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Demographic trends and scenarios

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This basic report exists only in an electronic version.

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1 Varied demographic patterns in Europe: "European demographies" rather than "European demography"

Since the 1970' the World population has been growing at a rate of one billion approximately every 12 years (PRB, 2011). However a vast majority of population increase is confined to developing countries, while the developed countries as a whole noted very small increases. Intra-European differentiation is significant. Eastern EU neighbours experience population decline and in some countries (Russia, Belarus, Moldova, Ukraine) dramatic levels of mortality, especially in males, comparable to those observed in developing countries (in a recent ranking of e(0) for total population, Russia is between India and Papua New Guinea, Belarus between Fiji and Bahamas; PRB, 2011). Countries to the south of the EU (South and East coast of Mediterranean) experience population increase driven by the above replacement fertility, young age structures and moderate mortality. In fact, the population growth in the South Mediterranean region is the second highest in the world, after sub-Saharan Africa. These differences in population dynamics of neighbouring regions generate and will generate in future a significant motivation to migrate – pressure to emigrate from North Africa and demand for migrants in Europe. Table 1 shows population characteristics for selected European, African and Asian countries.

Regions and countries of the world differ not only due to the speed of population change, but also due to its structure. European populations have usually regressive age structures with simultaneous "ageing from the bottom" (due to low number of births) and "ageing from the top" (due to low mortality of elderly). In the EU 18% of population is 65 or older and a similar share of population (16%) is less than 15 year old (PRB, 2013[1]). In Germany these shares are 21% and 13% respectively. In Africa population pyramids are progressive, high fertility guarantees population growth and young structures for the coming decades. In Egypt only 6% of population exceeded 64 years and 31% is below 15 (PRB, 2013).

Demographic differences between European nations and regions are so large that the continent is characterised by a plethora of distinct national demographies. However, there are some unifying pan-continental phenomena, like long term decrease in fertility and mortality.

[1] Data in the Population Data Sheet prepared annually by the Population Reference Bureau (PRB) usually refer to the year previous to the year of the publication of the PRB report or two years earlier. For some countries, in particular less developed, most recent data available at the time of compilation of the report are presented. (PRB 2011, 2013).

Table 1 Characteristics of population in ESPON and selected non-European countries

	Popula-tion mid-2011 (mln)	Net migration rate (per 1000)	Life expe-ctancy males	Life expe-ctancy females	TFR	% population aged <15	% population aged 65+	Projected population mid 2050 (mln)
World	6987	-	68	72	2.5	27	8	9587
EU	502	2	77	82	1.6	16	17	513
Austria	8.4	3	77	83	1.4	15	18	9.5
Belgium	11	6	77	82	1.8	17	17	12.5
Bulgaria	7.5	-3	70	77	1.5	14	18	5.7
Croatia	4,4	-1	72	80	1,5	15	17	3.9
Cyprus	1.1	6	76	81	1.6	17	10	1.1
Czech Republic	10.5	1	74	81	1.5	14	15	10.8
Denmark	5.6	4	77	81	1.9	18	17	6
Estonia	1.3	0	70	80	1.6	15	17	1.2
Finland	5.4	3	77	83	1.9	17	18	6.1
France	63.3	1	78	85	2	18	17	72.3
Germany	81.8	2	77	83	1.4	13	21	69.4
Greece	11.3	3	78	82	1.5	14	19	11.5
Hungary	10.0	1	70	78	1.3	15	16	9.2
Iceland	0.3	-7	80	84	2.2	21	12	0.4
Ireland	4.6	-8	77	82	2.1	21	11	6.1
Italy	60.8	6	79	84	1.4	14	20	62
Latvia	2.2	-4	68	78	1.3	14	17	1.8
Liechtenstein	0.04	2	79	82	1.6	16	14	0.04
Lithuania	3.2	-24	68	79	1.5	15	16	2.7
Luxembourg	0.5	15	78	83	1.6	18	14	0.6
Malta	0.4	-1	78	82	1.4	16	15	0.4
Netherlands	16.7	2	79	83	1.8	18	15	17.8
Norway	5.0	9	79	83	1.9	19	15	6.6
Poland	38.2	0	72	80	1.4	15	14	34.1
Portugal	10.7	1	76	82	1.3	15	18	10.7
Romania	21.4	0	70	77	1.3	15	15	18.5
Slovakia	5.4	1	71	79	1.4	15	12	5.3
Slovenia	2.1	0	76	83	1.6	14	17	2
Spain	46.2	1	79	85	1.4	15	17	49.1
Sweden	9.4	5	80	84	2	17	18	10.7
Switzerland	7.9	8	80	84	1.5	15	17	9
United Kingdom	62.7	2	78	82	2	17	16	75.7
Russian Federation	142.8	1	63	75	1.6	15	13	126.2
Egypt	82.6	-1	71	75	2.9	31	5	123.5
Nigeria	162.3	-0	51	53	5.7	43	3	433.2
India	1241,3	-0	63	65	2.6	33	5	1691,7
China	1345.9	-0	72	77	1.5	17	9	1312.6

Source: Population Reference Bureau, 2011.

1.1 Fertility

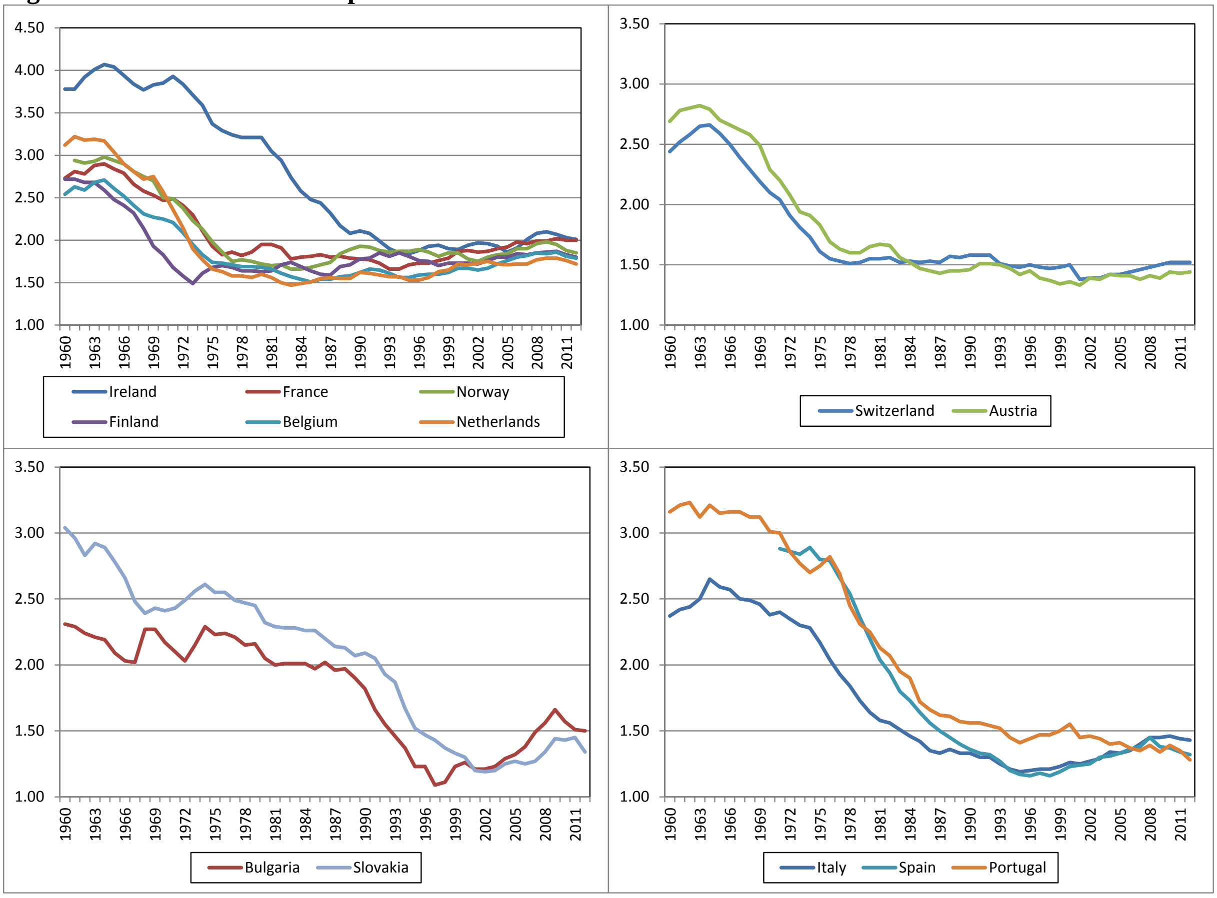
In the long term fertility is the most important component of population dynamics, as it has a direct impact on the relationship (in numerical terms) between the generations. Period total fertility rate (TFR) is a one number synthetic measure of fertility level, indicating the average number of children a hypothetical women in a given population would have if the age specific fertility rates for this population remained on observed level over her entire procreative life span. The TFR should equal to 2.1 to assure the generation replacement. Obviously, the calendar of births, the postponement effect and the share of childless women are equally important factors in the assessment of procreation in a given country or region. As noted in a recent European Commission’s report (2011), the birth postponement may result in the underestimation of fertility, as measured by period TFR. The TFR adjustment related to birth postponement varied from 0.15 to 0.4 child and was almost 0.2 for the EU-27 in 2005-2007.

According to the most recent PRB data the TFR stood at 2.5 for the World but continental values varied substantially from 4.8 in Africa to 1.6 in Europe, and within Europe from 2.0 in France, Ireland and Iceland to 1.2 in Bosnia-Herzegovina (PRB 2013). These differentiations have persisted for the last decades, but in general the trends conform to the overall fertility decrease in Europe (Figure 1). Few countries in Europe experienced in 1960s the TFR lower than 2.1. Few European countries experienced that high fertility in 2000s (Figure 1) and none very recently (PRB 2013). We observed over time a convergence in national fertility levels: the largest to the smallest TFR ratio was 2.24 in 1964 and only 1.70 in 2009, a drop by a quarter over 45 years for European countries included in Figure 1.

The last decade brought some increase in fertility, attributed by Goldstein, Sobotka and Jasilioniene (2009) to the realisation of deferred demand for children. The increase is, as they put it, from small to substantial, depending on country. It should be noted that if the postponement effect is the only reason of the fertility increase, this trend may not be sustainable in long term, as at some point fertility will complete the transition to older age profiles of mothers and stabilise again on lower (pre-transition) level.

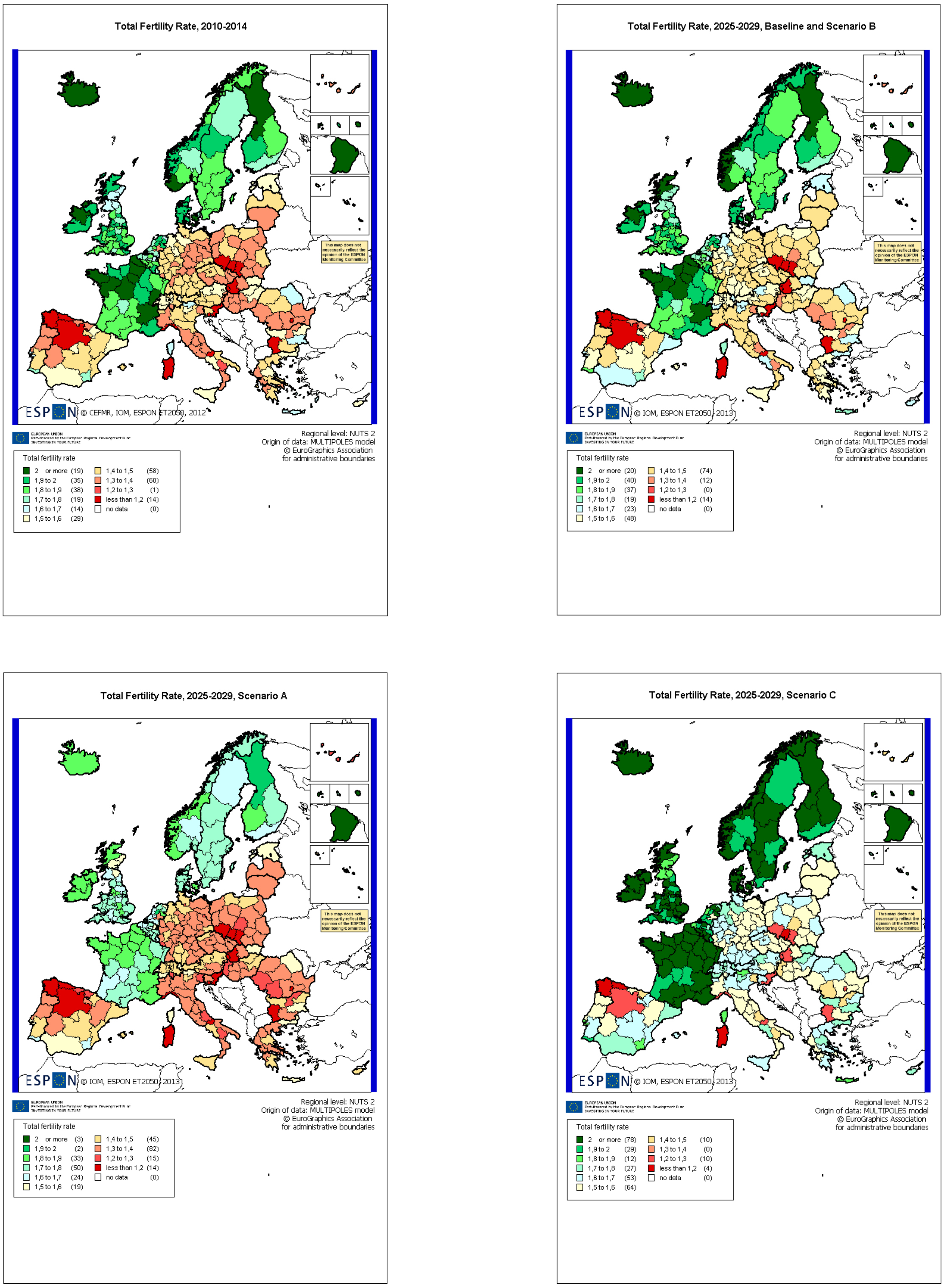
Regional differentiation of TFR values, as estimated in ET2050 for the 2010-2014 period and shown in Map 1, reveals a clear division of the European continent, with Northern and Western Europe enjoying relatively high and Central, Eastern and Southern Europe suffering from relatively low fertility. 46 per cent of NUTS 2 regions experienced TFR below 1.5 in the period 2010-2014. Historically, the differences in fertility between rural and urban areas was large, but the convergence is ubiquitous, perhaps fuelled by convergence in levels of education. Similarly, the convergence over time in regional TFR has been observed (Johansson, Rauhut, 2005).

Figure 1 TFR in selected European countries 1960-2012



Source: Eurostat database, accessed 16.2.2014.
Note: Only countries with long time series of data are presented.

Map 1 Total fertility rates in the period 2010-2014,and 2025-2029 according to the ET2050 estimates and scenarios, NUTS2 regions.

