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The ESPON 2013 Programme

DEMIFER
Demographic and migratory flows affecting European regions and cities

Applied Research Project 2013/1/3

Interim Report

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

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This basic report exists only in an electronic version.

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Aims and tasks

The **aims** of the DEMIFER project (DEmographic and MIgratory Flows affecting European Regions and cities; a Transnational Project Group project under the EPSON 2013 programme of the European Union), are:

1. to determine how distinctive are current trends in migration, fertility, and mortality and how they affect differences across regions in population growth, the size of the working age population and the ageing of the population.
2. to forecast how future developments in migration, fertility and mortality will affect population growth and changes in the age structure in different types of regions.
3. to analyse the extent to which the labour force in different types of regions will change due to increases in natural growth, internal migration, international migration and participation rates.
4. to evaluate which policy options could achieve increases in natural growth, migration and labour force participation.
5. to review the extent to which the effects of internal migration, migration between European countries and migration to Europe compensate or reinforce each other.
6. to assess the future effects of climate change on migration flows within, between and into countries and regions.

To achieve these aims we are engaged in the following **tasks**.

- Assembly of a **database** for European countries and regions (NUTS2) for the main demographic drivers of population development and of their socio-economic and environmental covariates for the years since 2000.
- Analysis of the **demographic regimes** that characterize the regions of Europe examining the fertility, mortality and net migration components and the changing age structures.
- Synthesis of those demographic regimes using cluster analysis to derive a summary **typology** of European regions.
- Extension of the database and analysis to encompass three **different migration streams**: inter-regional migration within countries, inter-state migration between countries and migration exchanges between Europe and the Rest of the World. The skill mix of migrant streams will be assessed.
- Analysis of the relationship between the age structure of national and regional populations and the **labour force** via participation and employment rates.
- Analysis of the relationship between the demographic dynamics of national and regional populations and the **size of the older population**.
- Projections of the future age structures and labour size and productivity through use of a **multiregional population projection model** that recognizes the hierarchy of migration streams. To the

model will be added a module that takes into account labour force participation, employment and productivity rates.

- Creation of a set of **reference scenarios** to drive the projection model. The first reference scenario will assess what will happen if the demographic regimes of mid-decade (2005) continue to 2050. The second reference scenario will explore what happens when various migration streams are turned off. Comparison with the first reference scenario will yield estimates of the impact of migration on population change.
- Creation of a set of **policy scenarios** to drive the projection model. The policy scenarios will adopt alternative but plausible views on the future developments in Europe and turn them into assumptions for the projection. The policy scenarios will combine current trends with the impacts of policies which impact on those trends. The trends to be incorporated in the scenarios will include climate change and resource depletion and the policies will include mitigation of climate change and development of resource alternatives.
- Assessment of the impact of the policy scenarios on **regional competitiveness and on regional cohesion**. Competitiveness will be affected by projected changes in population age structures, labour force participation and productivity, cohesion will be affected by social policy and the degree to which the demographic drivers converge or diverge in the future.
- Examination of all the processes and outcomes in detail in a set of **case studies,** in which more detailed local information and knowledge will be used to understand the many ways in which demographic and migratory flows affect European regions and cities.

Data and methods

The project focuses on the 27 members of the European Union and four additional European states that have a close relationship with the EU (EEA plus Switzerland). We will survey what equivalent data are available for candidate countries but will not formally include them in our models. We are conducting our analysis at two regional scales: the demographic analysis, the typology, the projection model and the scenarios will use the NUTS2 scale for which the required data are largely available. For the case studies we will select regions using the overall typology and employ NUTS3 level data as well as NUTS2 information to understand the processes at work.

We have assembled from ESPON and EUROSTAT databases data for the years from 2000 to 2007 for population by age, life expectancies at birth and total fertility rates for each NUTS2 region. For migration data have been collected for inter-regional migration in three partial arrays: origin-destination flows, out-migration totals by age and in-migration totals by age. From these the full origin-destination-age array of migration flows will be estimated to yield the origin-destination-age rates of migration needed in the projection model. Also included in the database are total emigration flows by age and immigration flows by age. These refer to all international migration from and to EU Member States. We will use a new estimate of migration flows between the countries of the EU to

extract inter-state intra-Europe migration. Taking the total of these flows by origin from total emigrations and the total of these flows by destination will yield estimates of extra-Europe emigration and extra-Europe immigration.

