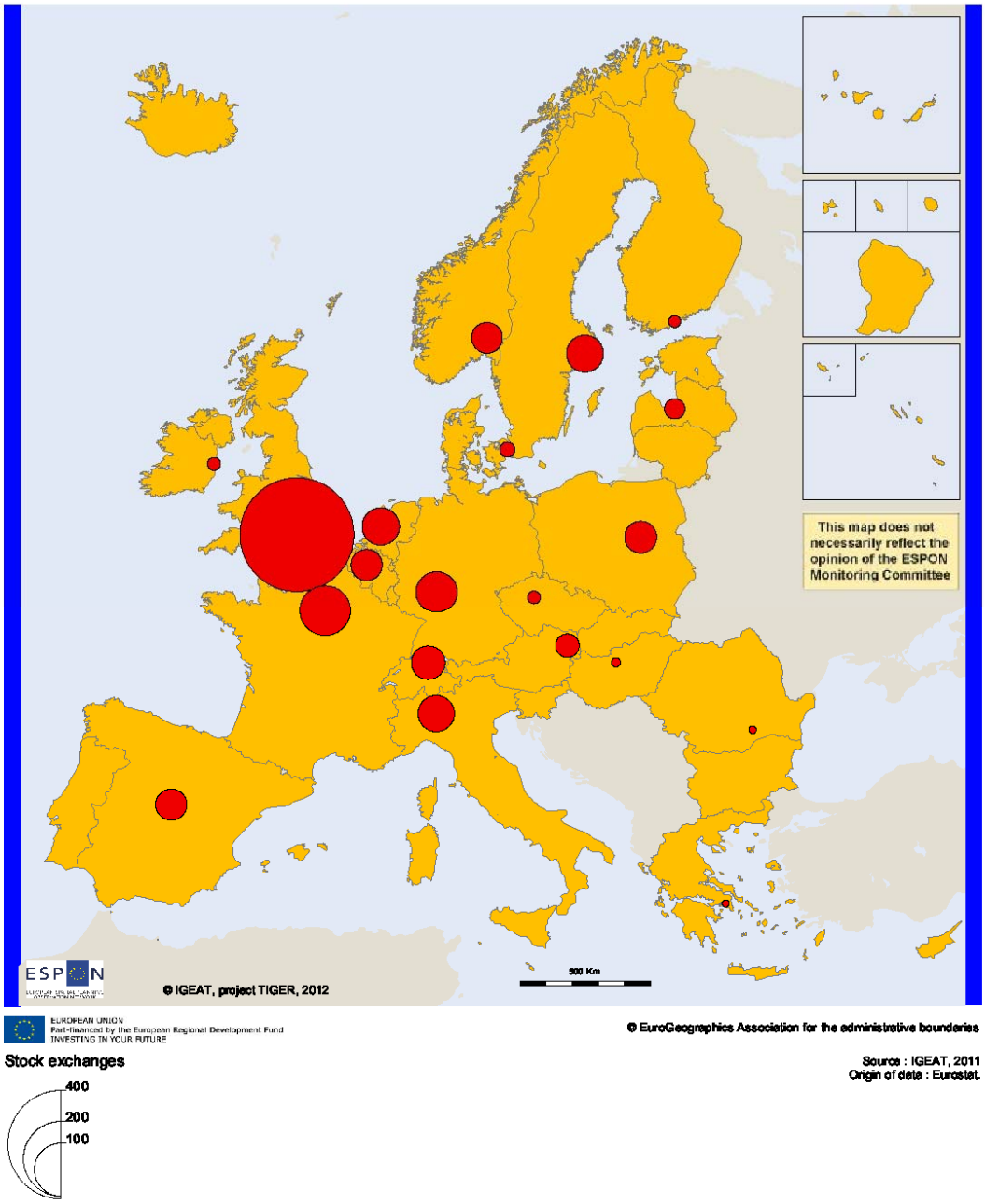
Real estate extra-EU (in % of cities)		Real estate extra-NAFTA (in % of cities)	
2007-2010		**2007-2010**	
1 to 5	82.81	1 to 5	92.76
Londres	*48.04*	*New York*	*68.08*
Frankfurt	*12.76*	*Boston*	*12.15*
Paris	*12.68*	*Washington*	*5.69*
Munich	*5.49*	*Los Angeles*	*4.26*
Berlin	*3.84*	*Atlanta*	*2.58*
1 to 10	94.46	1 to 10	98.98
1 to 20	99.15	1 to 20 (12)	100.00
1 to 50	100.00	1 to 50	100.00

2.2.7. Stock exchanges

The internationalisation of stock exchanges is measured by the number of non national companies quoted on the stock exchange (WP 10).

Concentration on the two most global financial cities is very high: New York is the only stock exchange where foreign companies are being quoted, while London has the leading role – though not exclusively – in Europe, and Paris is far behind.

Map 17: Number of foreigner issuers in the stock exchanges 2010 – EU



Map 18: Number of foreigner issuers in the stock exchanges 2010 – US

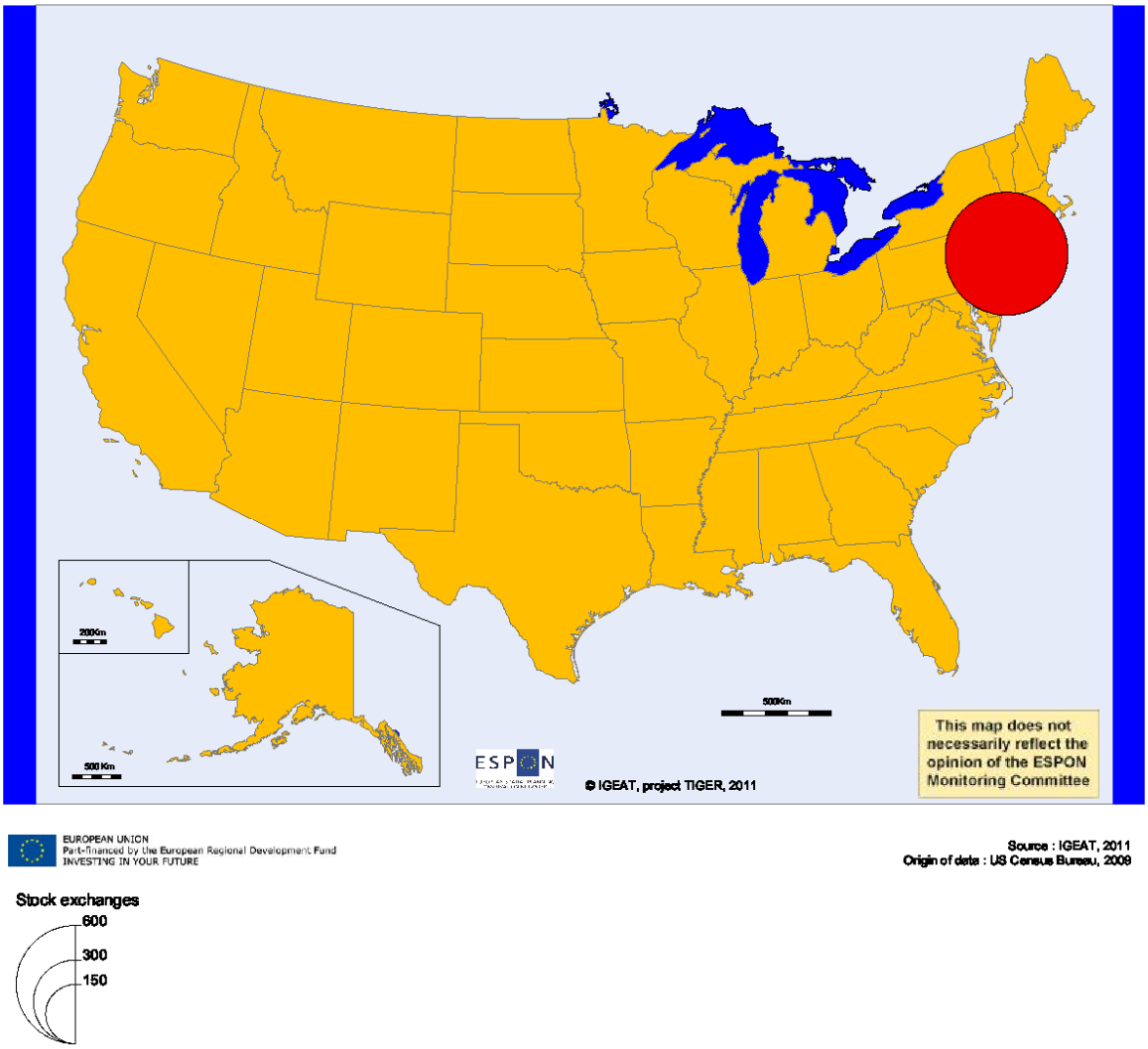


Table 12: Concentration of foreign quotation in stock exchanges in European cities, 2010

Stock exchange (in % of cities)	2010
1 to 5	70.75
Londres	*45.85*
Paris	*9.09*
Frankfurt	*6.03*
Amsterdam	*4.94*
Stockholm	*4.84*
1 to 10	90.02
1 to 20	100.00
1 to 50	100.00

Stock exchange extra-EU (in % of cities)	2010
1 to 5	82.95
Londres	*54.09*
Paris	*12.73*
Madrid	*6.36*
Zurich	*5.23*
Amsterdam	*4.55*
1 to 10	98.41
1 to 20 (14)	100.00
1 to 50	100.00

Note: There is no table for the US since New York is the only financial stock exchange, and concentration is obviously maximal.