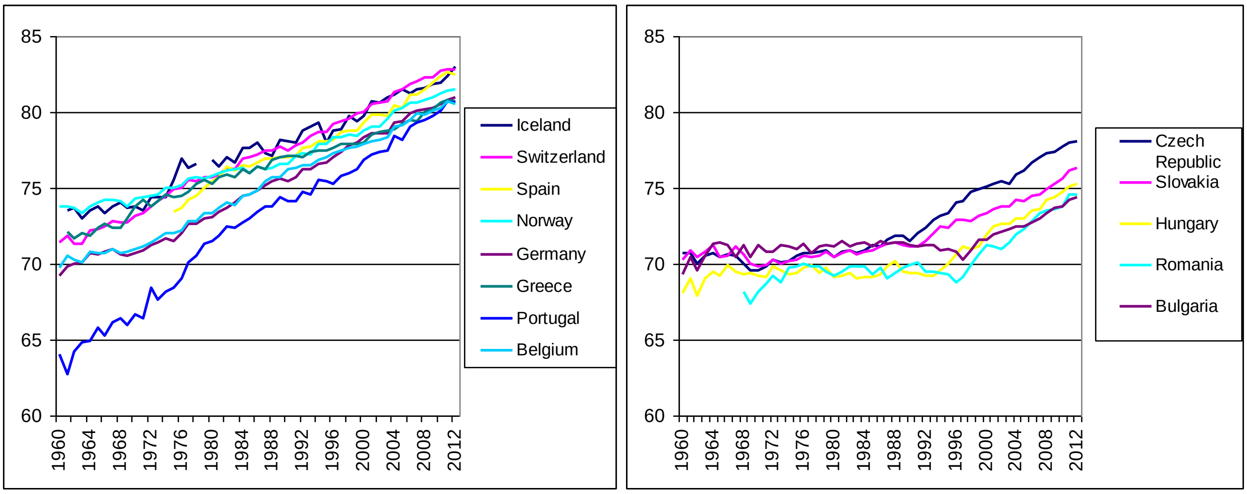


Source: Authors’ calculations

1.2 Mortality

In the countries in which the reduction in mortality was the most successful, life expectancy has been growing since it started to be measured in 1840 at the pace of around 2.5 year per decade (Oeppen, Vaupel, 2002). According to the most recent PRB report (PRB, 20103), the life expectancy of the World population stood at 70 years (68 for males and 73 for females). However, differences in life expectancy between continents are extremely high: it was 59 years in Africa, 79 in North America and 77 years in Europe. Life expectancy in Botswana, at 44 years, was slightly more than a half of life expectancy in Japan, at 83.

Figure 2 Life expectancy at birth in selected European countries, 1960-2012, both sexes together



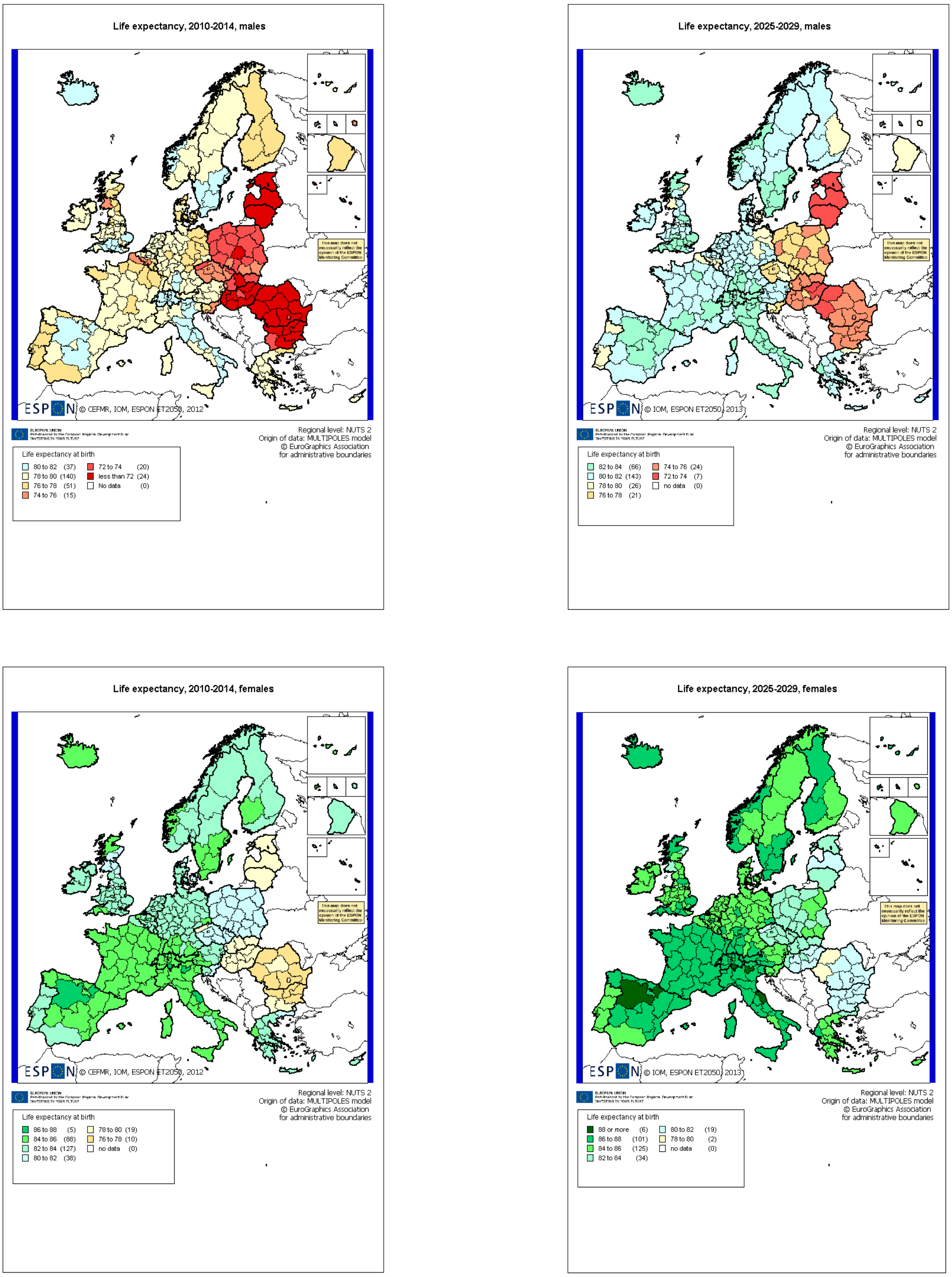
Source: Eurostat data base, accessed 16.2.2014.
Note: Only countries with long time series of data are presented.

In Europe in most countries life expectancy has been growing linearly over time (Figure 2). The largest increase was observed in Portugal, which gained 17 years since 1960. Other countries gained less, but still substantially: between 8 and 11 years for the countries for which data for 50 (or nearly 50) years were available. Careful observer will note that in the countries under communist regime life expectancy stagnated and the increase started only after the collapse of the communism. The difference between life expectancy of males and females had been increasing until 1980s and started to decrease in the last two decades. Around 2010 the gap varied between 11 years (Hungary) and 4 years (Scandinavian countries and the Netherlands), generally being larger in the post-soviet area and smaller in the wealthiest European countries.

The increase in life expectancy is an obvious consequence of decrease in mortality. For post-socialist countries, initial and very strong mechanism for the life expectancy increase was a reduction in the perinatal mortality. In Poland, the perinatal (0-6 days) mortality rate dropped from 19.5 per thousand in 1990, at the beginning of the social, political and economic transition, to 6.8 per thousand in 2010 (CSO, 2011). Such reduction of mortality at the bottom of the age pyramid is extremely effective leverage of life expectancy. In the most affluent countries, which reduced perinatal mortality much earlier, substantial gains in life expectancy comes from reduced mortality of old people as noted by Kannisto et al. (1994). They also argue that the reduction in mortality of elderly has accelerated in 20th century. Importantly, not only people live longer, they also live longer in good health.

The regional distribution of life expectancy (Map 2) shows a clear East-West divide, with countries belonging in the past to the Soviet bloc lagging very substantially behind. South European and Scandinavian regions have higher life expectancy than other countries of the "old" EU.

Map 2 Life expectancy at birth, by sex, in the period 2010-2014 and 2025-2029 according to the ET2050 estimates and scenarios, NUTS2 regions.



Source: Authors' calculations

1.3 Migration

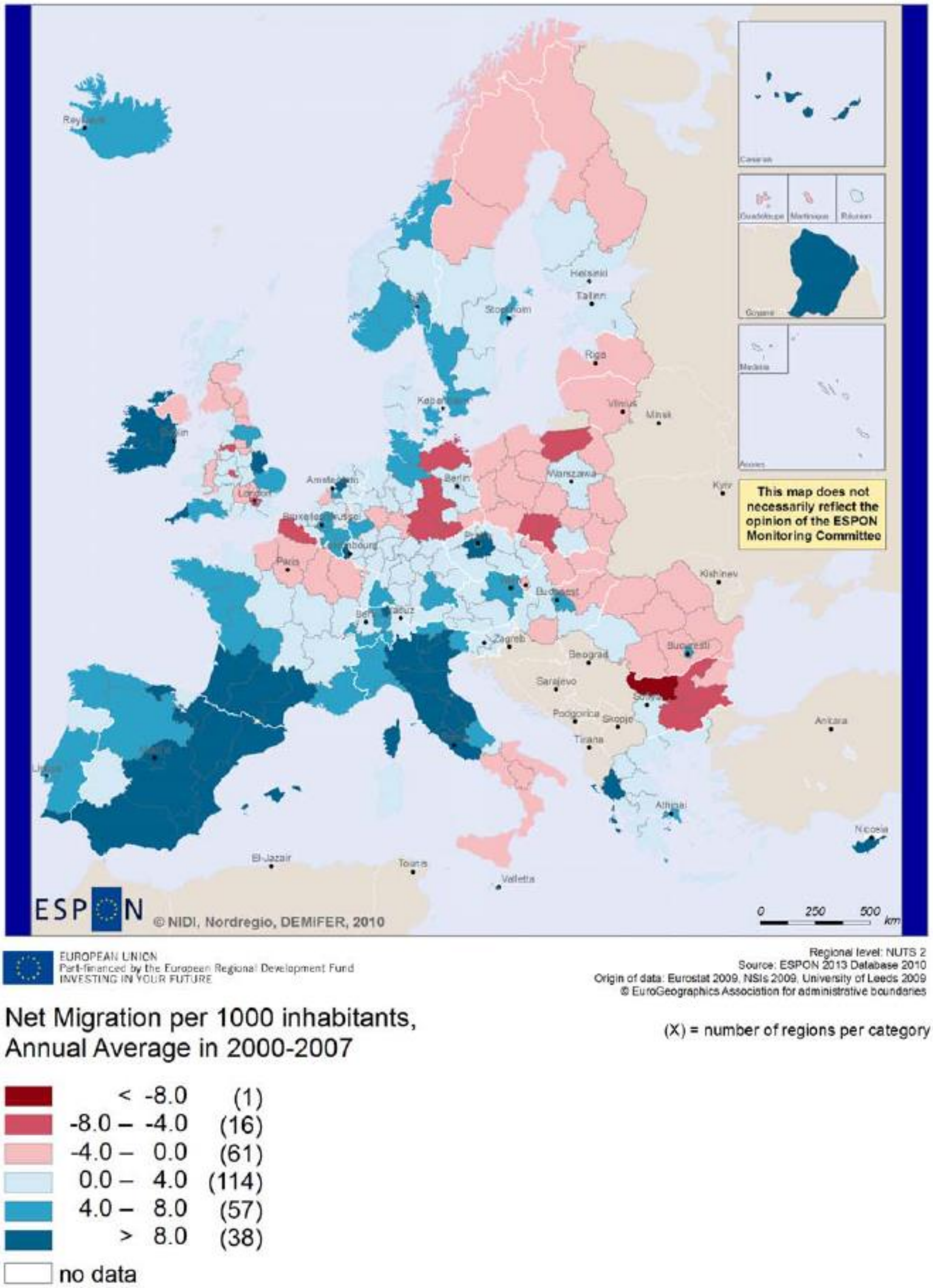
The analysis of migration trends is hampered by the lack of internationally comparable and reliable data. However, some observations can be made using the available national data, as collected by Eurostat.

The overall annual net migration pattern (Map 3) shows clearly that at the beginning of the century old EU member states gained migrants, whereas new ones lost migrants. However, large urban agglomerations in Central Europe constitute a very significant magnet: Warsaw, Budapest, Vienna with Lower Austria, Bucharest, Sofia, but also Athens in the south and Stockholm in the north gain more migrants than the regions surrounding them. This effect is not visible in Western and Southern Europe, however NUTS2 level on which it was captured is far to coarse for a detailed analysis. Over the period 2000-2007 over 70% of regions have positive net migration (van der Erf, de Beer, van der Gaag, 2010).

International migration has two components: intra-Europe and extra-Europe and their impact on population change differs. As indicated by population projections prepared within the DEMIFER project (Kupiszewski and Kupiszewska, 2010), in new EU member states intra-Europe international migration has a larger impact on population change than extra-Europe migration. This is also true for 32% of regions in Europe, most of which are located in Central Europe. In Western Europe, extra-Europe migration is usually more significant than intra-Europe migration. The impact of natural change, intra-European international migration and extra-European international migration on national populations in the EU, as modeled through the *Status quo* projection for the 2005-2050 period, is presented on Figure 3. It shows clearly that intra-European migration benefit more affluent countries of the EU, on the expense of poorer member states. On regional level it was observed that under migration patterns existing at the beginning of this century poorer Central European regions subsidize through labour force transfers the development of affluent regions in Southern, Western and Northern Europe (Kupiszewski and Kupiszewska, 2010).

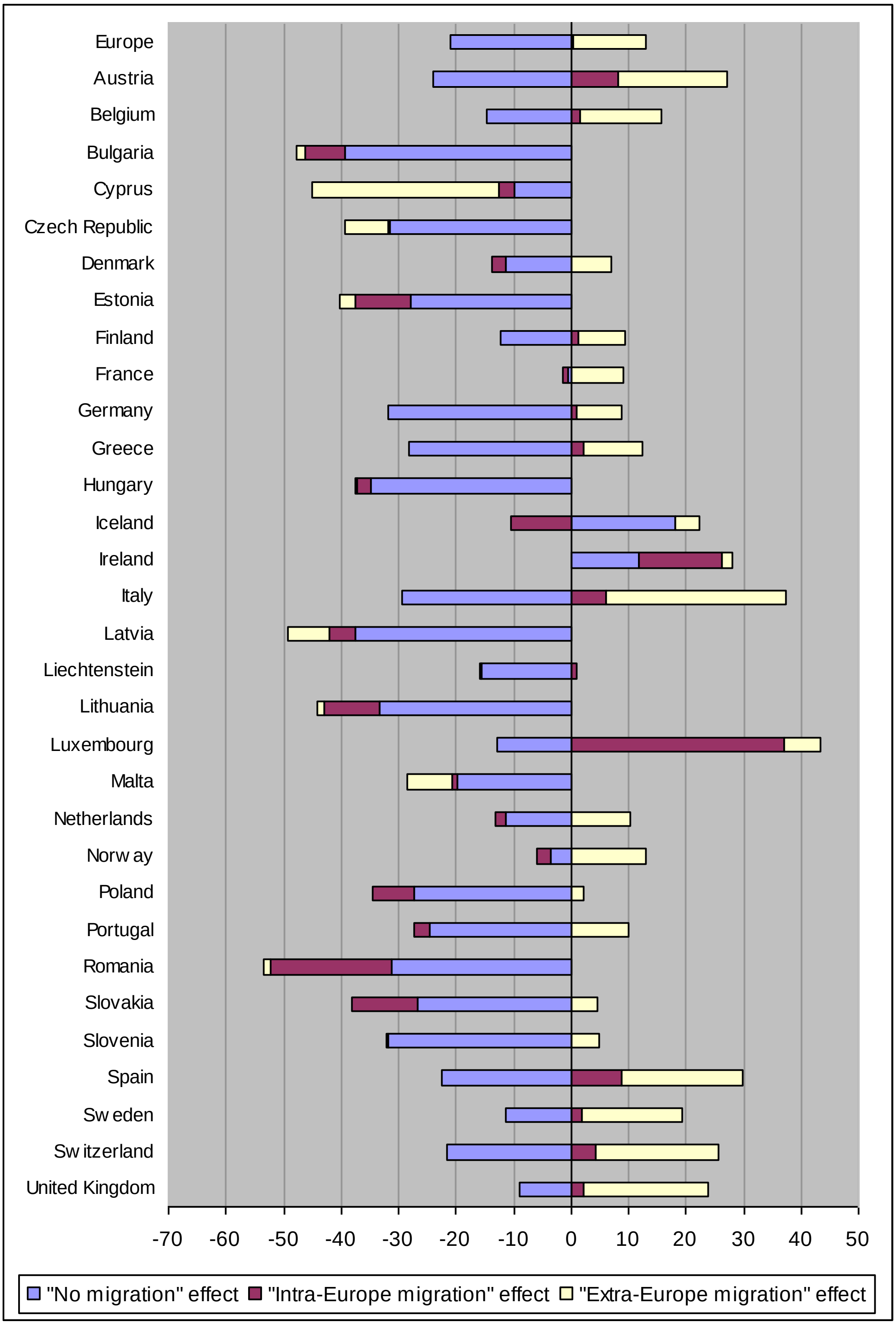
As the international migration has been a highly variable but a long-term phenomenon, European and regional populations became increasingly heterogeneous ethnically and diverse culturally (European Commission, 2011). Integration of migrants became the key problem and aim of governments and societies alike, being one of the important preconditions of demographic development of societies in receiving regions on one hand, and wellbeing of migrant families on the other.