There are many gaps in the database for particular countries. As far as possible we will fill the gaps from national statistics (e.g. for the UK and for Belgium). We will also use some simple extrapolations, where needed, to harmonize the years covered in the database. This is necessary because otherwise we will not be using comparable information.

To construct the typology of European regions a combination of clustering techniques will be used: a hierarchical algorithm will be used to generate a large number of solutions from which an optimum number of types will be chosen. Using the centroids of these clusters in four variable space, k-means clustering is used to optimize the allocation of regions to clusters.

To carry out the population projections we will use the MULTIPOLES software which simultaneously handles migration streams at the three levels of inter-region, inter-state and extra-Europe. The underlying model is based on multiregional cohort-component principles, implemented using five year age groups and five year time intervals. We will extend the age range of the model from its current upper age group of 85 and over to four more age groups ending in 100 and over. This reflects the increasing longevity of European populations and the rising probability that people will survive into their nineties.

The population projections will be driven by reference scenarios which will assume the constant application of rates for the demographic drivers around a 2005 base year for another 45 years. The policy scenarios will be developed, on the other hand, as a set of assumptions based on hypotheses about how European society will develop in the 21st century. Possible futures, we propose, will depend on where societies lie on two macro-dimensions called distribution/fairness and economy/ environment. On the first dimension, either market forces will predominate or social welfare considerations will be uppermost. On the second dimension, either the environmental challenges (climate change, resource depletion) will be overcome and economies will continue to grow or they will not and any economic growth will be curtailed. Combining these dimensions leads to four scenarios, which are labelled Challenged Market Europe, Limited Social Europe, Expanding Market Europe and Growing Social Europe.

How will we put policy flesh on these scenario bones? We will review the published literature on the likely impacts of policy on each of the components of the projection model and then translate these findings into judgemental modifications of the principal drivers. A set of expectations have been designed but these may be modified as we explore trends and policies.

The final step in the analysis will be to add labour force participation, employment and productivity forecasts to the demographic projections to yield projections of the labour force and the demographically driven economic product.

Demography and migration

It is well known that Europe's population has been ageing, that the rates of growth have been slowing and that the main driver of growth has switched from natural increase to net in-migration. The main force behind ageing has been the sustained below replacement fertility for the past four decades or so. We estimate that Europe's total fertility rate in the period 2000-6 averaged 1.48 children per woman. We find that fertility has increased somewhat in northern and western Europe in the 2000s compared with the 1990s but as yet the increase has been insufficient to counteract the negative demographic momentum that has developed. Migration into gaining regions does slow down the process of ageing but exacerbates the ageing process in regions losing migrants. Increases in life expectancy, virtually universal across regions and years mean further ageing and increasing survival rates to older ages. In 2000-6 Europe's life expectancy for men was 75.0 years and for women 81.2 years, with improvement rates averaging just over two years per decade for men and just under two years per decade for women.

So compared with the 1990s growth across Europe's regions in the 2000s has been lower. In the 1990s 73% of regions gained population; in the 2000s this had fallen to 70%. In the 1990s 42% of Europe's regions experienced both positive natural increase and positive net migration, while in the 2000s only 35% of regions were in this situation.

We map the variation across European countries and regions in the fertility, mortality and total migration. Variation in TFRs and life expectancies at birth in the regions follow a national pattern. For example, Italian regions have uniformly low fertilities and uniformly high life expectancies. However, when we look at both net total migration and net inter-regional migration, the northern Italian regions exhibit substantial in-migration while the South and Islands (the Mezzogiorno) experience sustained out-migration. Policies have been directed to redressing the underlying economic imbalance between north and south in Italy since the 1930s but have still not altered this structure.

The rates of growth in the years 2000-2007 have been mapped for the working ages and the older old. The first group provides the economic product while the second has large consumption needs for health and home care. A large number of regions (80 out of 285 or 28%) have declining work forces, while only a small number of regions (6 out of 287) have declining population 75 and over. We anticipate that in the years 2005-2050, the older old will grow fast as the baby boom generations reach retirement and then experience higher survival than previous generations. To meet the challenges of ageing then some regions will have favourable demographic dynamics while others will not.