2.3. Conclusion

Table 13 synthesizes the concentration of population, wealth and gateway functions for the most important five cities, including their evolution when data are available. Several conclusions can be drawn at this stage:

- The level of concentration on major cities is much more pronounced in the US than in Europe, which is characterized by a low number of very big (global) cities. This results from the historical political division of Europe which has allowed a large number of medium cities to emerge.
- In contrast to basic indicators, some gateway functions have a similar level of concentration in Europe and in the US, especially economic command functions and hub functions for air services. This probably reflects the growing unity of the European space, in which a few cities are able to play the role of gateways between European territories and the rest of the world, as is the case with air services.
- From our data, we cannot deduce clear trends of concentration in the US nor in Europe. Concentration to (global) cities has not been significant in the last ten years, even if in Europe one could have expected the integration of markets would increase the role of the major gateways.

Table 13: Synthesis of the concentration in EU and US

	EU			US		
Population		**1999**	**2007**		**2000**	**2009**
	1 to 5	7.93	8.16	1 to 5	18.0	17.6
	London	*2.56*	*2.57*	*New York*	*6.5*	*6.2*
GDP		**1999**	**2008**		**2001**	**2008**
	1 to 5	11.7	12.1	1 to 5	22.6	23.1
	Paris/London	*3.9*	*4.2*	*New York*	*8.7*	*8.9*
Headquarter			**2008**			**2008**
	1 to 5		57.2	1 to 5		40.1
	Paris		*22.5*	*New York*		18.2
GaWC (extra)			**2008**			**2008**
	1 to 5		18.24	1 to 5		27.00
	Paris		*4.96*	*New York*		*9.54*
Harbour functions (extra)		**1996**	**2006**		**1996**	**2006**
	1 to 5	32.22	29.23	1 to 5	50.02	45.54
	Rotterdam	*7.15*	*6.67*	*New York/Miami*	*11.56*	*9.85*
Air service (extra)		**1999**	**2008**		**1999**	**2008**
	1 to 5	69.19	70.66	1 to 5	65.79	64.38
	London	*27.31*	*27.92*	*New York*	*27.54*	*30.70*
Stock exchange (extra)			**2010**			**2010**
	1 to 5		82.95	1 to 5		/
	London		*54.09*	*New York*		*100.00*
Real estate (extra)			**2007-10**			**2007-10**
	1 to 5		82.81	1 to 5		92.76
	London		*48.04*	*New York*		*68.08*

3. Classification of cities according to the nature and intensity of links to global networks

3.1. Total connectivity

Our objective is to classify cities according to the nature of their links to European and global networks. This approach complements conventional approaches of sector specialisations, by

strictly putting emphasis on cities' role in global networks. This classification is based on 6 different types of networks, hence 6 indicators. For all types of networks, we measure both total connectivity and extra-continental connectivity for each city, in order to highlight those with real gateway functions for the European space. The different networks we examine are the following:

- firms in advanced producer services (GaWC) for the year 2008;
- air connections for 2008;
- containers connectivity of ports for 2006;
- foreign quotation on stock exchanges for 2010;
- investments in office real estate between cities (average 2007-2010).

To this we add an indicator of command functions: location of headquarters (2008).

For each city, we calculate indicators of total or extra-continental connectivity for each network, which results in 5 indicators in absolute figures. To make these indicators comparable, we calculate the share of each city in the total connections. For example, for air connections, we calculate each city's share in the total number of flights concerning European (or US) cities. We proceed similarly for headquarters.

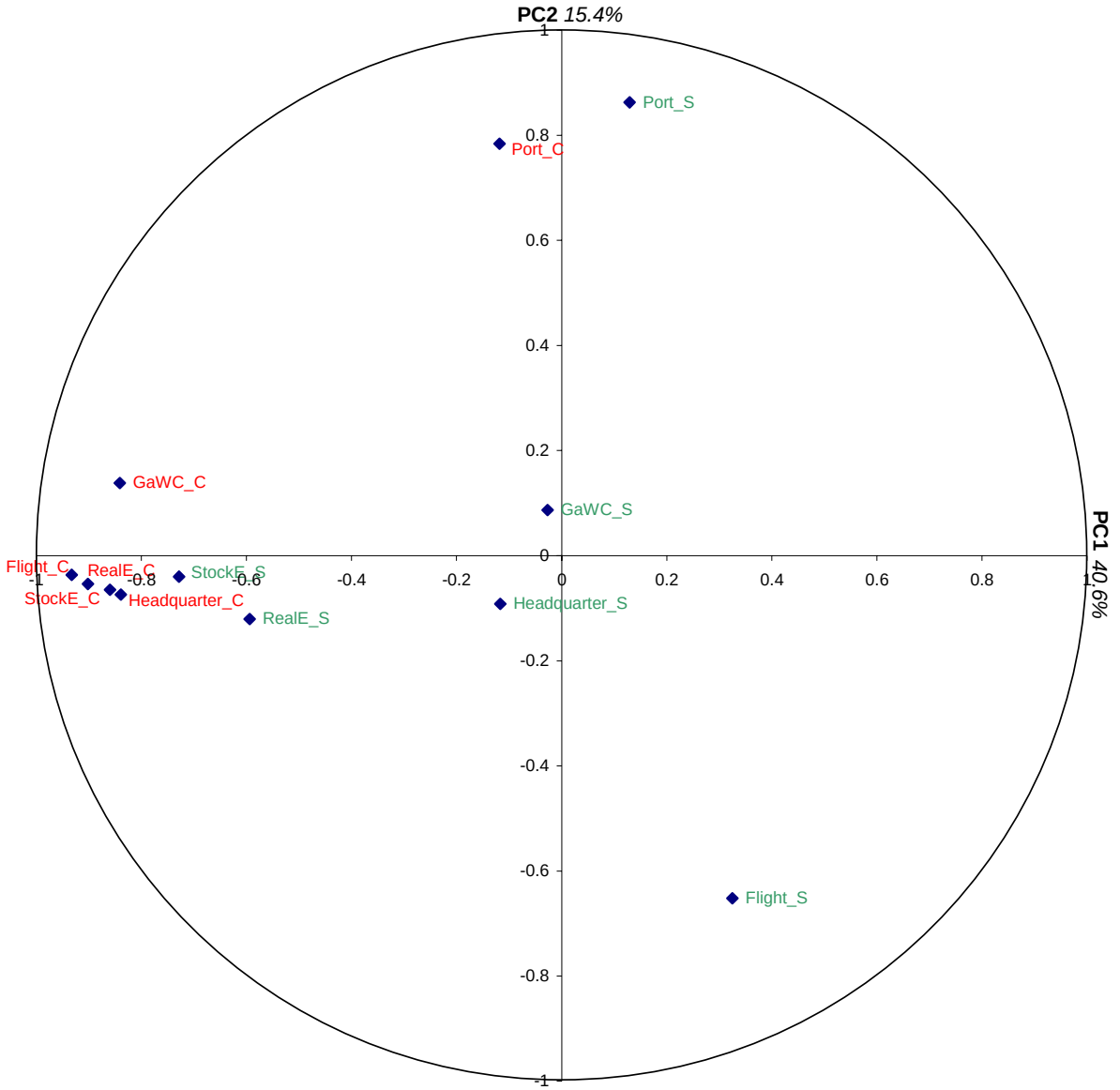
To these 6 basic indicators showing the concentration (C) of gateway functions in each city, we add 6 indicators of specialisation (S). We first calculate each city's average for all 6 indicators, and then the ratio between its share in each network and the average so as to highlight its specialisation.