Map 3 Average annual net migration per 1000 inhabitants, NUTS2 regions, average 2000-2007



Source: van der Erf, de Beer and van der Gaag (2010).

Figure 3 Impact of migration on population change 2005-2059, NUTS0[2]



Source: Kupiszewski, Kupiszewska (2010)

[2] Impact of migration expressed as percentage of population in 2005, calculated in DEMIFER by comparing the percentage change of population in three scenarios for 2005-2050: without migration ("No migration" effect), with intra-Europe migration only and with both intra- and extra-Europe migration (Kupiszewski and Kupiszewska, 2010).

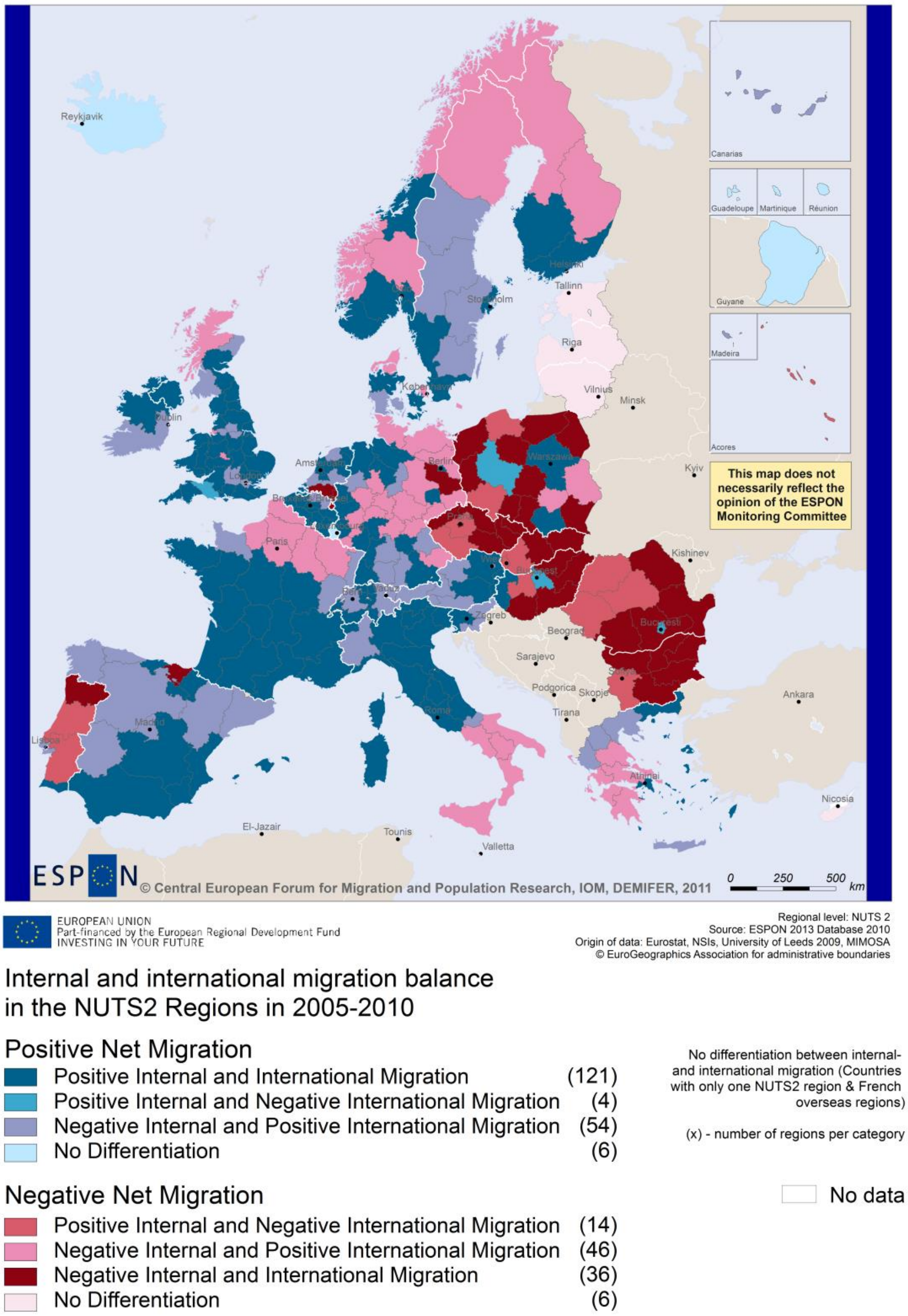
At the regional level, net migration balance may be decomposed into two components: net international migration and net internal (within the country) migration. Their impact on population change of the NUTS2 regions is presented on Map 4. The combination of positive internal migration and positive international migration occurred in 121 of NUST2 regions.

Internal migration systems (as measured by gross flows) in most European countries are dominated by large cities. In Spain, the migration system is multi-nodal, with Madrid, Barcelona, Cordoba, and Alicante playing dominant roles. In other countries, like in Hungary, Austria, all Scandinavian countries and Greece, a strong dominance of capital cities is clearly visible. The same situation is in France, and the UK, however, these countries have also strong links bypassing the capital cities. Italy, the Netherlands and above all Germany have complex, dense network of flows with many dominant cities (van der Erf, de Beer and van der Gaag, 2010), perhaps a model target system from the geographic point of view.

The complexity of the pattern of migration may be traced based on Rees et al. (2010c) study of London demographic development in the years 1999-2008. Inner London loses its population to Outer London, clearly a family-cycle-related development. It gains population from the rest of the UK, due to students and young job hunters flowing in to the job opportunities, academic institutions and thrills and light of the city centre. Outer London loses population with exchange with the rest of the UK, as families move to suburban areas and commute to work. International migration in most boroughs is positive, albeit in a few of Outer London boroughs it is negative. This particular migration pattern modifies substantially the age structure of population with very strong dominance of 25-34 years old population in Inner London and strong dominance of 5 years older age groups in Outer London (Rees et al., 2010c). London is an excellent example showing the complexity of migration patterns related to life cycle and labour market.

Looking into the future we should keep in mind that in contemporary Europe economic prospects and labour markets send powerful signals to potential migrants. The Euro-crisis induced reversal of the direction of flows between ex-colonies and Europe. Traditionally the flows were directed from the colonies towards the colonising countries, recently a reverse phenomenon has been observed. Angola and Brazil accept migrants from Portugal and Spain, defining new “New Worlds” (Wall Street Journal, 2012). It is difficult to envisage now what future economic development (or crash) in Europe may have on migration, however even quite improbable a decade ago scenarios should be considered. Europe, a long term magnet for migrants, may switch to the position of sending area if for example the sovereign debt crises results in bankruptcy of several Eurozone countries and collapse of their economic and social systems.

Map 4 Net migration by components, 2005-2010, NUTS 2 regions.



Source: DEMIFER (2011)

1.4 Population dynamics and structures

Population growth in Europe has a clear decreasing tendency, however remains positive on the EEA level. Annual population growth has dropped from 10.2 per thousand in 1962 to 2.8 per thousand in 2010 (all data from the Eurostat database). The situation in various countries differs very substantially: in 2010 we observed 19.3‰ population increase in Luxembourg, 12.7‰ in Norway and 10.3‰ in Belgium, but Lithuania lost 25.7‰ of its population and Latvia 8.4‰. The span between the fastest growing and fastest shrinking countries is 4.5 percentage points. Regionally, Europe is divided into declining peripheral Central Europe, where nearly all regions without a large city have been shrinking in the period 2000-2007 (Map 5), and regions in the EU 15 countries, which enjoyed positive population change, except a few southernmost and northernmost ones. The strongest population growth was observed in Southern Spain, Iceland, Northern Scotland, Ireland, Southern and Western France and Northern and Central Italy. One should keep in mind that these data refer to the pre-crisis patterns (2000-2008) and that the migration regimes have changed since 2008 quite substantially as it was discussed in Section 2.3.

Statistically, the demographic situation of European regions deteriorates. Johansson and Rauhut (2005) calculated, based on the data for the period 1990-1999, that in 32% of NUTS3 regions population increased due to positive natural increase and positive net migration. 15% of regions experienced negative values of both components. In the years 2000-2006 the relevant shares stood at 25% and 21% respectively (van der Erf, de Beer and van der Gaag, 2010). If we assume that regions experiencing positive net migration and natural increase can be described as ones with excellent demographic conditions whereas regions with both components negative – as ones with bad demographic conditions, we may see clearly that the share of regions with excellent conditions reduced by around a quarter, whereas the share of those in bad condition increased by more than a half.

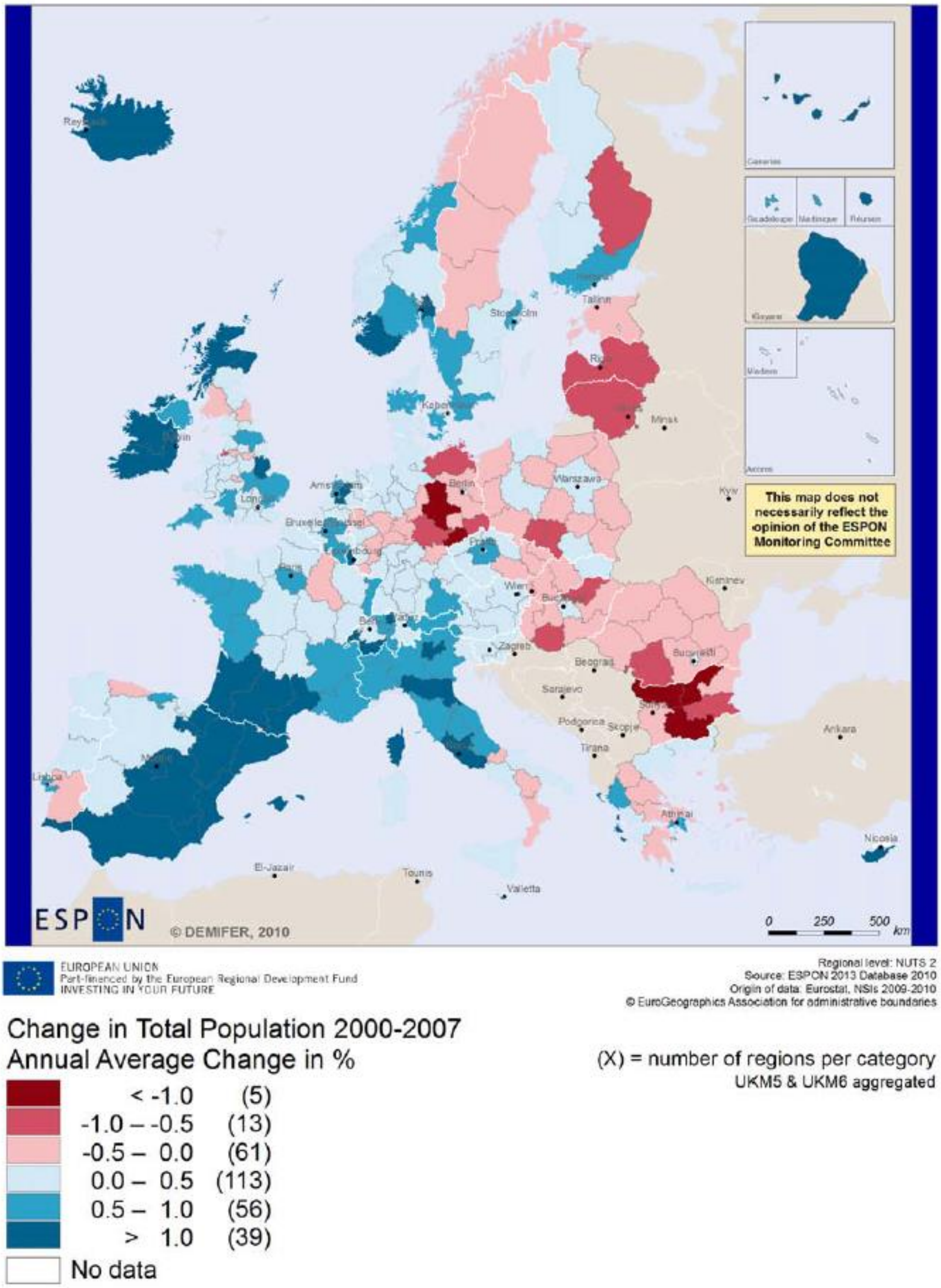
It was already noted that European populations are growing older. Ageing of population measured in this case with o*ld age dependency ratio* (ODR)[3] is shown on

Map 6. Broadly, population of Southern and Western European regions is older than in the Northern and East European ones. More specifically, low ODRs characterize regions in new EU member states (regions in Poland, Czech Republic, Romania), Ireland and Iceland and largest cities (Amsterdam, Bucharest, Paris, London, Oslo). Regions with high ODR are located in northern Italy (Liguria was the only region with ODR>40), Iberian Peninsula, France and Germany.

Population simulations conducted by Rees et al. (2010a) in the DEMIFER project go in line with the observations and analysis of past trends. Rees et al. (2010a) have shown that future regional population changes depend substantially on types of regions and scenarios adopted. Depopulation is not a dominant feature of population change, however in Central Europe and in remote regions it is very frequent. In depopulating regions quite often gender balance is adversely affected by higher mobility of women. This issue was extensively studied in the ESPON SEMIGRA project (Wiest et al. 2013).

[3] Defined as the ratio of population aged 65 and more to population in the age group 15-64 years, multiplied by 100.

Map 5 Average annual population growth rates (2000-2007), NUTS2 regions

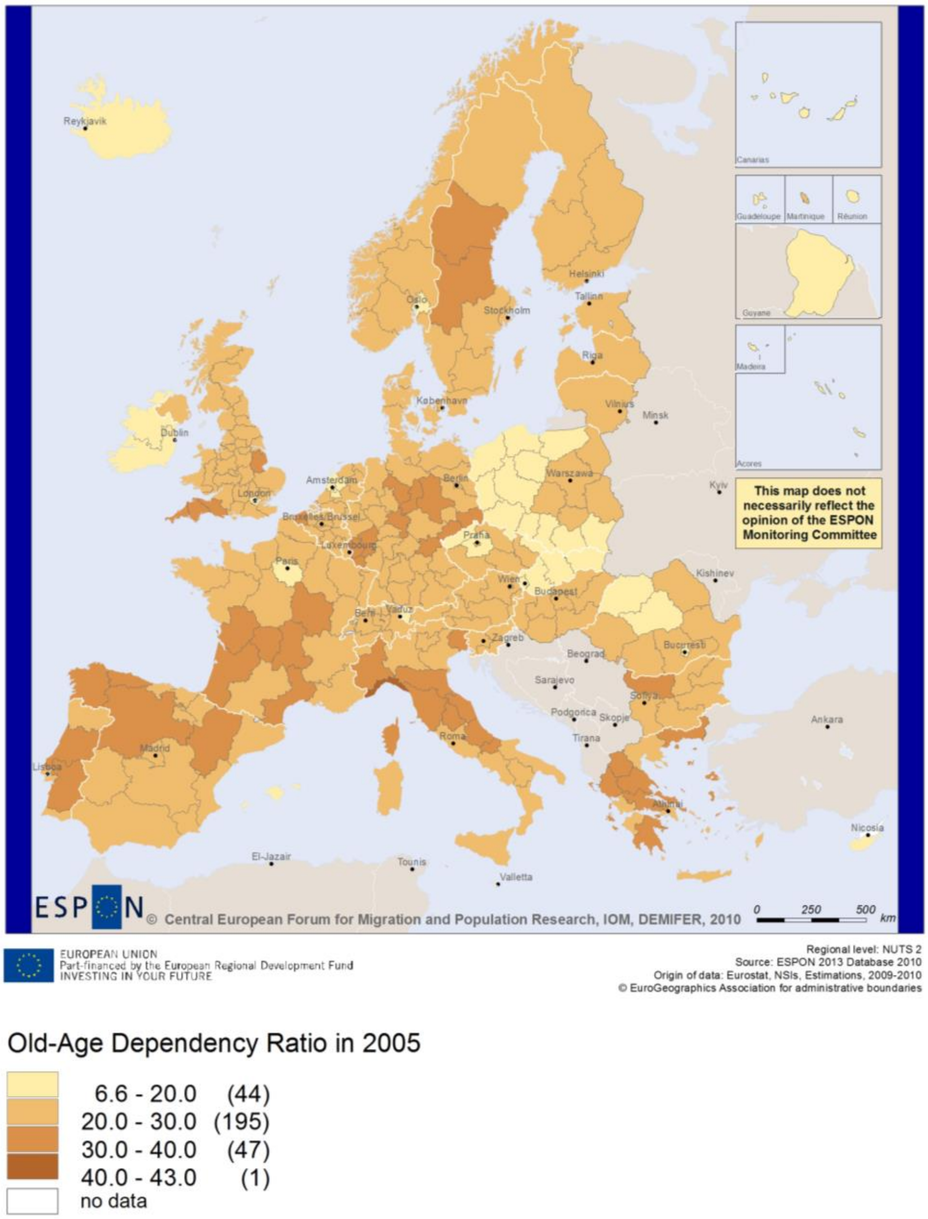


Source: : van der Erf, de Beer and van der Gaag (2010).