Demographic typology

Because it is difficult to retain a mental image of a large number of demographic indicators and their spatial patterns, it is very useful to develop a typology that synthesizes these detailed structures. We propose a seven member typology of the demographic status of European regions around 2005. Regions (16) in the *Young potentials* cluster exhibit the most favourable age structures in Europe and are found in eastern "costa" Spain and in Ireland. Regions (85) in the *Euro Standard* cluster have age structures close to the European average and populations that are still growing. They are found in the UK, central, western and southern France, western Germany, eastern Austria and in parts of all Nordic countries. The *Family Potentials* cluster (55 regions) has a younger age structure than the previous cluster with high natural increase and positive in-migration. These regions are found mainly in West and North Europe (in the UK, north and east France, in the Benelux countries, in Scandinavia and western Austria). The *Challenge of Decline* cluster (31 regions) experiences population decline and a high elderly share. Member regions are found in eastern Germany, parts of western Germany, central Sweden, Karelia, Estonia, Latvia, parts of Hungary and Bulgaria, Thessaly in Greece and Basilicata in Italy. The Transitions cluster (59 regions) has a younger than average age structure but declining population driven by natural decrease and net out-migration, though this is not universal. These regions are found in new Member States of Central and Eastern Europe but also in Greece and South Italy. The *Euromediterranean* cluster (31 regions) have high share of older populations and younger working ages but low fertility resulting in natural decrease counterbalanced by significant in-migration. Regions are found in Greece, North Italy, North East Spain, Portugal and France. The final *Specials* (7 regions) cluster collects together outliers with much younger age structures. The cluster includes the *departéments d'outre mer*, the Spanish exclaves (Ceuta and Mellila) and the two metropoles of Inner London and the Paris region.

Reflection on responses to the Inception Report

We summarise in this section of the report how the TPG will address the issues raised by reviewers of the Inception Report, aiming to make good the deficiencies recognized, to the extent that appropriate data are available and suitable models can found.

Description of further proceeding towards the Draft Final Report

Finally, we set out our plans for implementing the tasks identified earlier and so fulfilling the aims of DEMIFER. The Final Report will provide an in-depth assessment of how demographic and migratory flows are affecting and will influence the competiveness and cohesion of European regions and cities in the context of socio-economic and environmental challenges.

1 Introduction

This report describes the methodology and the main results achieved so far of DEMIFER (DEmographic and MIgratory Flows affecting European Regions and cities) as well as the planning of activities in the twelve months towards the draft Final report.

DEMIFER is a project supported by the ESPON 2013 Programme[1]. Two main developments form the point of departure for the project. First, the main *demographic* development in Europe in the next decades will be the ageing of the population. A major consequence of the ageing of the population is that the working age population will decline which may have a downward effect on economic growth and competitiveness in many European regions. Second, European regions will face several important challenges from *environmental* changes, particularly climate change and limitations in the availability of energy. Even though ageing and environmental change are global developments, the developments may be different for different regions and may affect migration flows across regions in different ways. The key objective of DEMIFER therefore is to assess the effects of demographic trends and migration flows on European regions and cities and to examine the implications for economic and social cohesion, taking into account the possible effects of climate change.

The aim of DEMIFER can be summarized in the following questions:

1. How distinct are current developments in migration, fertility, and mortality and how do they affect differences across regions in population growth, the size of the working age population and the ageing of the population?
2. How will future developments in migration, fertility and mortality affect population growth and changes in the age structure in different types of regions?
3. To what extent may the labour force increase due to increases in natural growth, internal migration, international migration and labour force participation rates in different types of regions?
4. Which policy options may result in achieving increases in natural growth, migration and labour force participation?
5. To what extent may the effects of internal migration, migration between European countries and migration to Europe compensate for each other or reinforce each other?
6. How will future effects of climate change affect migration flows?

[1] The project DEMIFER is carried out by a team of researchers of the Netherlands Interdisciplinary Demographic Institute (NIDI, Netherlands), the University of Vienna (UNIVIE, Austria), the International Organization for Migration/Central European Forum for Migration and Population Research (IOM/CEFMR, Poland), the University of Leeds/School of Geography (University of Leeds, United Kingdom), the Netherlands Environmental Assessment Agency (NEAA, Netherlands), the Nordic Centre for Spatial Development (Nordregio, Sweden), and the National Research Council (CNR, Italy).