It is thus the combination of volume and specialisation that enables us to classify cities. Volume indicates the total weight of cities in each network, and emphasizes the decisive role of a few cities in each type of networks. Specialisation complements volume in that it highlights in which types of gateway function a city is specialised whatever its position in global networks. Had we focused on volume only, we would have obtained unsatisfactory classifications corresponding to the urban hierarchy, since big cities tend to concentrate all global functions, except maritime gateway ones. On the other hand, considering only specialisation indicators would have resulted in rather confusing classification: indeed, a number of medium cities are limited to one or two gateway functions.

Two other steps complement our classification:

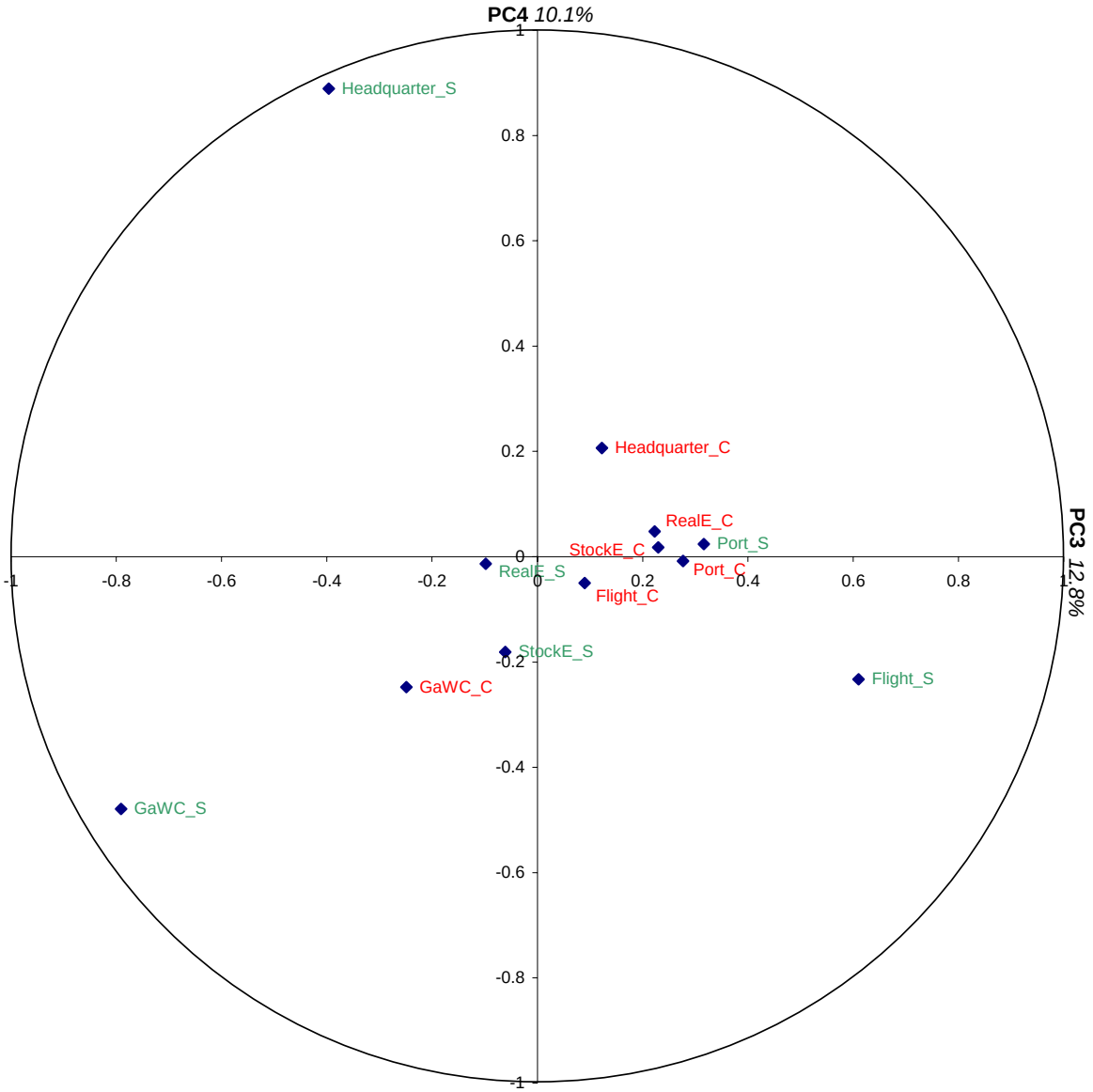
- A *Principal Component Analysis* (PCA) on the 12 indicators allowing us to retain the most relevant information in a few new variables. For both EU and US, we keep the first 4 PCs for which the information return is greater than one variable.

Figure 1: Correlation between indicators and the 2 first principal components, and their % of information return



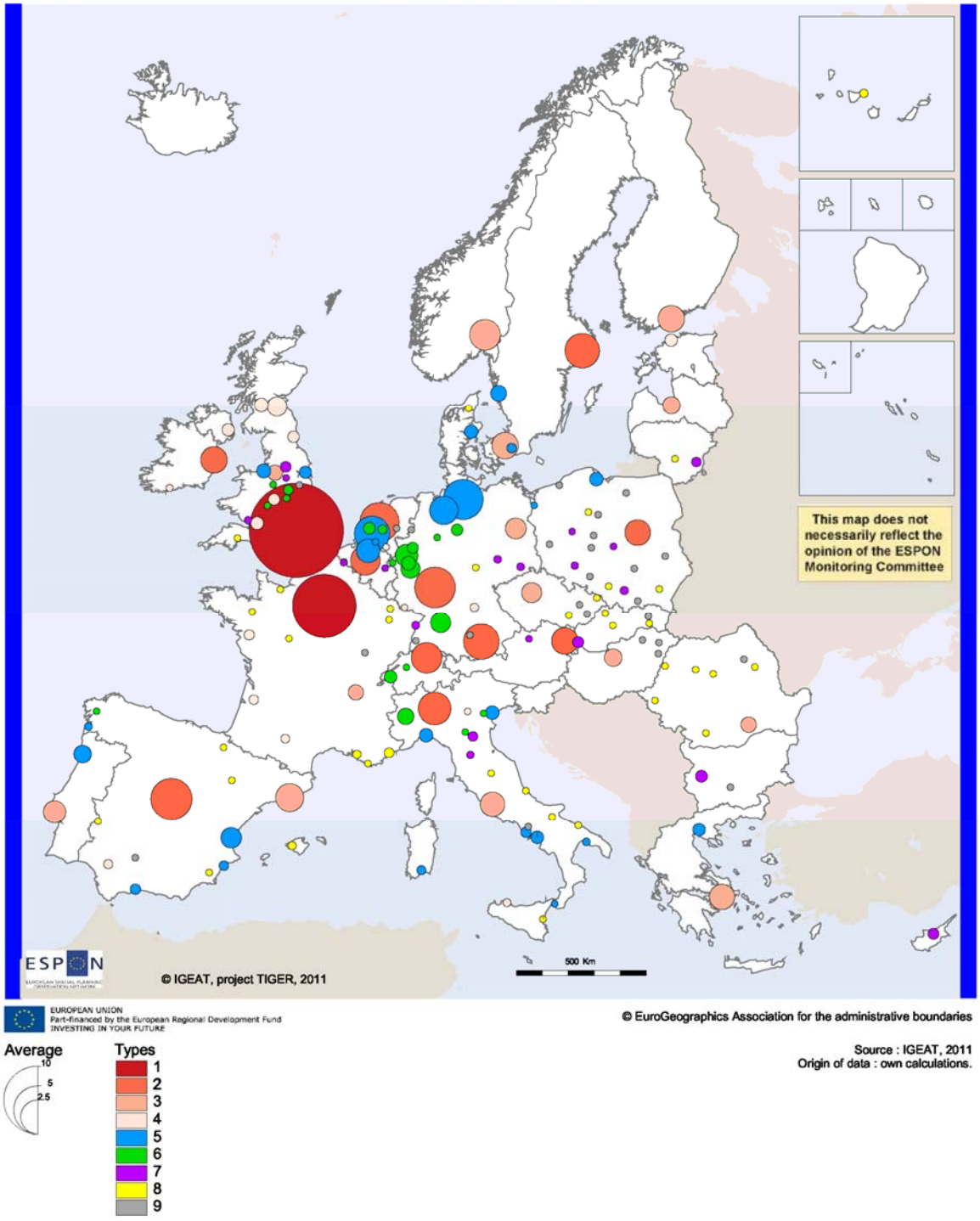
The first component illustrates the weight of cities that play a major role in all types of networks, except maritime networks. It indicates that global/major cities tend to concentrate all gateway functions. Hence, the first component highlights the urban hierarchy at continental level, and cities with a high score on this component tend to have a central role in all but maritime networks. The second essentially takes port functions into account, while the next components highlight high specialisations in certain types of networks. The third component isolates cities with major economic command functions, as opposed to the higher number of cities playing a role in advanced services. Finally, the fourth component isolates the relative importance of air connections for all those cities for which international functions are mainly related to air services.