If the trends observed at the beginning of this century persist, we will observe a very fast ageing of regions in the new member states, caused both by low fertility and high international emigration and supported additionally by internal migration shifting people from rural agricultural and remote regions to cities and suburban regions (Kupiszewski, Kupiszewska 2010).

An important structural characteristics of regional populations is the share of foreign population. The degree of the integration of these populations determines the social and humanitarian but also economic success of migration process (for a review of research on integration see for example Penninx, Spencer and Van Hear, 2008). In addition to substantial foreign communities located in all old EU member states and often geographically linked with the colonial past of the receiving countries, the post-enlargement migration wave has arrived. It shifted large numbers of citizens of new member states to the old member states, notably but not exclusively to the UK and Ireland. Migration generated an increased economic growth of receiving countries, but the costs of migration had to be met by local communities. These costs were different and not exclusively pecuniary: sense of anxiety in small localities where foreign population have swollen from nearly nil to a substantial fraction of total population, inflow of culturally different populations making some natives not feeling in their communities "at home", but also rapidly increased demand for schooling, medical care and social services, to name just a few. The consequence was the rise in anti-immigrant movements and political parties, well-illustrated by a rapid switch from very tolerant to intolerant society in the Netherlands, to give just one example. Migrants suffer from higher unemployment rates and deskilling (European Commission, 2011). It does not come as a surprise that the crucial issue considered by researchers, humanitarian organizations and policymakers is how to best integrate the migrants, how to protect them against unscrupulous criminals, and how to make them productive for the economy and able to support themselves and their families.

Map 6 Old-age dependency ratio, 2005, NUTS2 regions



Source: Kupiszewski, Kupiszewska (2010).

2 Population policies

Population policies are not regulated by the Lisbon Treaty (European Union, 2010), however they may be seen as a part of social policies. So far the European Union impacted demographic policies by financing research and discussion on demographic issues and presenting its views, among others, in the annual report on demographic developments in the EU. As a follow up to the Green Paper on confronting demographic change (Commission of the European Communities, 2005), the European Commission presented a communication where it identifies population ageing as the main demographic and social problem in the coming decades (Commission of the European Communities, 2006).

The Communication offers both sober and grim assessment of the coming demographic change and its consequences. The authors argued that ageing is unavoidable and that fertility increase (if any) and migration will not offset the structural deficiencies. They also noted that the increase in the share of elderly is often associated with social and family changes, notably the increase in the number of one person households consisting of an elderly person only. Moreover, ageing has a regional dimension and there is a threat that these regions which are most affected by ageing and - quite often associated with it - depopulation will face problems with provision of basic social and health services in future. The Commission proposed a programme which would help to moderate the negative impact of ageing, covering five areas:
"•Promoting demographic renewal in Europe
• Promoting employment in Europe: more jobs and longer working lives of better quality
• A more productive and dynamic Europe
• Receiving and integrating migrants in Europe
• Sustainable public finances in Europe: guaranteeing adequate social security and equity between the generations." (Commission of the European Communities, 2006: 13).
This programme, which could be boiled down to the following recommendations: increase fertility, productivity, employment, retirement age, integrate migrants, introduce flexible forms of employment and reform pension systems seems to offer a viable solution. Notably the increase in labour participation seems to be an effective tool as shown by Bijak Kupiszewska, Kupiszewski (2008).

A DG for Regional Policy study published in 2008 (Commission of the European Communities, 2008) offers an overview of demographic processes, but did not produce any policy-relevant proposals. In a follow up paper Aversano-Dearborn M. et al. (2011) look at the regional policy from the point of view of regions' vulnerability to a variety of factors, including demographic one. The authors selected certain variables describing demographic performance of regions in such areas as ageing, population growth, population age structure, migration flows (Webb's classification), international migration and integration and produced an integrated regional classification of demographic change vulnerability. The main four classes are "Demographic high performers": Iceland, Ireland, Denmark, some Swiss regions and eastern Turkey; "Migration destinations" in Southern Europe, a few regions in the UK, metropolitan regions and Estonia and Latvia, "Balanced demographic regions" occupying Croatia, Austria, Germany , Benelux, north-eastern France, most of the UK and Scandinavia and "Migration origins" covering most of regions in the new member states and Turkey. This is a very useful assessment, presenting expected demographic challenges at a glance.

Migration policy has always been within the remit of the EU and its legal predecessors. Initially, the policy focused on the free movement of labour within the Union. Regulations concerning this area go back to the times of the European Community for Coal and Steel, that is to 1950. Communalization of admission policies is quite recent and goes back to Amsterdam Treaty of 1997. Initially asylum policies and illegal immigration were targeted, but over time the scope of regulations has been growing to include migrants' rights, integration and migration of highly skilled. Recent developments show quite clearly that the European Commission aims at curbing illegal migration and making legal migration, especially of highly qualified migrants, easier. This thinking was expressed by two Directives of the European Parliament and the Council, one on a single work and residence permit and a common set of rights for third country workers and the second one on the conditions of entry and residence of highly skilled third country nationals. Integration measures are within the jurisdiction of national governments, but the Commission is very active leading discussion and financing a variety of projects supporting successful integration of third country nationals into the receiving societies.

3 Interaction between population and key factors

Settlement systems and population change
The nature, structure and topology of settlement systems has a rather limited influence on national populations, but has a profound direct impact on population distribution, in particular on migration. The settlement structures and topology of settlement system organize commuting (and in consequence suburbanization and counterurbanization processes) and migration to a large extent. In the centre of the debate there have been centre-periphery and concentration-deconcentration processes.

Various settlement systems in Europe are at differing stages of the urbanization-suburbanization-counterurbanization-reurbanisation cycle (Rees and Kupiszewski, 1999; Champion, 2010). Gentrification of city cores (Grzeszczak, 2010) contributed substantially to the reurbanisation phase (Champion, 2010). Centrifugal migration does not usually imply an increase in the agricultural activities (Johansson, Kupiszewski, 2009). Emigrants from cities and towns often utilise rural space as a place of living, but not work, sometimes they engage in entrepreneurial activities which are associated with rural areas, such as tourism or localised traditional production and services. The concentrating and deconcentrating effect of migration is highly dependent on migrants' age and therefore life cycle (see examples in Rees and Kupiszewski, 1999 or Rees et al., 2010c).

In the past, people typically moved from rural areas to nearest service centres, usually local small towns, then up the urban hierarchy to regional towns, to national capitals and finally to world cities. This is not the case anymore and many migrants bypass smaller settlement units migrating directly to large and world cities (Grabowska-Lusińska, Okólski, 2009). Kupiszewski (2006) demonstrated that international migration may substitute in certain circumstances internal migration.

The development of international migration, globalization of migration processes and decrease in the costs of travel resulted in migration flows going from rural and peripheral areas directly to world cities. Emigration from rural and remote areas leads to adverse effects: depopulation, ageing and deformation of sex structures of affected populations. Emigration is selective: emigrants are young, better educated and more entrepreneurial than stayers. Demographic deterioration of rural and peripheral areas is one of the important issues which should shape research agenda on the future organization of space. Obviously, rural depopulation is by far not universal. Some rural areas attract population either in consequence of sub- and counterurbanization or as poles of economic growth, mostly in the areas of high tourist and recreational value.

Transportation networks and population change
Transportation networks provide the infrastructure for any human mobility. They serve intra-regional commuting which is the main socio-economic mechanism facilitating sub- and counterurbanization and it also provides the necessary tools for migration. High cost of transportation may result in population loss and simultaneously the distribution of population impacts the transport costs (Velte, Magro and Jimenez, 2010). Small populations are often unable to support the costs of adequate public transport infrastructure, resulting in social disadvantage of the poorest.

It was noted that rural and remote regions depopulate (Rees, Kupiszewski 1999). However the peripherality studies tend to use population as a mass term in models, but rarely explain population change as a consequence of the development of transport networks (Schürmann, Talaat, 2000).

Climate and population

Rees, Wohland and Boden (2010) in their assessment of the impact of climate change on migration in Europe noted that climate-generated displacements and migration of population have mostly local character, therefore Europe should not expect any significant immigration generated by climate change. Research by ESPON climate team (Greiving et al., 2011) assess that physical impact of climate change (rising sea level and floods) will concentrate along north-western European coast and will be also visible in isolated regions in Southern Europe (River Po valley, Venice). Social impact will be most acute in Southern Europe, especially in large urban agglomerations which may suffer substantially from summer heat. Economic impact will mainly concern Alpine regions, where snow cover will deteriorate. Overall both teams agree that population should not be affected significantly by climate change, however there will be some regions which will suffer substantially.

Economy and population

Economic development is a key albeit sometimes indirect factor of regional population change. It influences very strongly the direction and the magnitude of migration flows. There is a plethora of research on the subject, linking various aspects of economic developments and migration. Jennissen (2004) offers a comprehensive overview of the impact of macroeconomic factors on international migration flows. Putting aside this complex body of research, it may be useful to refer to statistical migration data of just three countries: Spain, Iceland and Ireland, which, in consequence of the 2008 financial market collapse and the sovereign debt crisis turned from immigration to emigration countries in a very short period of time. While the impact of modifications in the size of the natural growth on population development is delayed (it takes some 20 years from birth to the entrance on the labour market), migration is a swift and powerful agent of change. Therefore when looking at future population development, we need to consider melting of Eurozone as a wild card, and consider the consequences of such melt-down on migration, both in short and medium perspective.

The impact of economic developments on migration as well as on fertility and mortality is further discussed in the next section.

4 Long term theoretical perspective in a nutshell: What shapes population development in Europe?

A review of a rich body of theories explaining demographic phenomena in a concise way enforces arbitrary selectivity. Our selection of presented theories is very subjective and was driven by our perception of theories' usability in the current research. We tried to look at possible future developments of populations from theoretical perspective. From the forecasting point of view it is customary to consider each of the components of growth separately and so we did in the section below.

Fertility

There are several main factors impacting fertility: social and cultural change, including values, attitudes and preferences; economic consequences of having children: the cost of bringing up and the expected benefits of having them; and development of medicine and related to them development and spread of contraceptives. These factors have been framed within a number of theories, the most important of which are second demographic transition, Becker's economic fertility theory and Easterlin's hypothesis.

Similarly to the first, the second demographic transition (van de Kaa, 1987) links demographic processes with modernisation. The second demographic transition occurs in industrialised societies and explains decline in fertility, often to the levels well below replacement, by social, cultural and economic emancipation of women and a change in the system of values to the one in which family and children are perceived as less desirable to freedom and individualism. The development of social security institutions and parting with elementary existential threats played also important role in the transition. One of the factors making fertility decline possible is the availability of effective contraception. The crucial lesson to learn from this theory is that when looking at possible future changes in fertility, we need to assess the chances of changing preferences of women, from individualistic to appreciation of family values.

The 1992 Nobel prize winner in economy, Gary Becker (1981) summarised his earlier works (Becker 1960) in a theory which expresses neo-classical consumer approach to children, treated as a durable commodity, with certain costs attributed to their birth and rearing and characterised by a certain utility function. Children are a luxurious commodity on which surplus cash is expended. One implication is that the increase in earnings should stimulate fertility. Becker's economic theory of fertility was challenged by Easterlin (1978), who suggested that fertility increases when income of young males is high relative to their aspirations, and linked aspirations to the size of cohort, looking at the economic processes from a more sociological perspective. Assessment of the economic value of children may change in future quite rapidly, as the social security systems started to be less and less generous (this already takes place, by redefinition of payouts, for example moving from exit salary defined pension to average salary defined pension or by increasing retirement age and curbing possibility to take earlier retirement), and a danger of their collapse in some countries may become real. Having children and maintaining good relationships with them may be quite soon a recognized and valuable retirement strategy.

Outside the main and well established "classical" theories, two issues should be taken into consideration: fertility trap hypothesis and population policies. Wolfgang Lutz and colleagues (Lutz, Skirbekk and Testa 2006) formulated a low fertility trap hypothesis, proposing that in Europe low and declining fertility will stay in future. Easterlin's hypothesis serves as an economic pillar of the fertility trap hypothesis, as it was noted that aspirations of young people are growing, but their income is not, and will not increase in future due to the ageing of population. Sociological arguments are built around the observation that preferred family size is declining. It seems that in the vision of European regions in future we will need to take declining, or at least not increasing fertility as a quite likely development.

Finally, fertility may be stimulated or destimulated by national policies. Kotowska and Matysiak (2008) have shown the impact of the labour markets and social support institutional settings on fertility. They assess that countries which developed support for mothers on the labour market and for child care have higher fertility than countries which polarise labour market between male bread winner and female child carer. There is, therefore, a room for increase in fertility in some European countries, albeit such increase should not be taken for granted, even when supportive social and labour market policies are implemented.

Mortality

The changes in mortality in the past have been explained by „epidemiologic transition" (Omran, 1971), stating that population mortality patterns evolve from „pestilence and famine" through „ receding pandemics" to „degenerative and man made deceases" (Omran, 1971: 516-521). Olshansky and Ault (1986) added the fourth phase of „delayed degenerative diseases". The epidemiological transition was enrooted in epidemiology and medicine and paid little attention to social, cultural and civilisational underpinning of the changes in mortality. These factors were exposed in „health transition" theory proposed by Frenk et al. (1991) and Caldewell (1993). These two theories do not contradict each other. In fact they support and complement each other. Epidemiological and medical changes would not be possible without economic, social and cultural development and vice-versa.

From the forecasting point of view it is important to identify measurable factors (variables) which influence positively or negatively the change in mortality. A review of such factors was offered by Spijker (2004), who examined the impact of economic and socio-cultural development, environmental change and evolution in lifestyles and education on mortality. Interestingly, he did not identified that expenditures on health care improved mortality significantly. However, it should not be overlooked that the entire epidemiological transition has been linked to improved health care, especially introduction of antiseptic regimes and vaccinations, originating much more in human innovativeness and research than in the increase in expenditures.

An important unanswered question is the one on the limits of human longevity. Many demographers attempted to set an arbitrary limit on expected life expectancy and, as Oeppen and Vaupel (2002) have shown, they all failed miserably. That does not justify an assumption that the human longevity will rise infinitely, but may allow to assume a linear growth for the 40 years long perspective of the ET2050 study.

Migration

There is a long tradition to distinguish between internal and international migrants. Following King and Skeldon (2010) we support the view that whenever data allows, we should look at migration as one process, without dividing them into "internal" and "international". Most of existing migration theories are universal and most likely international migration may substitute internal migration and vice versa. It should be also noted that freedom of movement of labour in the EU and EFTA made the differentiation between internal and international migration within Europe less important. However, the existing body of research and research tradition, data availability and policy requirements make integration of the analysis of the two migration flows difficult.

Research into migration resulted in the abundance of migration theories aiming at the conceptualization and explanation of the phenomena. There are numerous papers summarising these theories, the seminal Massey et al. (1993) paper being perhaps among the most quoted ones and Bijak (2010, Chapter 4) offering more up to date and more mathematical perspective. The problem with these theories is that they are fragmented and span across numerous and distant research disciplines. Kupiszewski, Bijak and Kicinger (2012) established that from the point of view of migration forecasters the most effective way to use the existing body of theoretical knowledge is to apply simple theories which are easy to operationalize. Further, they arrived at the conclusion that few theories can be used directly, notably the push-pull theory is very useful. This theory was initially formulated (albeit not yet called the pull-push theory) in seminal works of Ravenstein (1885, 1889) in late XIX century and later rephrased and tested by generations of researchers. Contemporary demography and population economics tend to attribute the decision to emigrate to push factors and associate pull factors with the selection of the destination.