Figure 2: Correlation between indicators and principal components 3 and 4, and their % of information return



- A *Hierarchical Clustering* is also performed on these first four Principal Components weighted by the square root of their eigenvalue in order to take the relevance of each component into account. Therefore, the classification gives more emphasis to the first than the fourth CP. The clustering process is limited to 7 groups for the US and 8 for the ESPON territory. We add an additional group that includes all the urban areas whose connectivity is nil for all types of networks.

Map 19: Classification on gateway functions – EU



Note: The size of the circles represents the weight of gateway functions (% of total EU) for each urban area.

	Number of cities	Weight of gateway functions	Relative specialisation (1=average specialisation)					
		Part of total EU	GaWC	Headquarter	Flight	Ports	Stock exchange	Real estate
Type 1	2	28.24	0.34	1.77	0.65	0.08	1.70	1.47
Type 2	11	26.89	1.20	0.88	1.08	0.02	1.45	1.37
Type 3	14	15.33	1.97	0.41	1.58	0.98	0.45	0.60
Type 4	17	4.17	1.63	0.44	2.50	0.94	0.00	0.49
Type 5	25	15.76	0.46	0.08	0.82	4.58	0.00	0.06
Type 6	20	5.68	1.05	4.06	0.63	0.02	0.00	0.24
Type 7	19	2.85	4.45	0.16	1.27	0.05	0.00	0.08
Type 8	37	1.08	0.00	0.00	5.90	0.07	0.00	0.03
Type 9	26	0.00	null	null	null	null	null	null

The first four groups are characterised by cities with diversified gateway functions – they show high values for many indicators. These groups are represented in a red gradient: with London and Paris in the darkest red (type 1) corresponding to the highest scores. This first group of only two cities represents a bit more than one quarter of the total (all cities) weight of gateway functions – London alone accounting for nearly 20%. The next groups can be considered as less and less important despite diversified types of gateway: type 2 includes Brussels, Amsterdam, Frankfurt, Stockholm, Madrid, and Warsaw as the only Eastern European city; type 3 groups cities with a less prominent role in global networks, such as capital cities in peripheral Europe (most capital cities of Eastern Europe plus Rome, Lisbon, Athens, Copenhagen, Helsinki or Oslo) as well as Barcelona; finally, type 4 includes cities of much lower importance in networks but still characterized by their diversification in the nature of gateway functions they are specialised in.

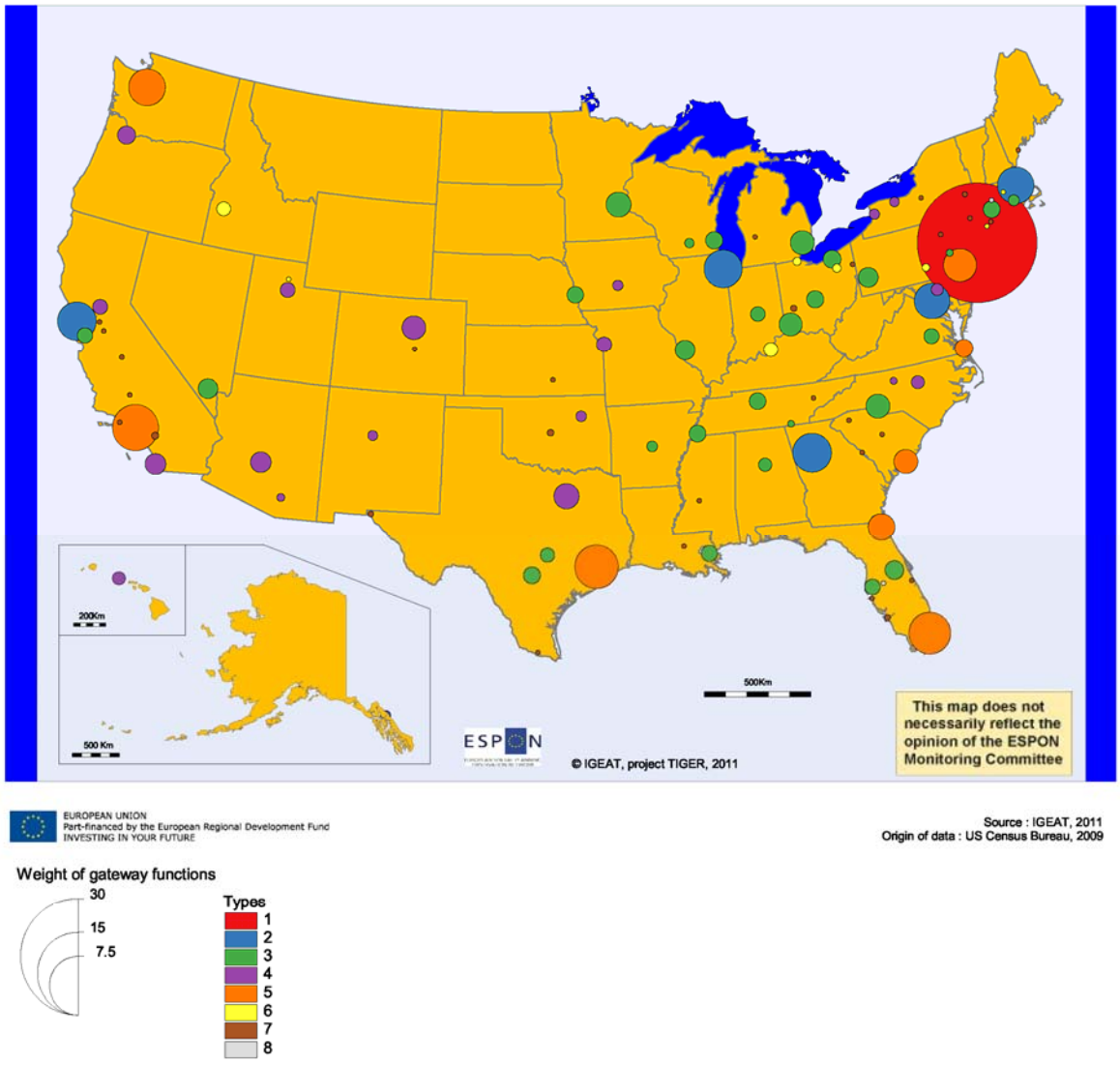
The four next groups, from 5 to 8, distinguish themselves by a marked specialisation in only one type of gateway functions. Type 5 groups together rather important cities mainly specialised in harbour functions (e.g. Hamburg, Rotterdam, Bremen and Antwerp). Type 6 (green) is specialised in transnational headquarters, which means that despite an insignificant role in global networks they host major transnational companies. This is typical of cities located in the Rhine-Ruhr or Turin. Type 7 (pink) contains cities mainly present in the firms' networks of advanced producer services (GaWC), and Type 8 cities with air connections only (yellow).

However, we must also bear in mind that 'to be specialised in' does not mean 'to have the biggest absolute value in the indicator'. For instance, types 6 to 8 correspond to small cities specialised in one gateway function as a result of the fact that it is nearly the only function for which data are not nil. This is confirmed by the low values in weight of gateway functions for these groups (Table).

The last group includes cities for which no data are available.

The same classification method has been used for the US (map 20). The results can be interpreted the same way as in the EU, in spite of some differences in the urban hierarchy. The pre-eminence of New York is much higher than London's in the ESPON territory. Behind New York, only few cities concentrate a diversified range of gateway functions: they are represented in the blue type. The orange type concentrates port gateways which are, in opposition to Europe, mainly large cities with other global functions. As for the other types, they include cities specialised in some global functions.