Jenissen (2004) offered a comprehensive inventory of mostly economic factors of migration in Europe. The most significant factors are these which characterise income, or, more precisely, the income disparity between sending and receiving regions or countries, and the availability of jobs, or the difference between employment level in sending and receiving regions or countries. A list of migration factors to be considered should go beyond macroeconomic ones. Certainly migration policies constitute important and to some extent overlooked and difficult to quantify set of factors.

Therefore, looking into the future of international migration we need to analyse the possible differences between incomes, employment levels and migration policy decisions. From that point of view, the key issue is the economic impact of the 2008 financial crisis and the sovereign debt crisis. The crises either have changed the direction of migration flows in some European countries or may do so in the near future. This concerns in particular Iceland, Ireland and the PIGS countries which either have or most likely will change from net migration gainers to net migration losers. Such change will turn upside down the population dynamics of these countries and perhaps other European countries as well.

Economic crisis may result in the tightening of migration policies, enforcing “the fortress Europe” attitude. This, however, should not be taken for granted, as there will be a strong pressure from the labour markets and entrepreneurs, who will be starving in a decade or so for more labour, to implement relaxed migration policies to bring labour from the outside of Europe. It is difficult to assess which of the two pressures will be stronger.

Internal migration in the European countries is much less researched than international and its patterns are much more diversified and complex. As in the case of international migration, the key pull factors of internal migration are related to the relocation of population to regions which are more affluent and offer better employment opportunities. On top of this come concentration and deconcentration processes related to life cycle as well as the quality of life factors. The latter factors differ very substantially from country to country, so it is almost impossible to suggest one or more trends which will govern internal migration in Europe. Instead, such trends should be defined on country by country basis.

Population change

The most fundamental theory explaining population change in Europe and elsewhere is so called (first) demographic transition developed by Notestein (1945) and based on earlier concepts of Warren Thompson and Adolphe Landry. Similarly to Thompson, Notestein proposed sequential stages of demographic development, evolving from high mortality and high fertility, through intermediate stages, to low fertility and low mortality, going from one equilibrium to another. Population growth follows a logistic curve. The transition from the traditional to the modern demographic pattern is driven by modernisation, urbanization and industrialisation. The transition disseminates through the diffusion of cultural, social and technological patterns. The theory was rigorously tested by Chesnais (1986) and in contemporary demography attained a status of an axiom. In Europe most countries are in the final or penultimate stages of the transition.

From the point of forecasting, more relevant might be Malthusian (Malthus, 1798) and neo-Malthusian theories relating population growth to the availability of resources: food in the classical Malthus' formulation, supplemented by natural resources in the *Limits to Growth* – a report of the Club of Rome (Meadows et al, 1972). Importantly, Turner (2008) has shown that "Business as usual" scenario of the *Limits to Growth* coincides with observed developments. Taking into account the limitations imposed on human development by climate change and the technological change required by the needs to limit emission of CO^2 and other gases, we may rephrase the relationship between the growth of population and resource availability, taking curbing environmental impact into account and considering gas emission allowances, as one of the "resources". These environmental aspects of limits of population growth have been highlighted by Meadows Randers and Meadows (2004) in their overview of the *Limits to growth* after 30 years.

The resources (un)availability and environmental impact will, no doubt, be among the factors limiting regional population development. What concerns the latter, the increasing costs of the use of environment (the costs of CO2 emission, various environment-related taxes etc.) may limit industrial production as well as some transport-dependent services in Europe, where the standards are already relatively high. This may lead to economic stagnation and loss of population by most vulnerable, industry-dependent regions, due to emigration to regions more prosperous economically, perhaps with more environment friendly economic base. The former factor concerns in particular the availability of water which, if scarce, may result in outflow from regions with water deficit. Finally, demographic momentum would limit population increase, as the number of potential mothers would decline.

5 The MULTIPOLES model

In the further sections of the report, we briefly present the assumptions and results of the demographic scenarios prepared within the ET2050 project. The Baseline scenario (2010-2050) and three exploratory scenarios (2010-2030) are presented. The scenarios were prepared using the MULTIPOLES model. MULTIPOLES is a cohort-component, multistate, hierarchical population projection model, capable to model population and labour force (by sex and 5-year age group) for multi-country, multiregional systems or for multi-ethnic systems (Kupiszewska and Kupiszewski, 2013; Kupiszewski and Kupiszewska, 2011). It can be used to produce projections, simulations and forecasts of complex hierarchical population systems and to analyse the impact of various scenarios concerning migration, fertility, mortality and economic activity on population and labour force size and structure. Continuously developed since 1996, it has been applied in a number of projects, e.g. for studying the aging of the countries of Europe (Bijak et al, 2008) and more recently for modelling population of European regions in ESPON's DEMIFER (Kupiszewska and Kupiszewski, 2010) and for the simulations of population of Serbia (Kupiszewski et al, 2012a).

MULTIPOLES was specifically designed to model the impact of three categories of migration: internal, international within the system (e.g. within EU) and from outside of the modelled system. In the version of the model used in ET2050, population of each of NUTS2 regions is modelled in division into sex and 21 five-year age groups. Population of each region changes as a result of births, deaths, in-migration and out-migration from/to other regions of the country, immigration and emigration from/to other ESPON regions abroad as well as immigration and emigration from/to the countries outside the ESPON space. Deaths, migration flows inside the ESPON space and emigration to third countries are calculated for each region-sex-age group separately by applying region-, sex- and age-specific mortality rates and respective migration rates to the population at risk. Immigration from third countries is modelled in terms of absolute numbers. Births are calculated for each region by applying region- and age-specific fertility rates to the population of women in the fertile age groups. A detailed description of the model may be found in Kupiszewska and Kupiszewski (2010).

The start year of all ET2050 demographic scenarios was 2010. Population of each region (in division by sex and 5- year age group) was calculated in 5-year steps, i.e for 2015, 2020, 2025 and 2030 for the three exploratory scenarios and up to 2050 for the Baseline scenario. In addition to population numbers, the model calculates the indicators of population aging - Old Age Dependency Ratios (ODRs) for each regions. Moreover, the components of population change are calculated for each 5-year period (2010-2014, 2015-2019, 2020-2024 and 2025-2029 in the exploratory scenario and up to 2045-2049 in the Baseline scenario).

6 Assumptions for the Baseline scenario

In MULTIPOLES the assumptions are formulated for each component of population change, i.e. for fertility, mortality and migration. In the case of the first two components, we have reasonably good data about past trends in Europe and based on this information we are trying to make predictions for the future. For migration, the situation is far more difficult as the required data on international migration are not reliable and not available on the regional level. Estimates of net migration to Europe reported in various sources (Eurostat data, MIMOSA project estimate, IMEM project estimate) vary significantly. There are also problems with the availability of recent data on internal migration (matrices of flows between NUTS2 regions by age and sex). Given the lack of reliable data on migration, we have to accept a large degree of uncertainty of any population forecasts.

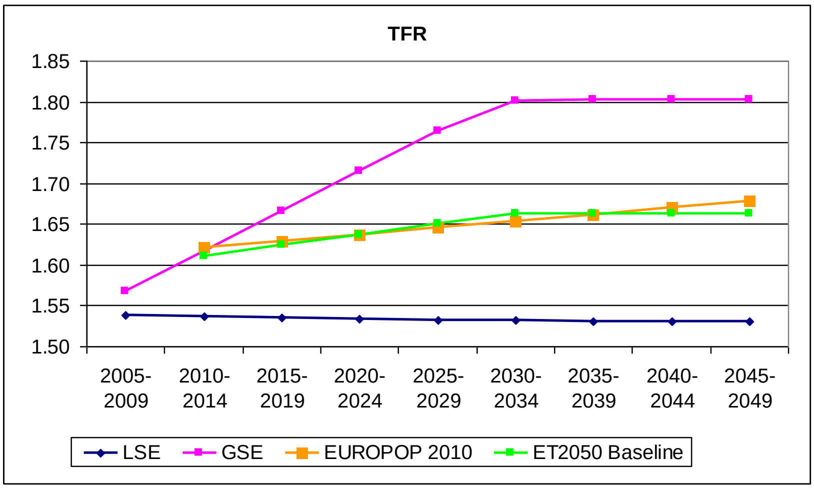
In order to deal with the problem of data quality and availability, it is important to take into account various existing sources of information on past trends and various existing forecasts for the future. When preparing our demographic scenarios for ET2050, we were guided by five main sources: Eurostat data and projections, data from national statistical institutes, migration estimates from the MIMOSA project funded by Eurostat, migration estimates from the IMEM project conducted within the NORFACE program, and population projections prepared within the ESPON's DEMIFER project. The latter ones were very useful as they were prepared on a regional level (NUTS2), while the Eurostat's EUROPOP2010 population projections were prepared on the national level only. In the DEMIFER project, a *Status quo* (STQ) scenario and four regional scenarios were prepared, covering the period 2005-2050 (Rees et al., 2010a). In ET2050, we used some information from two scenarios: *Growing Social Europe* (GSE) scenario and *Limited Social Europe* (LSE) scenario (Rees et al., 2010a). These two scenarios assumed regional cohesion, including convergence of fertility and mortality rates, but differed in the assumptions about the economic development.

The demographic Baseline scenario assumes „business as usual" conditions, no major policy changes and slow economic recovery. Economic conditions in the coming years will be to a large extent controlled by the financial and economic crises Europe has experienced recently. We assumed that the number of immigrants will be growing slowly to respond to the labour shortage (related to aging Europe).

Fertility assumptions

It is assumed that family friendly policies will prevail but fertility will remain low in Europe. We assume that total fertility rate (TFR) will increase from 1.61 to 1.66 in 2030, then it will be stable. Age specific rates in 2010-15 will be as in the DEMIFER's GSE scenario, then they increase linearly until 2030-35 to values equal to the average of those in the GSE and LSE scenarios and then will remain constant over the period 2035-50. The assumed 2010-2050 values of TFR are very similar to those assumed in the Eurostats's EUROPOP 2010 projection (see Figure 4). In all ESPON countries, total fertility rate will be below the replacement level of 2.1 births per woman both in 2025-2030 and 2045-2050.

Figure 4 Assumptions on total fertility rate in the ET2050 Baseline, EUROPOP 2010 and DEMIFER



Source: Rees et al (2010b), Eurostat database, Authors' calculations

Cohesion policies on national and subnational levels will result in a slight reduction of the differences between countries and between regions. The gap observed between higher and lower fertility countries will remain clearly visible despite these reductions. Regional variation in TFR assumed in the Baseline for the 2025-2029 period is presented in Map 1.

Mortality assumptions

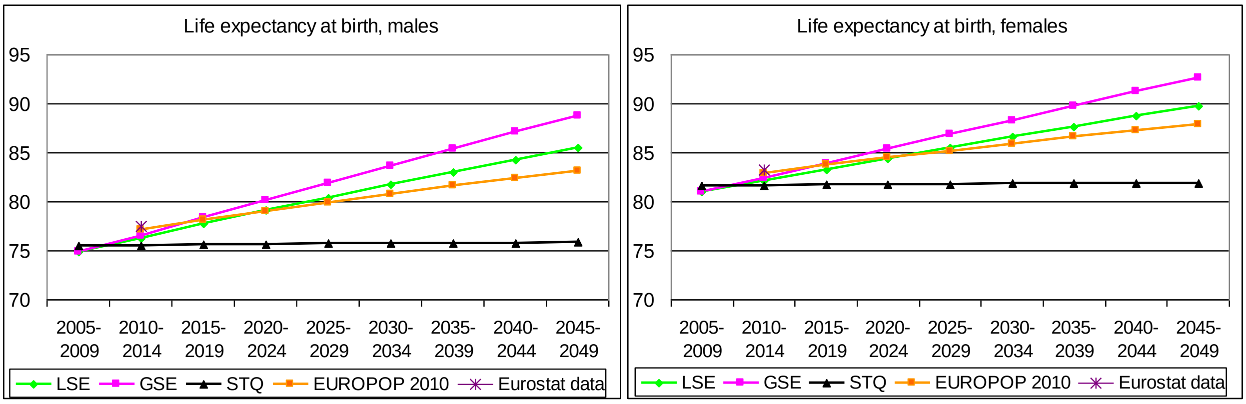
Longer life expectancy is considered as nearly certain. The increase will be a result of an interplay of medical advances and lifestyle factors, such as smoking, drinking and obesity.

Two observations were important when formulating the quantitative assumptions about mortality: (i) Life expectancy observed in Europe in 2010 (77 for men and 83 for women; Eurostat data) were higher than forecasted in the EUROPOP 2010 Eurostat's projection and in DEMIFER's scenarios; (ii) future life expectancy has been underestimated in most forecasts prepared for European countries in the past.

We assumed that life expectancy will increase to 81 years for men and 86 years for women in 2025-30 and to 85 years for men and 90 years for women in 2045-50. Thus, a narrowing of the gap in life expectancy between men and women is expected. Moreover, convergence in regional and national life expectancies is expected in consequence of cohesion policies. However, as in the case of fertility, regional and national differences in life expectancy will be still clearly visible (see Map 2).

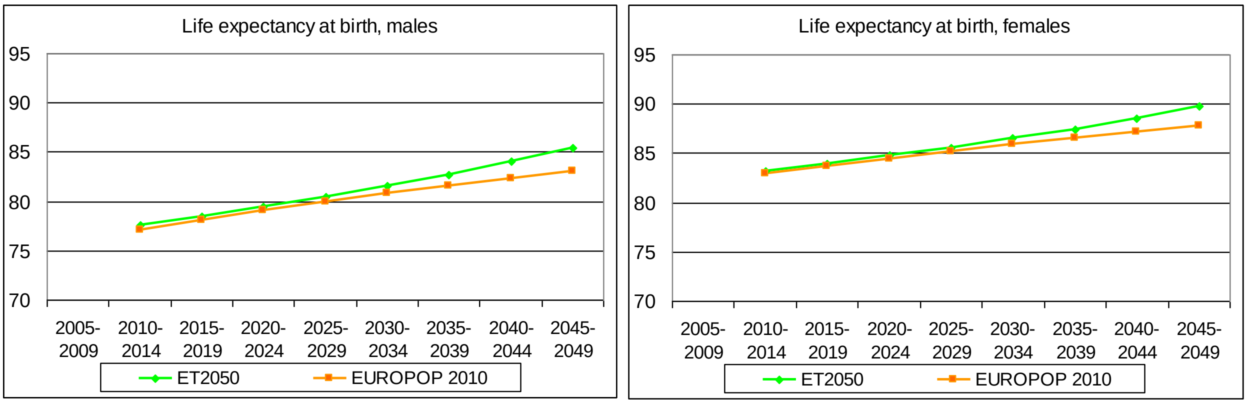
The assumptions about the age and sex specific mortality rates were as follows: 2010-2014 rates will be as in 2015-2020 in the DEMIFER's LSE scenario, and they will decrease linearly to reach 2045-50 rates as in DEMIFER's LSE scenario. The assumed trajectories of life expectancy are slightly higher than that in the Eurostat's EUROPOP 2010 forecast, reaching in the 2050 the values assumed in the Demifer's LSE scenario (Figure 5 and Figure 6).