Map 20: Classification on gateway functions – US



	Number of cities	Weight of gateway functions	Relative specialisation (1=average specialisation)					
		Part of total EU	GaWC	Headquarter	Flight	Ports	Stock exchange	Real estate
Type 1	1	32.24	0.27	0.57	0.22	0.31	3.10	1.54
Type 2	5	15.80	1.23	1.12	1.33	0.33	0.00	1.99
Type 3	28	18.20	2.07	2.15	1.43	0.23	0.00	0.12
Type 4	18	9.33	2.84	0.27	2.28	0.14	0.00	0.48
Type 5	8	22.02	0.67	0.47	0.61	3.90	0.00	0.34
Type 6	8	1.39	0.00	5.29	0.71	0.00	0.00	0.00
Type 7	29	1.01	0.00	0.25	5.75	0.00	0.00	0.00
Type 8	2	0.00	null	null	null	null	null	null

3.2. Extra-continental connectivity

We finally apply the same analyses to extra-continental connections. 'Extra-continental' is defined as extra-NAFTA and Central America for US cities, and extra-European and neighbourhood areas for European cities. Neighbourhood includes here former USSR, near

Middle East (Lebanon, Turkey, Syria, Jordan) and Northern Africa. Hence, we highlight cities with truly global connectivity in networks, excluding those cities whose connections with the rest of the world, sometimes very local, as for example connections between Baltic and Russian cities, or Spanish and North African cities. This analysis is limited to five networks, excluding headquarters, and we only consider the first three components.

As in the PCA on total connectivity, the first principal component highlights the opposition between cities with diversified networks – once again excluding maritime networks – and the others. The second component opposes cities specialised as port gateways to those rather specialised in networks of advanced producer services firms.

Figure 3: Correlation between indicators and the first 2 principal components, and their % of information return

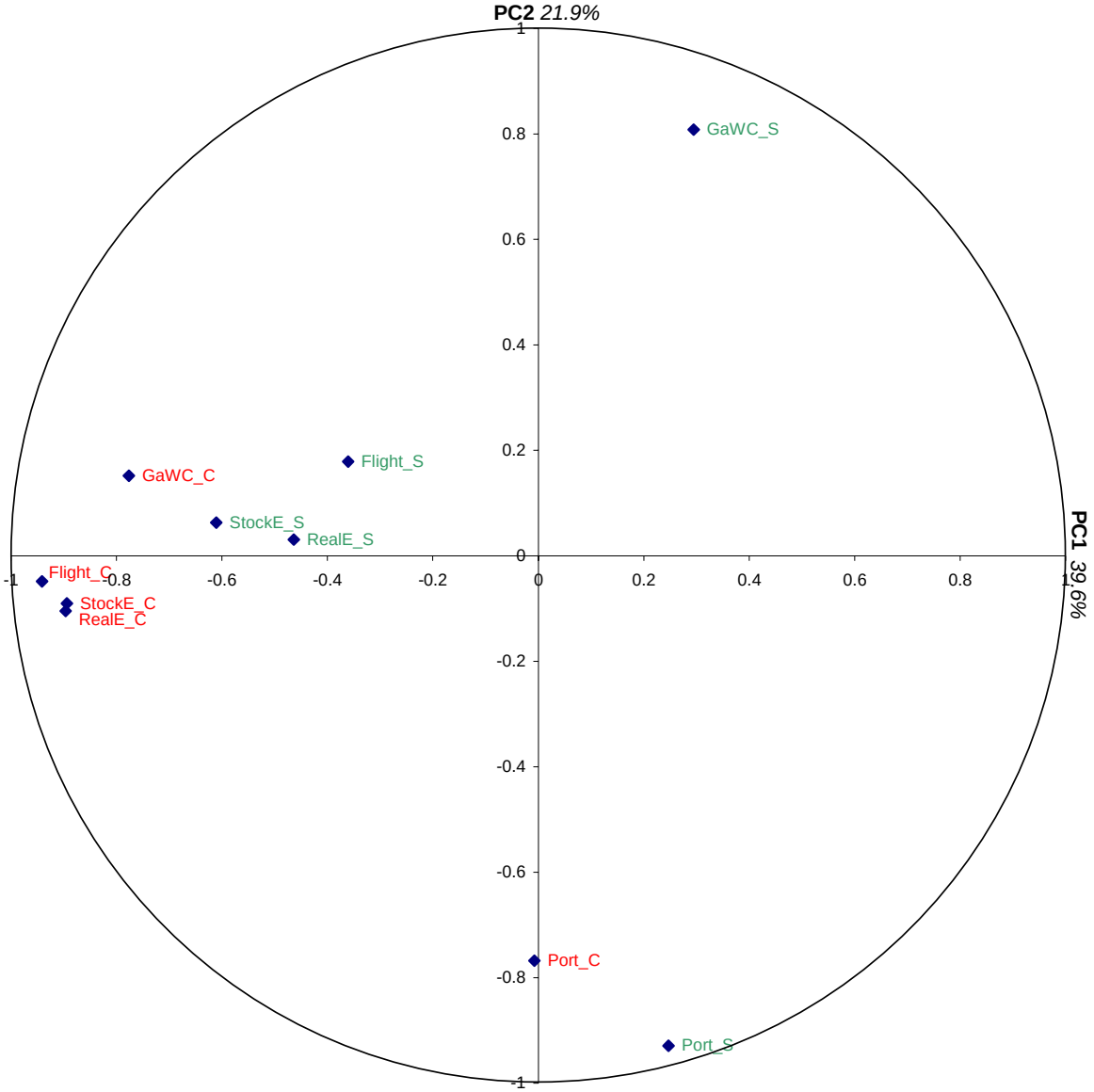
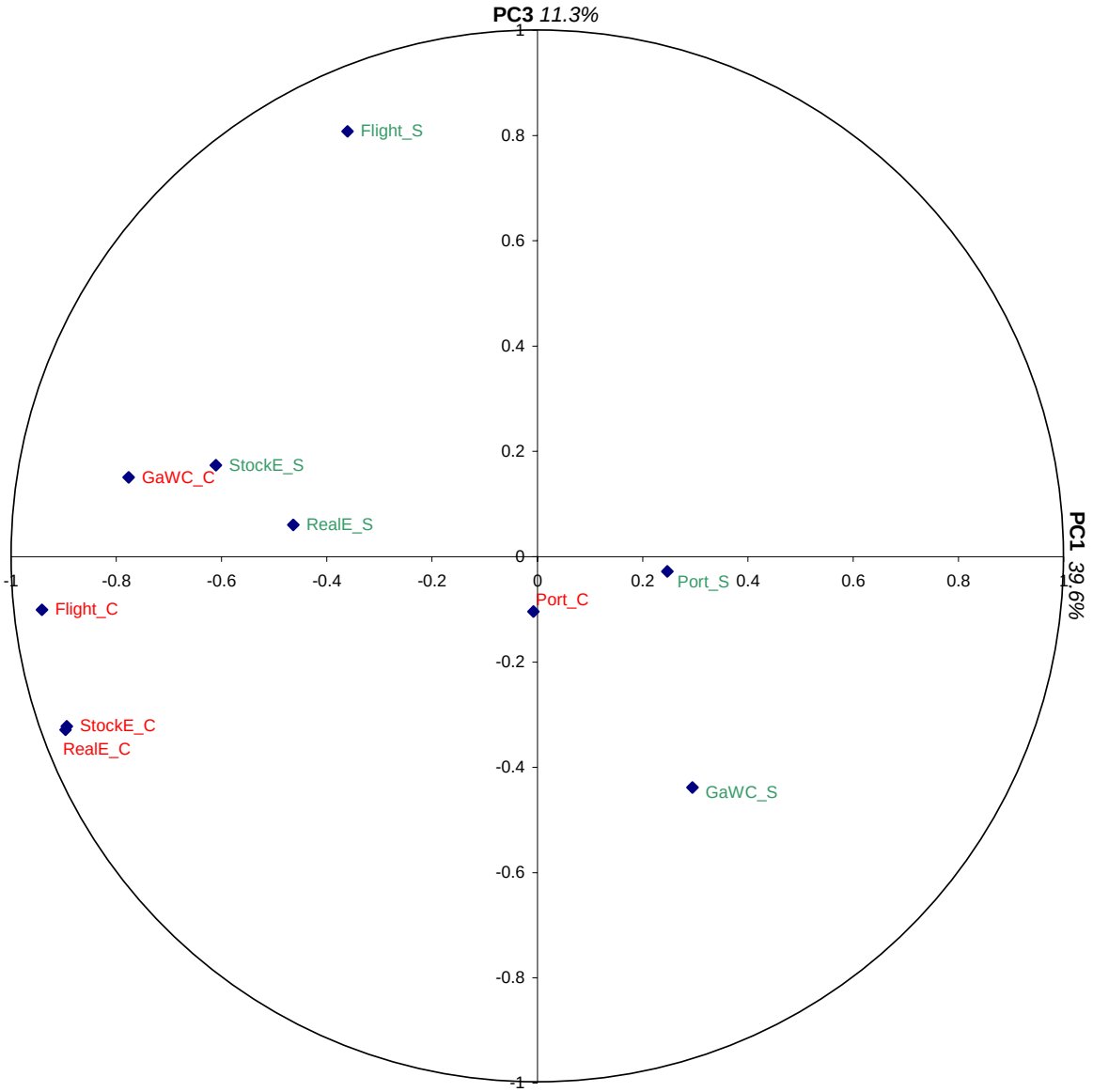
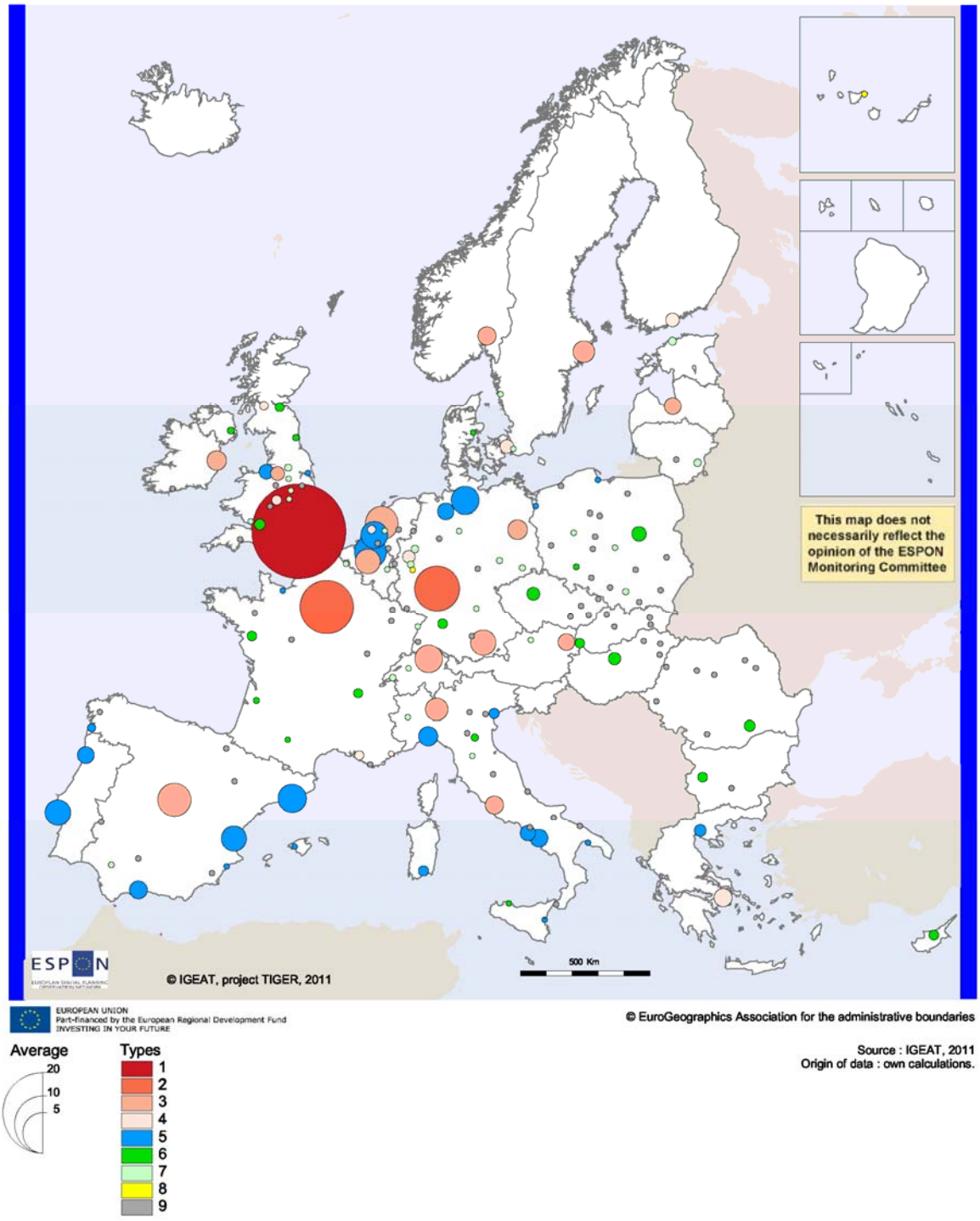