Figure 5 Assumptions on life expectancy in EUROPOP 2010 and DEMIFER's scenarios



Source: Rees et al (2010b), Kupiszewski and Kupiszewska (2010), Eurostat database, Authors' calculations

Figure 6 Assumptions on life expectancy in ET2050 and in EUROPOP 2010



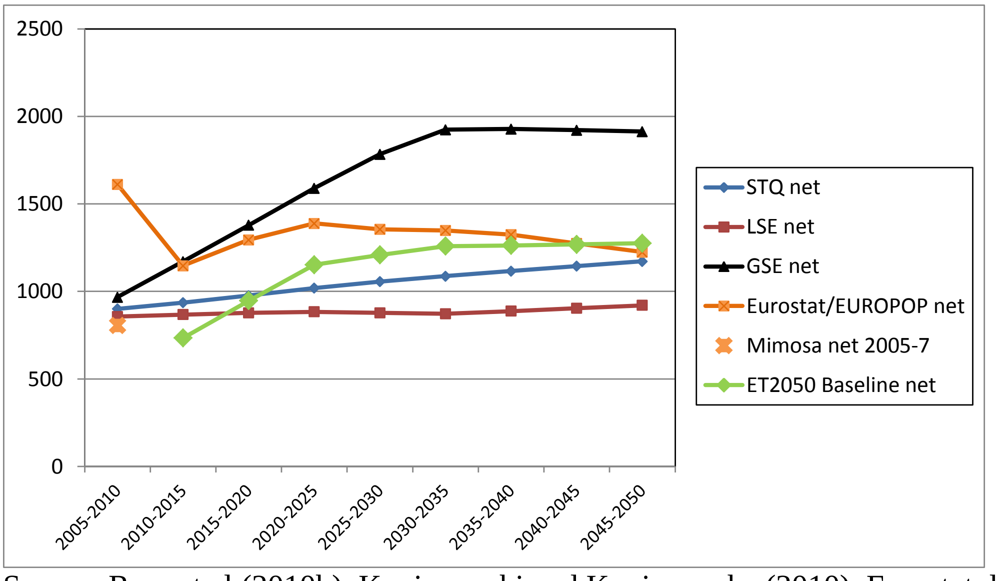
Source: Eurostat database, Authors' calculations

Assumptions on migration

International extra-European migration

It was assumed that in the Baseline scenario the economic development of Europe will be sluggish and that anti-immigration sentiments will still be alive. In consequence,, immigration policies will be restrictive to some extent. Migrants will originate mainly from the neighbouring countries, like Ukraine or Belarus, Arab countries, former colonies, as well as from populous Southern and South-Eastern Asia. They will continue to be attracted mainly by cosmopolitan centres and urban agglomerations. Brain-drain of less developed areas will continue. There will be also some emigration from Europe to the rest of the world, especially from the countries crippled by the sovereign debt crisis. In numerical terms, we assumed that until 2030-35 extra-Europe immigration will increase by 2 per cent every 5 years, then it will be constant. In the most crisis-hit countries the increase will be delayed by five years. As a result, net extra-European migration will grow slowly from 0.73 mln per year in the period 2010-2014 to 1.21 mln per year in 2025-2029 and 1.28 mln in 2045-2050. Figure 7 presents average annual migration gains in the ET2050 Baseline scenario, compared to net migration in the Eurostat's EUROPOP 2010 forecast, three scenarios in the DEMIFER project and estimates for 2005-2007 from the Eurostat's MIMOSA project.

Figure 7 Average annual net migration 2010-2050, ET2050 Baseline, EUROPOP 2010 and DEMIFER scenarios



Source: Rees et al (2010b), Kupiszewski and Kupiszewska (2010), Eurostat database, Authors' calculations

International intra-European migration

The assumptions on international intra-Europe migration were formulated in terms of age and sex-specific emigration rates. As there is no coherent data on international migration between European states to inform about the observed flows, our estimates (based on the results of modelling migration flows within the Eurostat's MIMOSA project, the more recent Northface IMEM project and on the recent Eurostat's data originating from national statistical agencies) have been used as the departure point for formulating the scenario. Then it was assumed that in the least crisis-hit countries emigration rates will be constant. In the most crisis-hit countries, in particular in Cyprus, Greece, Italy, Spain, Portugal and Ireland, the crisis-related increased rates will gradually drop back to the pre-crises values in 2020-25 and then will be constant.

Internal migration

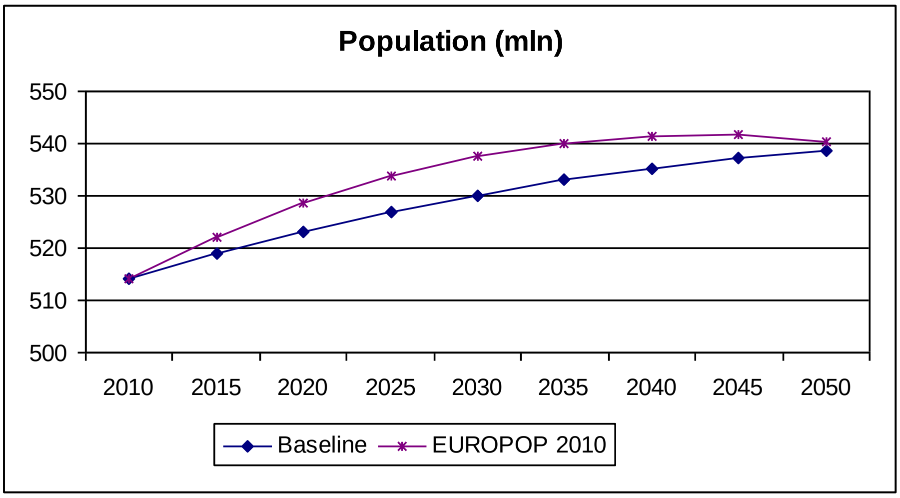
The scenario concerning internal migration is generated by defining the matrices of origin-destination-age-sex-specific rates of migration flows. It is done for each country separately on the NUTs 2 level. In practice such complex matrices have to be modelled in several steps. First, the level of internal migration can be establish for each country and then the distribution of migrants between various origin-destination pairs. The ET2050 Baseline scenario concerning internal migration was based directly on the DEMIFER's LSE scenario. It assumed that the average level of out-migration rates in each country will remain constant, however the cohesion policies will moderately reduce the differences in the attractiveness of regions, effectively flattening migration gains and losses. In other words we assumed that the average level of mobility will be maintained but regional differences will decrease.

7 Baseline scenario – the results

Total population of 31 European countries will grow slowly, from 514 mln in 2010 to 539 mln in 2050 (Figure 8).

Europe as a whole will be growing under the Baseline scenario but many regions (40 per cent) will be declining. On Map 7 the regions which gain population are marked in cold colours, those which loose population are marked in warm colours. The largest depopulation is observed in the former socialist countries (mainly as a result of the intra-Europe emigration) and Portugal. Population growth is expected in northern Europe, France, Benelux, southern Spain and northern and central Italy, as well as regions with megacities and large cities. Population growth is induced by immigration or immigration coupled with relatively high fertility. Regional differences in average annual net migration rates are presented in Map 8.

Figure 8 Population of 31 ESPON countries, Baseline scenario and EUROPOP 2010

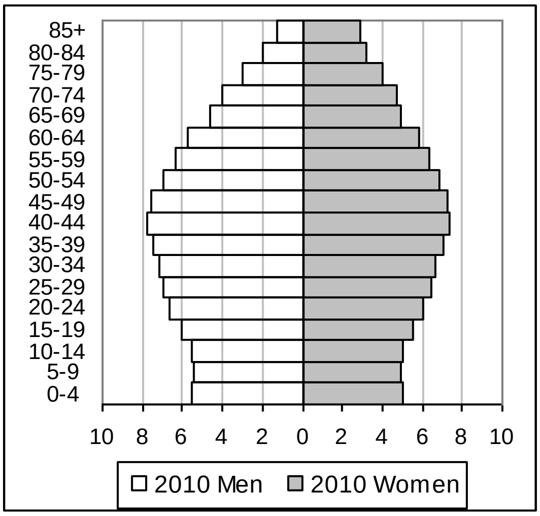


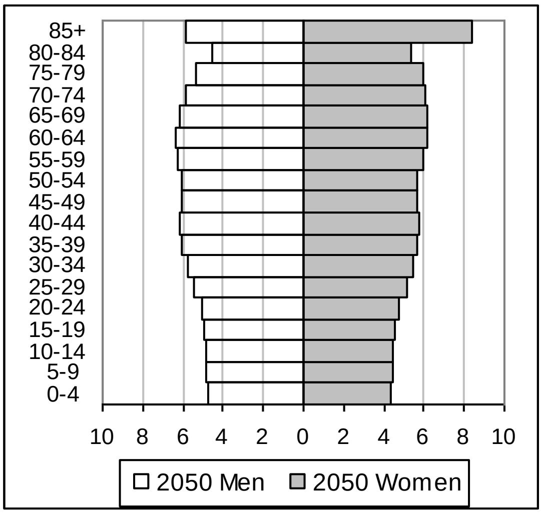
Source: Eurostat database, Authors' calculations

Aging is universal across Europe. Figure 9 shows the aging process for the 31 ESPON countries aggregate, by comparing the age pyramids in 2010 and in 2050. As shown in Figure 10, the share of population aged 65 years or more will increase from 17 per cent in 2010 to 30 per cent in 2050.

A synthetic indicator of the age structure of population is old-age dependency ratio (ODR) defined as the number of persons aged 65 or more per one hundred persons in the working age. The ODR values in European regions in 2010, 2030 and 2050 are presented on Map 9. The ODR values observed in the majority of regions will grow from 20-30 persons aged 65+ per 100 persons in the working age in 2010 to 40-60 in 2050. In 2010, ODR not exceeding 30 was observed in 212 regions in Europe (74 per cent of regions), in 2050 only in 2. ODR above 60 was not noted in 2010, while such level of ODR is expected to be observed in 73 regions in 2050

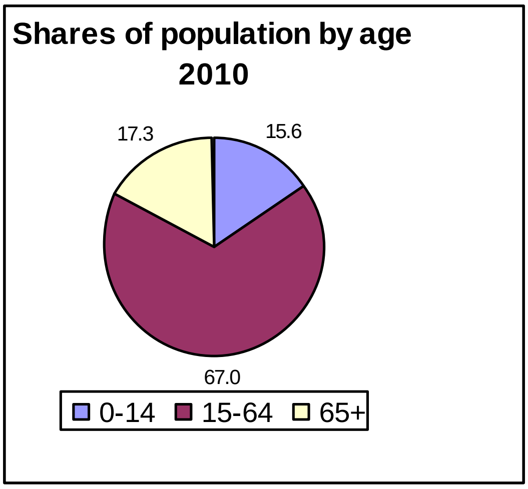
Figure 9 Age pyramids 2010 and 2050, ESPON countries, Baseline scenario.

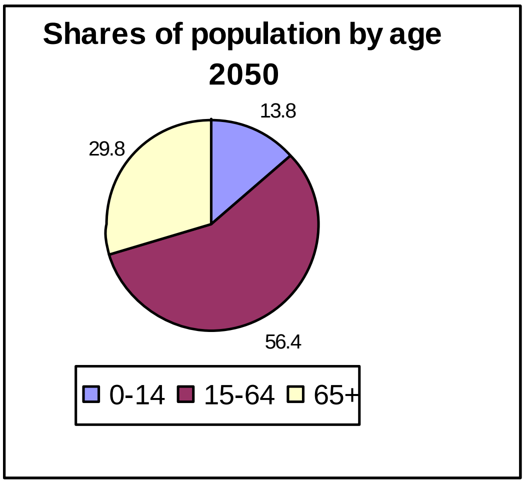




Source: Authors' calculations

Figure 10 Broad age structure of the population of the 31 countries, 2010 and 2050, Baseline scenario.

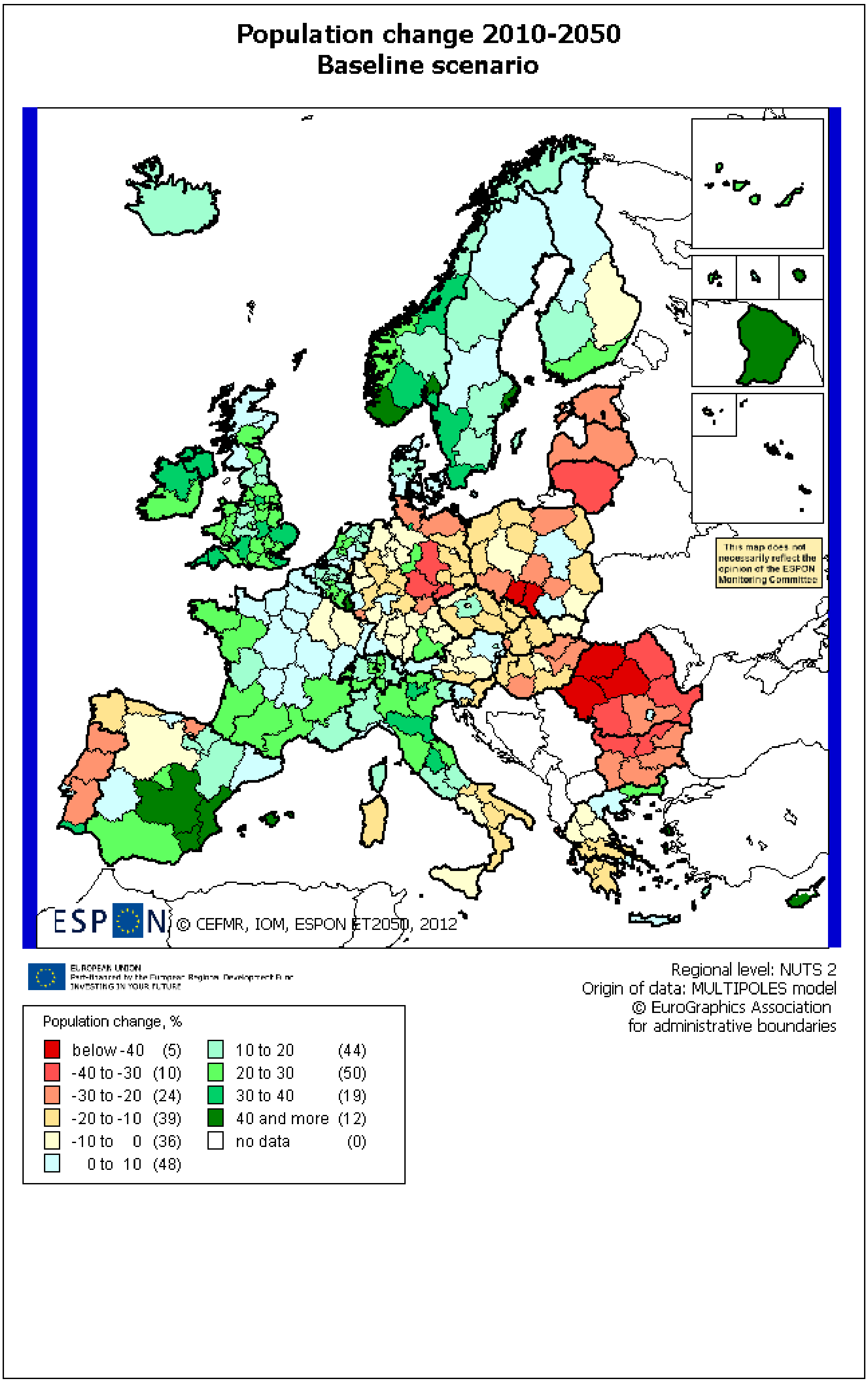




Source: Authors' calculations

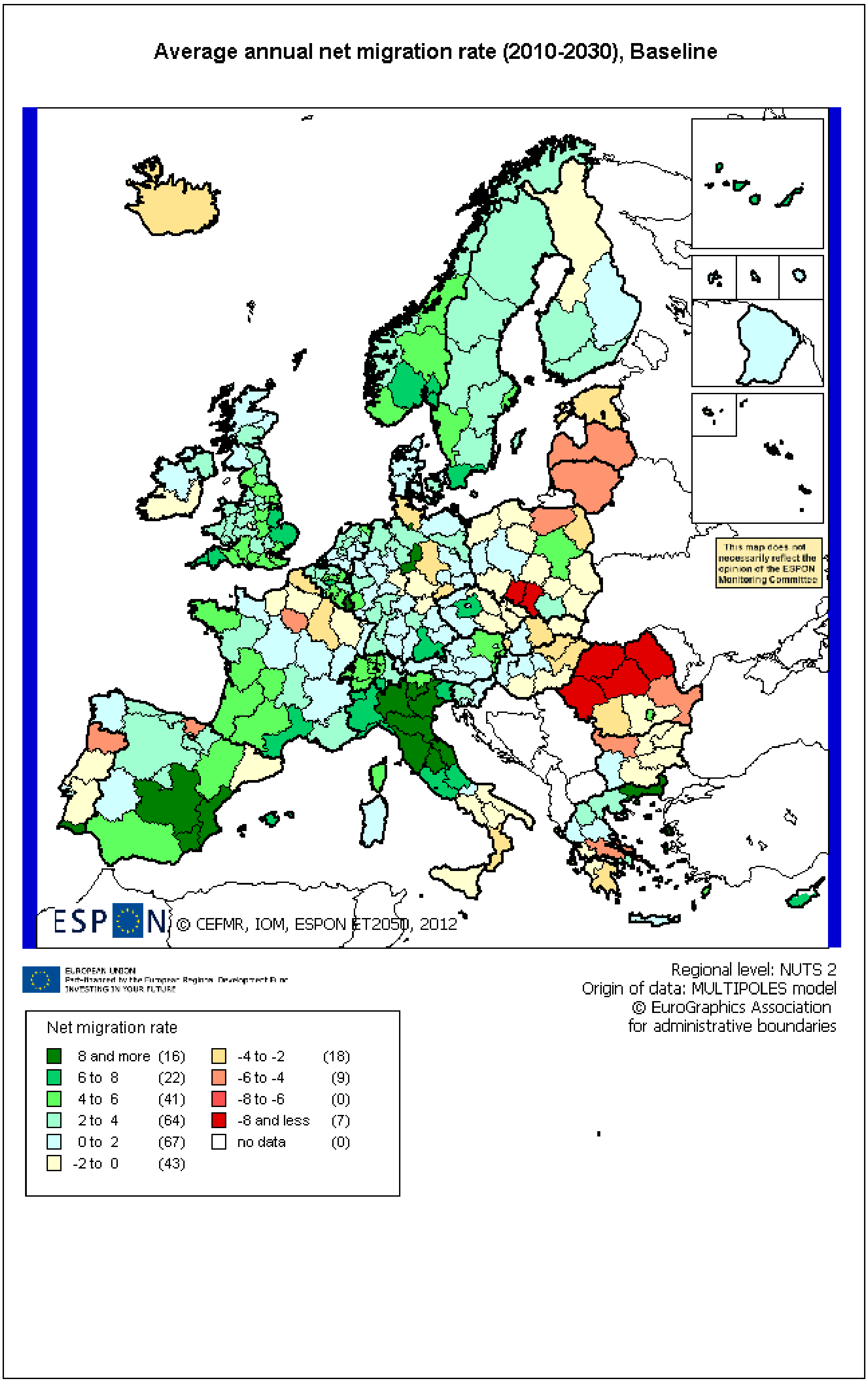
Most advanced aging will be observed in the former GDR, except Berlin, in Portugal except Lisbon and Algarve and in northern Spain. Speed of aging (measured here as the ODR change over a specified time) also vary between the countries (Map 10). Fast aging, reinforced by emigration of persons in the working age, is observed in the former socialist countries. Poland will change it status from young in 2010 to old in 2050. Relatively slow speed of aging is observed in Spain, Italy and the UK thanks to immigration flows.

Map 7 Population change 2010-2050, Baseline scenario



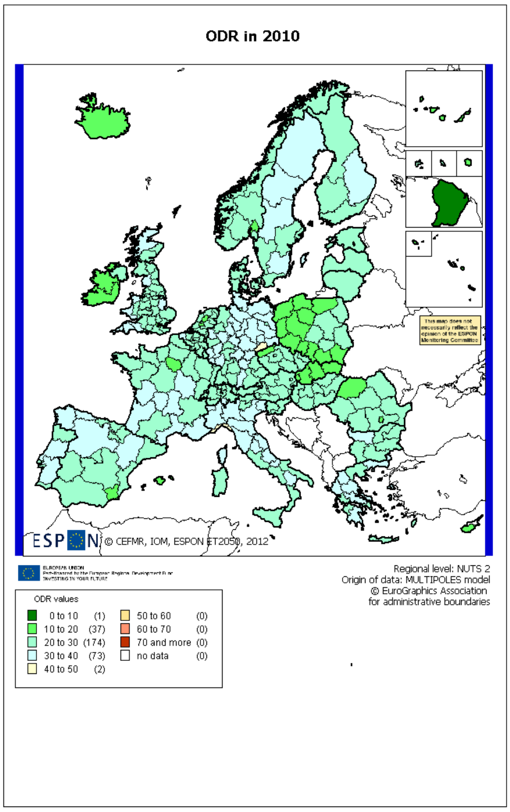
Source: Authors' calculations

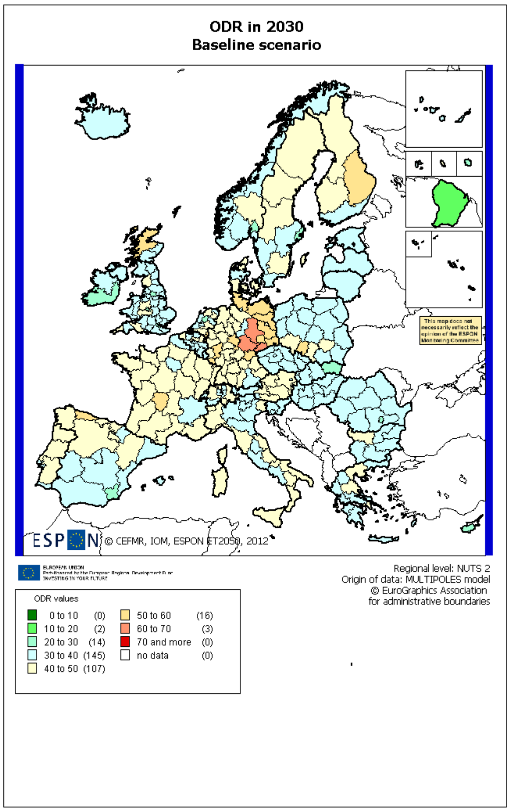
Map 8 Average annual net migration rates, 2010-2030, Baseline scenario.

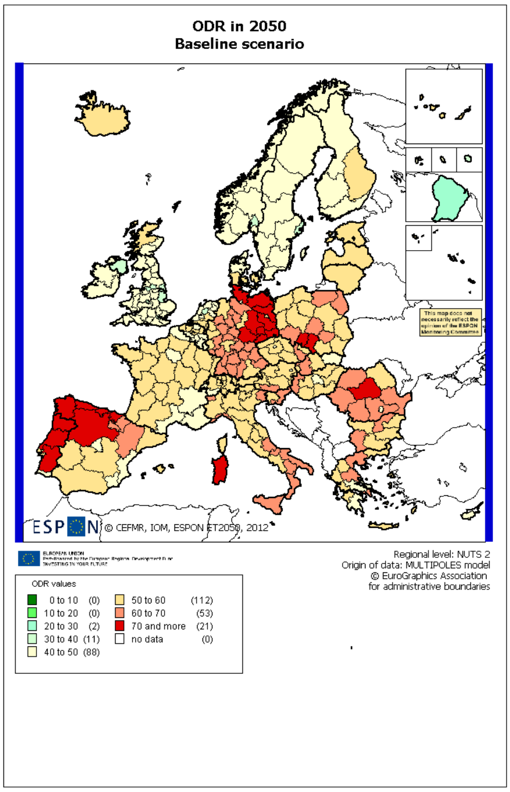


Source: Authors' calculations

Map 9 Old-age dependency ratios, 2010, 2030, 2050, Baseline scenario.

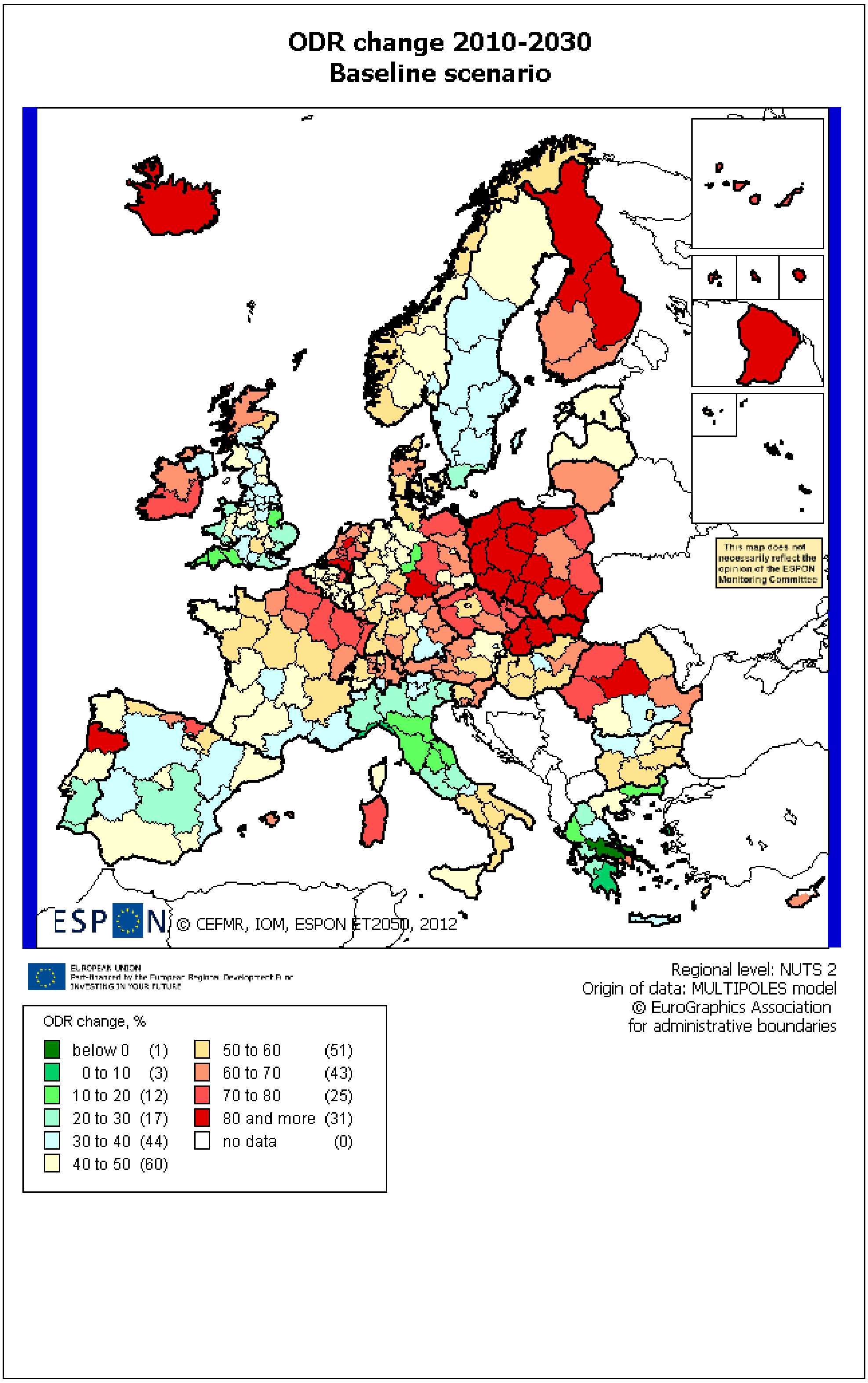






Source: Authors' calculations

Map 10 Old-age dependency ratios change 2010-2030, Baseline scenario



Source: Authors' calculations

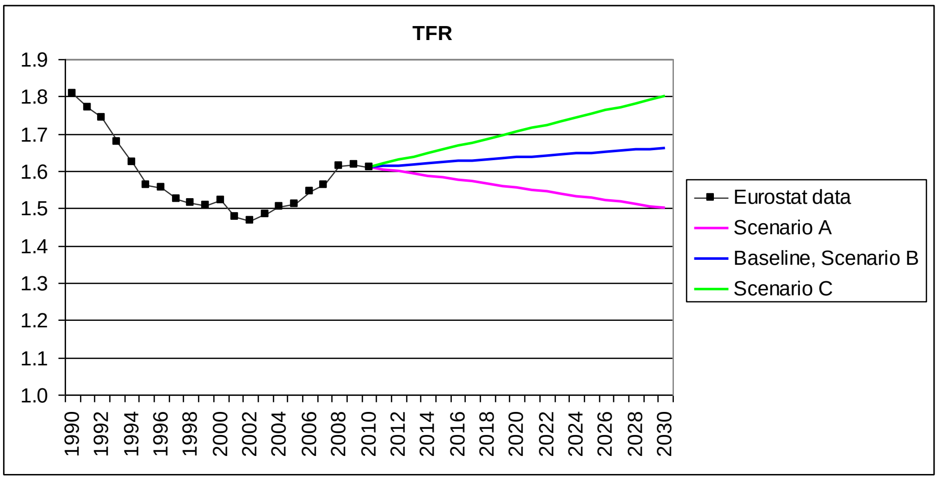
8 Assumptions for the exploratory scenarios

The general assumptions for the three exploratory scenarios were as follows.
Scenario A („Megas") promotes European metropolitan areas; growth will be driven by dynamic large cities (mostly the capitals). GDP will be growing slightly faster than in the Baseline. Welfare system will be fully privatised, lacking of adequate policies supporting families and women. Openness to migrants from outside Europe will result in increased international mobility within Europe.
Scenario B („Cities") promotes second rank cities (polycentricity at national level). It was assumed that the GDP will be growing faster than in the Baseline. Fertility will be as in the Baseline. We expect moderate immigration from outside Europe and a slight increase of international mobility within Europe.
Scenario C („Regions") promotes peripheral and rural areas. GDP will be growing slower than in the Baseline. Pro-family policies will be implemented on a national level. Strict immigration policies will be enforced. A decrease of international mobility within Europe will be observed.

Taking into account these general assumptions, detailed assumptions on components of demographic change were made. They were as follows:

Fertility assumptions
In Scenario A („Megas") a decrease of TFR to 1.5 in 2030 was assumed because the competition on the labour market and the lack of adequate social policies are not compatible with childbearing. In Scenario B („Cities") the assumptions were as in the Baseline scenario (TFR equal 1.66 in 2030). It was deemed that better economic condition and reinforced welfare system will not be enough to trigger TFR increase, because of the competition between family-related and other values. Scenario C („Regions") was the most optimistic, with TFR increase stronger than in the Baseline, to 1.8 in 2030. Fertility rates will increase in all the regions thanks to national level social policies supporting families and women, stronger and more efficient than in the Baseline scenario. A summary of the scenarios is shown on Figure 11.

Figure 11 Total fertility rates 1990-2030, Eurostat data, Baseline scenario and exploratory scenarios



Source: Eurostat database, Authors' calculations

Mortality assumptions
In all exploratory scenarios an increase of life expectancy and decrease of mortality rates was assumed the same as in the baseline scenario.

Migration assumptions
Assumptions vary regionally and are governed by a general principle of larger immigration flows to the regions promoted in a given scenario. Scenario A („Megas") assumes an increased share of flows to regions with European metropolitan cities (rank 1 regions). Scenario B („Cities") assumes an increased share of flows to 2nd rank regions. Scenario C („Regions") assumes a decrease of outflows from peripheral and rural regions (rank 3 regions).

Extra-Europe migration
Scenario A („Megas") assumes immigration increases faster than in the Baseline scenario. Scenario B („Cities") adopts the rate of increase higher than Baseline but lower than in „Megas"). Scenario C („Regions") assumes immigration lower than in the Baseline (decrease by 2 per cent every 5 years).

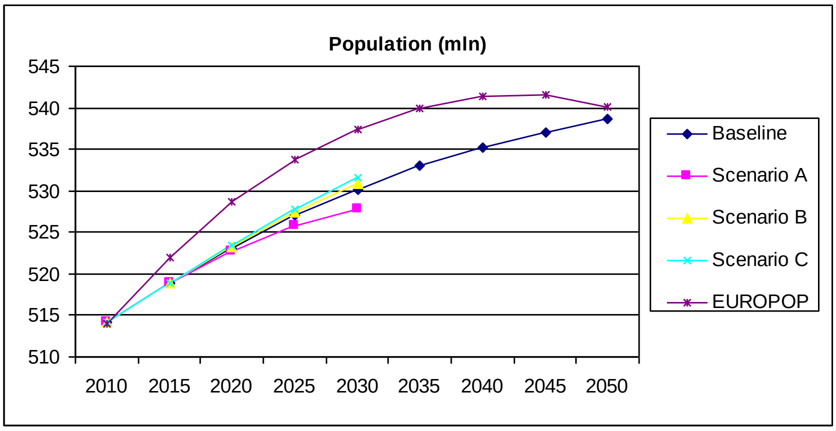
International migration within Europe
Scenario A („Megas") assumes increased emigration rates from rank 2 and 3 regions. Scenario B („Cities") assumes increased emigration rates from rank 3 (peripheral and rural) regions. In Scenario C („Regions") decreased emigration rates from rank 3 (peripheral and rural) regions are assumed.