Figure 4: Correlation between indicators and principal components 1 and 3, and their % of information return



Map 21: Classification on extra-continental gateway functions – EU



	Number of cities	Weight of gateway functions	Relative specialisation (1=average specialisation)				
		Part of total EU	GaWC	Flight	Ports	Stock exchange	Real estate
Type 1	1	27.63	0.18	1.00	0.12	1.96	1.74
Type 2	2	15.29	0.40	1.87	0.00	1.02	1.72
Type 3	14	23.02	1.58	1.39	0.01	1.13	0.89
Type 4	9	3.74	2.77	1.26	0.22	0.04	0.70
Type 5	25	22.15	0.30	0.09	4.54	0.00	0.07
Type 6	20	5.35	3.97	0.30	0.48	0.03	0.22
Type 7	28	2.82	4.95	0.03	0.02	0.00	0.00
Type 8	2	0.01	0.00	5.00	0.00	0.00	0.00
Type 9	70	0.00	null	null	null	null	null

If we look at map 21, what is most notable is the low number of cities that really play a role in the extra-European context. Indeed, apart from main (often capital) cities and ports, most cities have a very limited weight in gateway functions outside Europe. This is especially confirmed by type 9 (in grey), which includes 70 cities without any extra-continental connection. Second, London is even more dominant than in the previous classification – more than one quarter of the total weight in gateway functions. In this context, Paris loses importance, with a profile similar to Frankfurt's.

As in the classification on total connectivity, the first 4 types are characterised by diversified gateway functions, except harbour connectivity which is the specialisation of Type 5 (blue). Types 6 and 7 are both in green (dark and light) because of their similar specialisation in GaWC combined with a very low part in total EU.

4. Classification of cities according to the geography of networks

We will focus in this section on the geography of networks. For this purpose, we consider each city's relationships with the rest of world, divided into 20 macro-regions (WUTS).

Data by world region are available for the 5 following indicators:
- firms in advanced producer services (GaWC) for the year 2008;
- air connections for 2008;
- containers connectivity of ports for 2006;
- foreign quotation on stock exchange for 2010;
- investments in office real estate between cities (average 2007-2010).

This means 100 variables (5x20) in absolute terms. We first calculated the share of a region in the total for each indicator and, in order to reduce the high number of variables, we calculated the mean value of all 5 indicators for each region and retained only these 20 new variables.

After that, we built a classification characterized by a cleavage opposing European and global profile. Therefore, we decided to analyse the geography differently. A first map (Map 22) represents the part of the ESPON (W111 and W112a) space in the geography of cities' networks. We also created a new typology excluding ESPON networks to better understand extra-European geography. Moreover, we used new variables to indicate each world region's specialisation. This was first calculated by indicator in each region and for each city:

$$S_{xj} = \frac{V_{xj} / V_{xtot}}{V_{totj} / V_{tottot}}$$

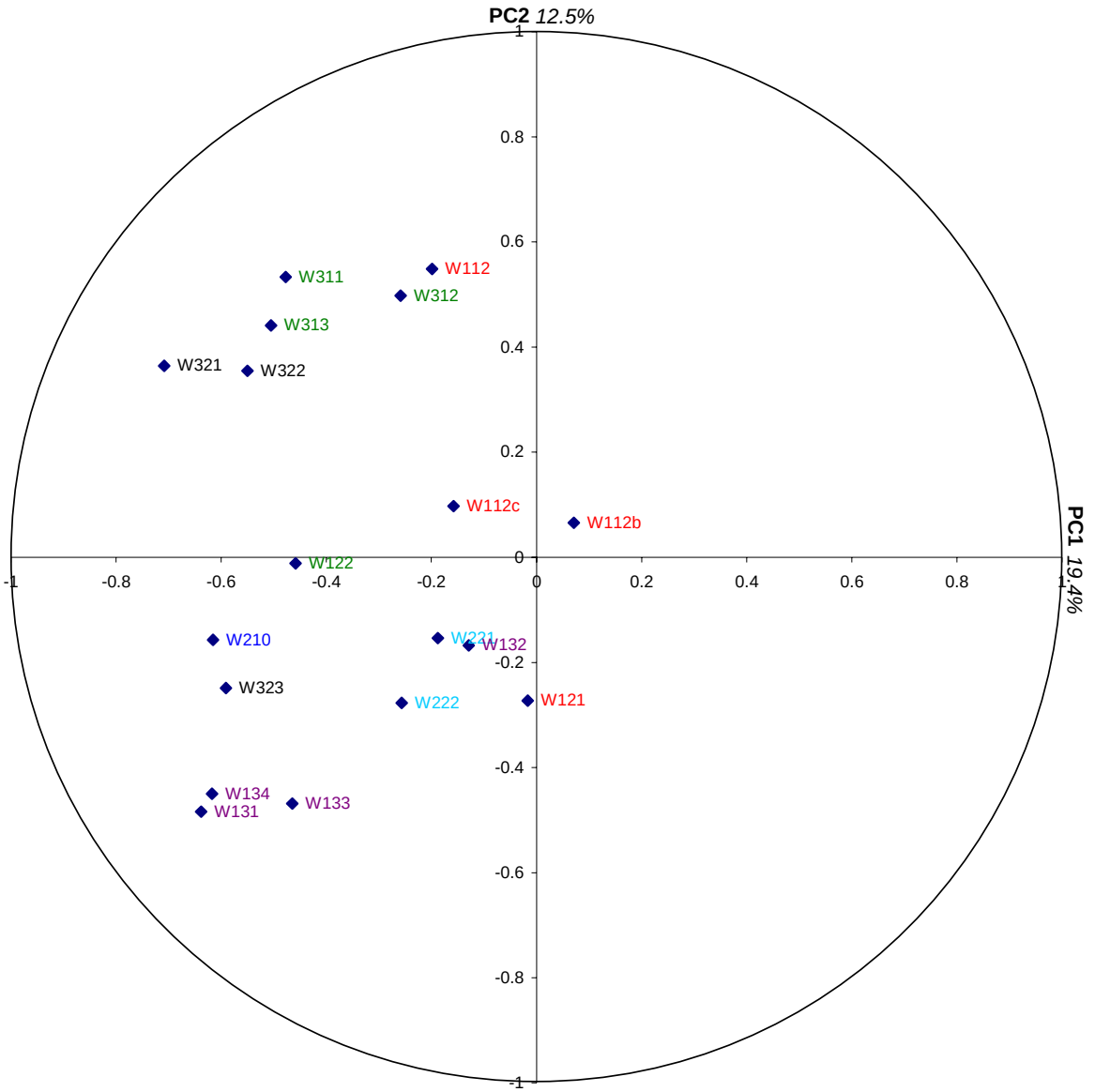
where S_{xj} = specialisation in region 'x' for the city 'j'
V_{xj} = value for the city 'j' in the region 'x'
V_{xtot} = total value of a region 'x' for all the cities
V_{totj} = total value of all the regions for the city 'j'
V_{tottot} = total value of all the regions for all the cities

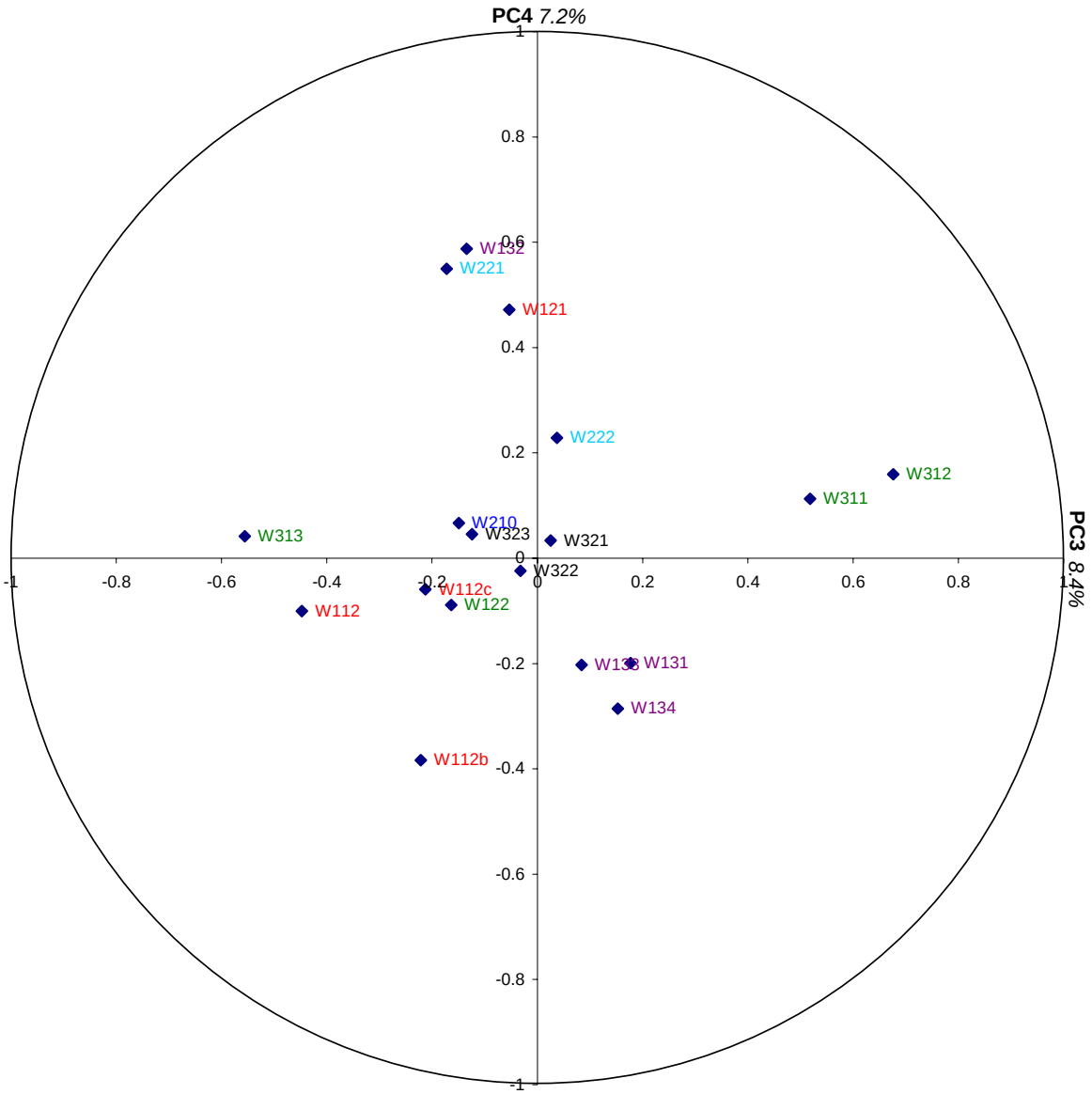
Second, we calculated the mean value of all indicators to reduce the number of variables to 18.

As for the typology, we proceed in two steps: a principal component analysis, from which we keep only the 4 principal components even if 8 have an eigenvalue higher than 1, and a hierarchical ascendant cluster analysis.