Internal migration
Scenario A („Megas") assumes an increase of the rate of out-migration to European metropolitan areas from rank 2 and rank 3 regions. In Scenario B („Cities") an increase of the rate of out-migration to 2nd rank regions from rank 1 and rank 3 regions is assumed combined with a decrease of outmigration from 2nd rank regions to rank 1 and rank 3 regions. In Scenario C („Regions") a decrease of out-migration from the peripheral and rural areas and an increase of the rate of out-migration to the peripheral and rural areas are assumed.

9 Exploratory scenarios – the results

Population obtained in each of the exploratory scenarios and in the Baseline scenario (in mln) are presented in Figure 12.

Figure 12 Population in exploratory scenarios, the Baseline scenario and in EUROPOP 2010

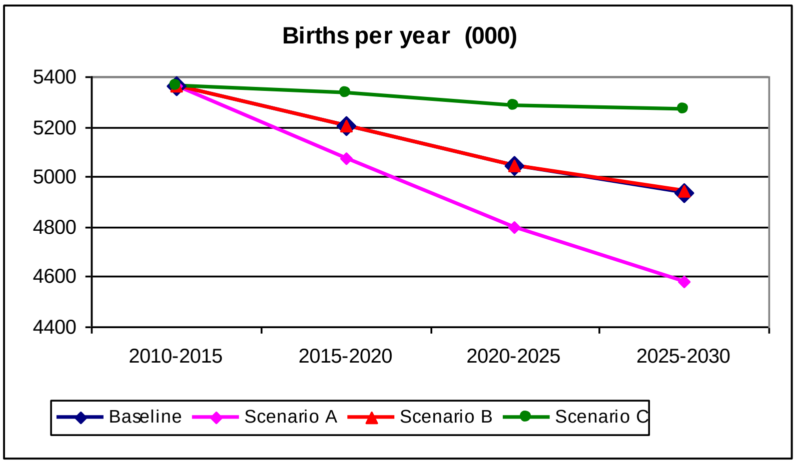


Source: Eurostat database, Authors' calculations

In Scenario A („Megas") population is lower than in the Baseline, despite increased immigration, because of lower fertility. In Scenario B („Cities") population is slightly higher than in the Baseline thanks to higher immigration. In Scenario C („Regions") we observe, despite decreased immigration, the largest increase of population, which is generated by higher fertility.

A decrease in the number of births in the ESPON area is predicted in all three exploratory scenarios (Figure 13). In Scenario C, a small decrease will be observed despite the assumption on pro-family and pro-natalist policies and increasing fertility. This is related to population aging and the related decrease in the number of women in the fertile age. Scenario A, which is based on the assumption of highly competitive economy with a limited social security component would result in nearly 800 thousand drop in the number of births per year between 2010 and 2030.

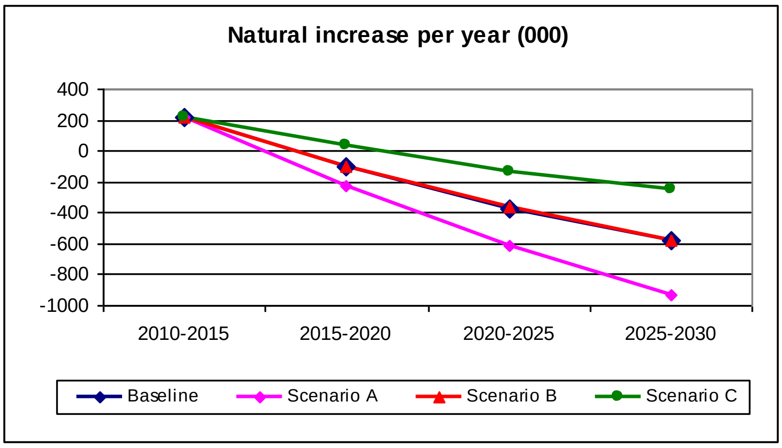
Figure 13 Annual number of births in the three exploratory scenarios and in the Baseline



Source: Authors' calculations

The decreasing number of births, combined with an increasing number of deaths would result in decreasing natural change (Figure 14). Natural change would be negative (more deaths than births) starting from the 2015-2020 period in Scenarios A and B and starting from the 2020-2025 period in Scenario C.

Figure 14 Annual natural increase in the three exploratory scenarios and in the Baseline

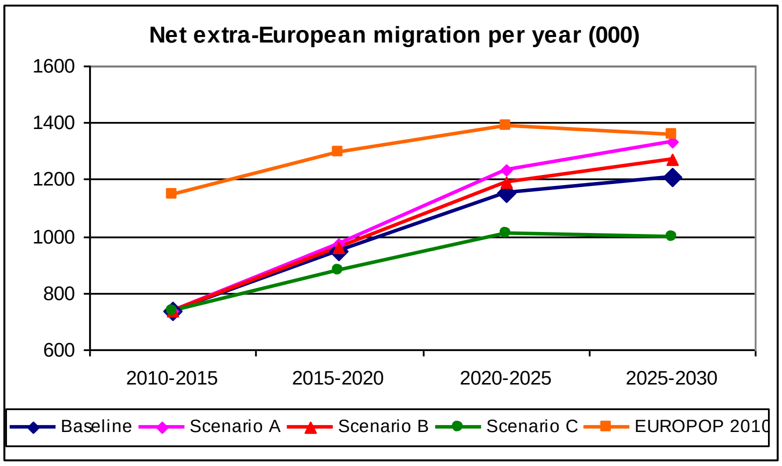


Source: Authors' calculations

With a negative natural change, the growing extra-European migration (Figure 15) will constitute a key balancing factor of population dynamics.

In the exploratory scenarios the assumption on low fertility was accompanied by the assumption on high net migration gains (Scenario A), and the assumption on higher fertility was coupled with the one on low net migration (Scenario C). As a consequence, the resulting total population did not differ very much between the scenarios, but this lack of a difference is somewhat illusive. In Scenario A characterized by high net migration, the national, cultural and ethnic composition of population will be much more heterogeneous than in Scenario C characterized by low net migration.

Figure 15 Annual net extra-Europe migration in the three exploratory scenarios, in the Baseline and in EUROPOP 2010.



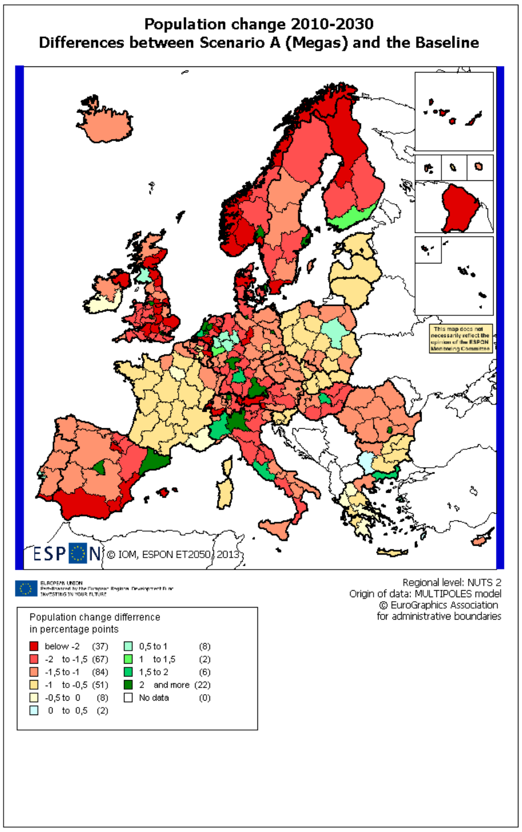
Source: Eurostat database, Authors' calculations

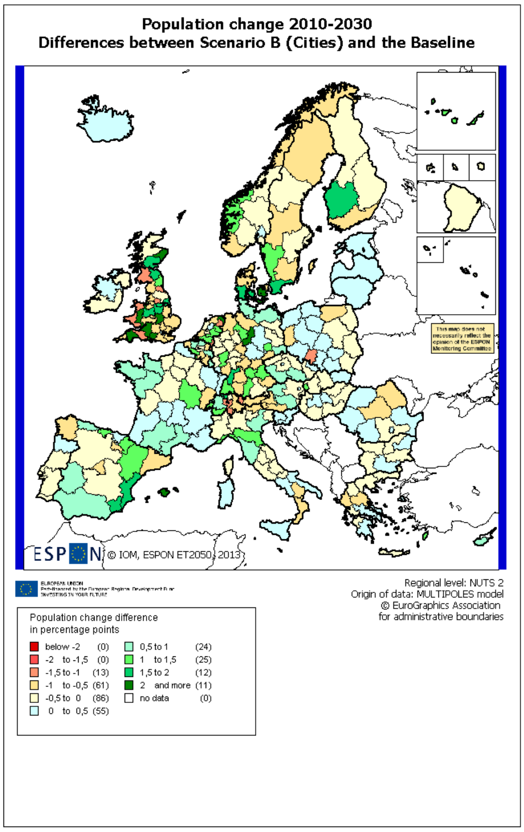
Regional populations
In most of the regions, population in Scenario A („Megas”) will be lower than in the Baseline scenario, as depicted in Map 11. The exception are European metropolitan areas. They will have population higher than in the Baseline thanks to an increased inflow of migrants that will counterbalance the declining fertility. Scenario A leads to the concentration of population in the largest cities. In Scenario B („Cities”), as expected, the 2nd rank cities have population slightly larger than in the Baseline scenario thanks to increased inflows. In Scenario C („Regions”), most of the regions will have higher population than in the Baseline thanks to growing fertility. Rural and peripheral areas will benefit additionally from reduced emigration. At the same time, some large cities will have lower population than in the Baseline, because of smaller inflows. Overall, Scenario C will lead to a more balanced distribution of population between various categories of regions.

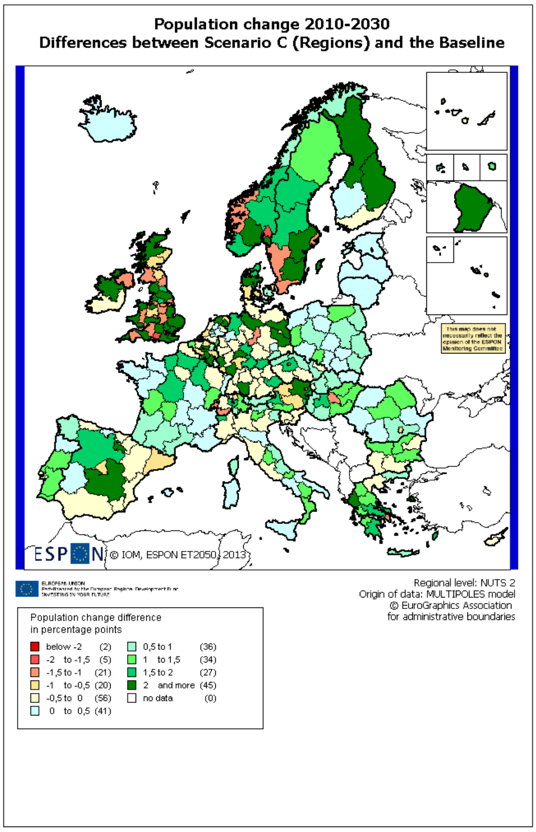
Population aging
The differences in the speed of ageing (expressed as the percentage change of ODR in the 2010-2030 period;

Map 12) between the exploratory scenarios and the Baseline generally follow the migration pattern assumed in the exploratory scenarios. In each scenario the promoted regions gain young migrants faster than the other regions, therefore the ageing in these regions is slower. The strongest reduction of the speed of aging in the promoted regions is observed in Scenario A, which is related to the highest immigration in this scenario. In Scenario C, the reduction of aging in the peripheral and rural areas is related to a large extent to a reduced emigration of working age population. The result of substantially higher fertility assumed in Scenario C is hardly visible, as in 2030 too little time will have passed for most of children born between 2010 and 2030 to join the labour force.

Map 11 Population change 2010-2030: Difference between the exploratory scenarios and the Baseline.

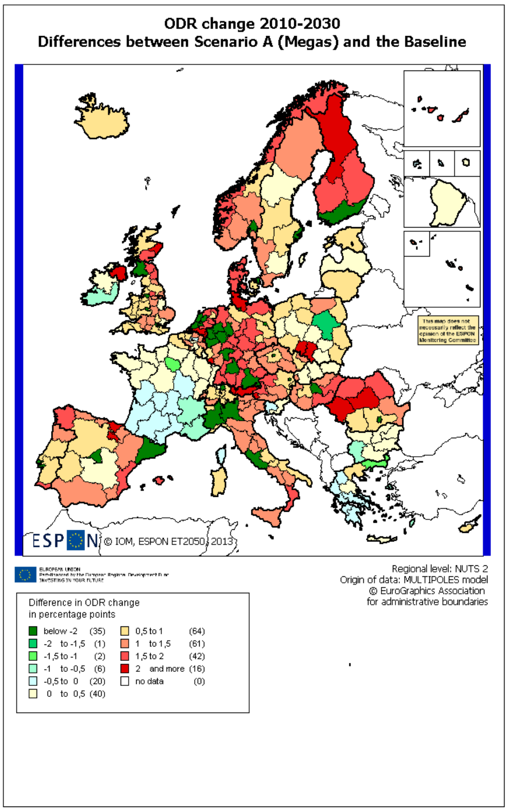


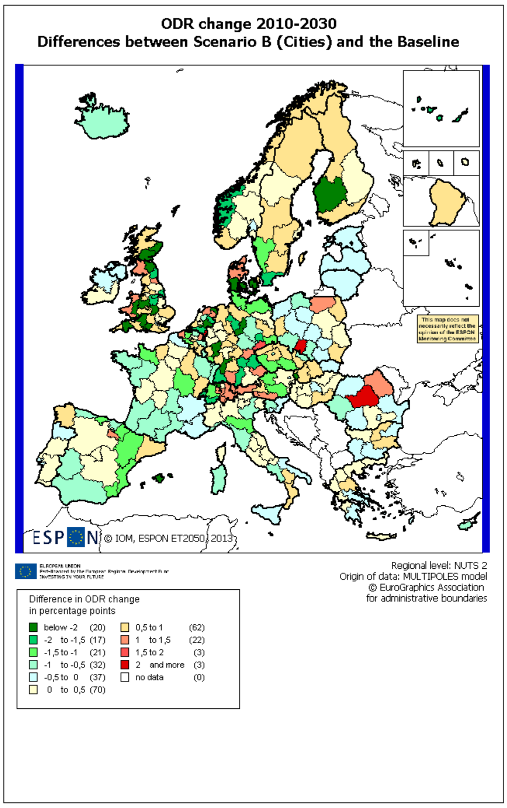


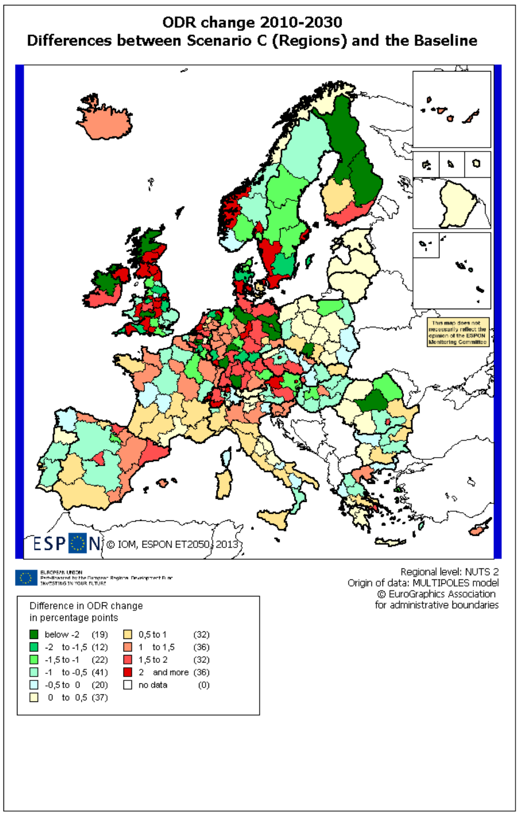


Source: Authors' calculations

Map 12 ODR change 2010-2030: Difference between the exploratory scenarios and the Baseline







Source: Authors' calculations

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