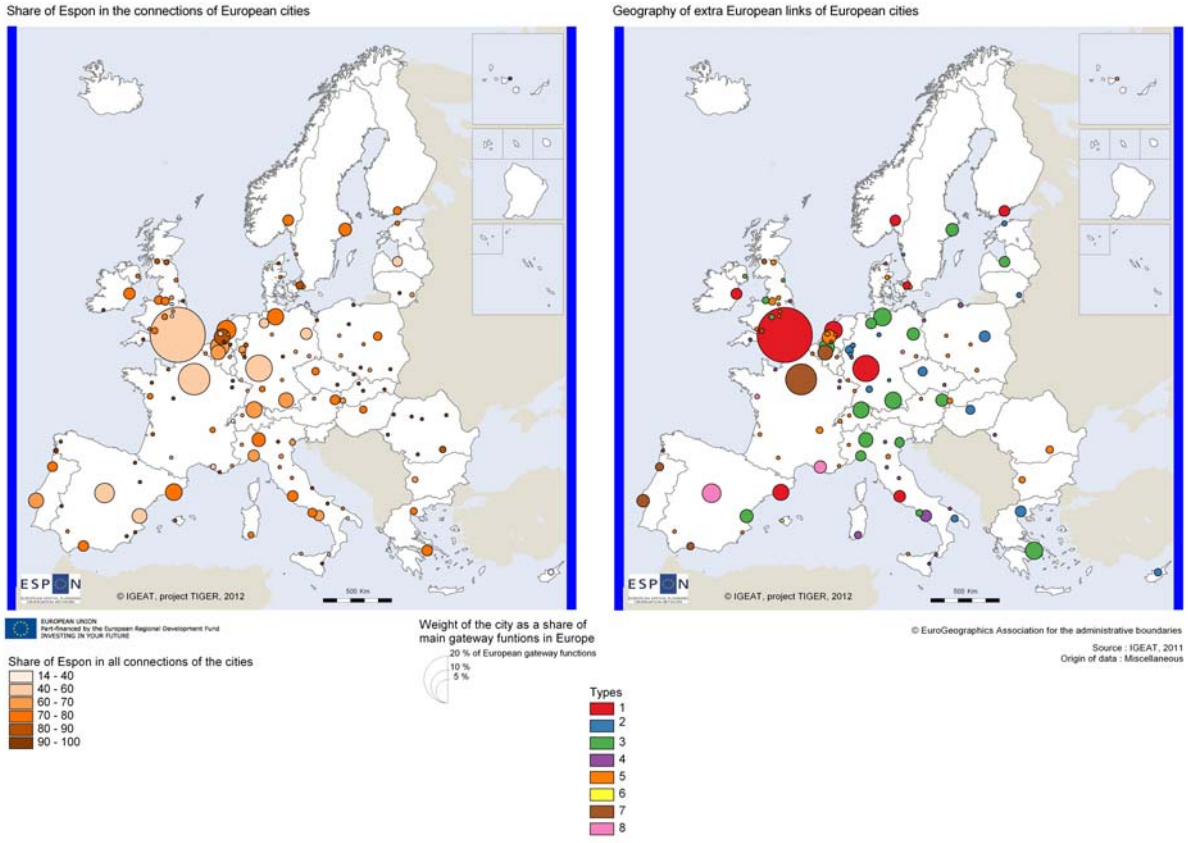
Our results are represented below.

Figure 6: Correlation between indicators and the 4 first principal components, and the % of information return




PC4 7.2%
PC3 8.4%
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
W132
W221
W121
W222
W312
W311
W210
W313
W323
W321
W322
W112c
W112
W122
W131
W134
W112b

Map 22: Share of Espon in the connections of European cities and Geography of extra-European links of European cities



	Number of cities	W112	W112b	W112c	W121	W122	W131	W132	W133	W134	W210	W221	W222	W311	W312	W313	W321	W322	W323
Type 1	9	1.92	0.58	0.64	0.59	0.71	0.29	0.43	0.40	0.50	0.87	0.60	0.41	1.40	0.68	1.11	0.88	1.17	0.52
Type 2	16	0.96	1.27	0.70	0.26	0.26	0.27	0.24	0.25	0.24	0.24	0.20	0.18	0.27	0.23	0.36	0.28	0.24	0.18
Type 3	19	0.79	0.69	0.86	0.52	0.59	0.40	0.35	0.38	0.39	0.73	0.31	0.35	0.36	0.49	0.39	0.43	0.61	0.59
Type 4	19	0.49	0.51	0.00	0.31	0.05	0.01	0.02	0.03	0.01	0.03	0.02	0.26	0.04	0.09	0.00	0.01	0.03	0.01
Type 5	37	0.33	0.39	0.36	0.68	0.21	0.30	0.31	0.30	0.26	0.30	0.35	0.24	0.17	0.35	0.20	0.18	0.19	0.19
Type 6	1	0.52	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.01	14.36	0.00	1.11	1.66	0.00
Type 7	8	0.21	0.29	0.25	0.55	0.51	1.99	0.43	2.16	2.39	0.68	0.31	1.13	0.56	0.45	0.21	0.55	0.57	0.72
Type 8	4	0.23	0.36	0.37	0.85	0.30	0.48	4.16	0.47	0.27	0.42	2.01	2.81	0.22	0.28	0.31	0.26	0.21	0.93

The first type (in red) has the most global profile. It is notably the case of London, Frankfurt, and Amsterdam. This worldwide distribution is also present for the third type (green) but with a lower total weight in gateway functions. The second type is relatively specialised in the rest of Europe, especially the Balkans (W112b) and former URRS (W112).
All the cities with a very low weight in networks and thus a more uncertain geography are included in types 4 (the lowest weight and the most uncertain) and 5.

The last three types present a less global character, nevertheless more oriented toward one or more regions of the world:

- Type 6 → is only represented by Palma de Mallorca, particularly oriented toward Asia.
- Type 7 → shows relative specialisation in Africa, as observed in the table. Logically, we find here Paris, Brussels, and Lisbon (among others).
- Type 8 → especially Madrid with a high concentration of networks toward South America.

Conclusion

In this paper, we have described the urban systems of the European territory, by comparing it to the US. We highlight the low concentration of the European urban system, resulting in the limited number of very big cities, apart from London and Paris. This can be explained by the political divisions of Europe, which has resulted in the emergence of important cities in each European country and a limited process of urban agglomeration at European scale.

However, it has also been shown that gateway functions in transport, advanced services, real estate, or commanding economic functions are concentrated within few major cities in Europe, to a similar level as in the US depending on the types of gateway functions. Hence, the absence of very large cities does not necessarily result in the low concentration of major hub.

In this paper, the importance of cooperation and complementarities between city economies has been highlighted in this project by the diversity of gateway functions of urban areas in Europe (see also WP 3, 9, 15, 17). This diversity is functional but also geographical. As far as the functional specialization of cities is concerned, we observe a strong correlation between the different types of functions: the cities' role in advanced business services, as commanding centre for firms, as major hub for air connections or as nodes for real estate investments are strongly correlated with each other (Maps 20 and 21). However, in Europe, port urban areas are distinguished as hubs in the transportation of goods but seem to be very specialized in this type of function. Also, some medium size cities still remain the commanding centres for large firms without playing an important role in the wider networks related to the activities of those firms. Overall, the result is a complex urban system in which cities seem to have intermediary roles at different levels (global, European, national, regional), rather than being specialized in one specific function. This might be called a scale – instead of a functional – specialization of European cities. Of course, this conclusion has to be qualified since more refined analyses in advanced business services show that below a certain size, cities are more specialized in certain areas than others.

In addition to this scale specialization of cities, strongly linked to their position in the European urban system, we certainly observe a geographical specialization of cities in their gateway functions. Of course the most important cities have the more global geographical profile but still show specialization (Map 22): London is the most global European city in the geographical scope of its networks but still shows specializations toward Northern America, the Middle East and Eastern Asia; Paris is a global city, nevertheless showing specific linkages with Africa; Madrid is the European gateway for Latin America in nearly all types of networks we studied; Nicosie plays a gateway role with both former USSR and the Middle East. Here again, the lower the size of gateway functions, the most exclusive its geographical specialization in non European links.

Bibliography

Beaverstock, J.V., Smith, R.G. and Taylor, P.J. (1999), 'A roster of world cities', *Cities*, Vol. 16, No 6, pp. 445-458

Beaverstock, J. V., Smith, R. G. and Taylor, P. J. (2000), "World city-network: a metageography?", *Annals of the Association of American Geographers* 90 (1), pp. 123–134

Lennert *et al.* (2010), *FOCI, Future Orientations for CIties*, Final Report, ESPON, http://www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/foci.html

Castells, M. (1996), *The Rise of the Network Society*, Oxford, Blackwell

Sassen, S. (1991), *The Global City*, Princeton, Princeton University Press