In order to assess the impact of internal and international migration it is important to note that the effects are not merely related to numbers of migrants but rather to characteristics of migrants, particularly differences in skill level. Moreover we need to distinguish migrants from another region in the same country, migrants from another European country and migrants coming from outside Europe. It is important to assess which regions attract highly skilled migrants and which not.

Since the project will assess the impact of demographic and migration developments on social and economic cohesion we will develop a demographic typology that includes indicators of population growth, the growth of the working age population and population ageing and we will examine the relationship between demographic differences and social, economic and territorial differences for each type of regions.

For assessing the effect of alternative developments in fertility, mortality, internal migration, international migration and labour force participation on population growth, the size of the work force and population ageing, we need to use a multiregional demographic projection model.

There are two reasons to develop alternative scenarios. One reason is the uncertainty on future developments in the main driving forces of developments in natural growth and migration. Because of this uncertainty alternative scenarios will be specified to show the range of possible future developments. Another reason for specifying scenarios is to explore alternative policy options. In examining policy options we will distinguish three levels: the European, the national, and the regional level. By means of comparing the outcomes of the scenarios we will assess the effects of both different developments in driving forces and different policies on changes in population growth, the growth of the work force and population ageing. We will examine how these differences affect regional cohesion and competitiveness.

The organisation of this interim report is as follows. Chapter 2 discusses the methodology that will be used in DEMIFER. This chapter discusses data issues, the method for developing a demographic typology, the model that we will use for calculating scenarios and an outline of the scenarios that we will develop. Chapter 3 discusses results obtained so far in analysing demographic and migration differences across NUTS2 regions since 2000. Chapter 4 describes a new typology of regions. Chapter 5 includes a reflection on the response on the Inception report. The final chapter includes a point-by-point description of further proceedings towards the Draft Final Report of DEMIFER. Annexes provide more details on the projection model to be used for the calculation of the scenarios, the previous ESPON study in the field of demography and migration, the interrelationship between demography and economic performance, and the further implementation of the project towards the Draft Final Report. The final Annex contains a list of relevant literature.

2 Methodology

2.1 Introduction

The aim of DEMIFER is to assess the effect of future demographic trends and migration flows on the competitiveness of European regions and cities and to assess the effects of different policy options. For this purpose DEMIFER will develop scenarios taking into account possible different future developments in the main driving forces of demographic and migration developments. For specifying these scenarios DEMIFER will develop a demographic typology of regions focusing on the relationship between demographic and economic developments. This chapter describes which data are available, how the typology will be developed, which model we will use for calculating the scenarios and how we will specify alternative scenarios.

2.2 Data

2.2.1 NUTS classification

Within the framework of this project demographic and migration data are collected on the NUTS2 level and the NUTS3 level. The latest review of the NUTS classification took place in 2006 and was extended in 2008 to accommodate the accession of Bulgaria and Romania. As far as possible the regional data refer to this 2006 classification. The current number of NUTS2 regions in the EU-27 is 271, the number of NUTS3 regions 1303. The highest numbers of NUTS3 regions can be found in Germany (429), United Kingdom (133), Italy (107) and France (100). In Cyprus, Luxembourg and Liechtenstein there is no distinction between the NUTS levels. For Estonia, Lithuania, Latvia, Malta, the Former Yugoslav Republic of Macedonia (FYROM) and Iceland, the NUTS2 level coincides with NUTS1 and NUTS0 (country level).

2.2.2 Availability of demographic data

Table 1 presents an overview of the data that have been collected so far on the NUTS2 level and table 2 on the NUTS3 level. The main source of these data is Eurostat. In case of missing data, the main source for data were the national statistical institutes (NSIs). Mainly because of changes in the NUTS classification estimates were sometimes necessary to comply for older years with the latest classification.

Table 1 for the NUTS2 regions relates to the following data:

Popage: Population on 1 January by sex and 5 year age group (up to 85+);

OD int: Origin/destination matrix for internal migration (from and to NUTS2 regions);

In-mig: Internal in-migration by sex and, if available, 1 year age group (up to 85+ or higher);

Out-mig:	Internal out-migration by sex and, if available, 1 year age group (up to 85+ or higher);
Immigration:	External in-migration by sex and, if available, 1 year age group (up to 85+ or higher);
Emigration:	External out-migration by sex and, if available, 1 year age group (up to 85+ or higher);
E0, E65, E85:	Life expectancy by sex at birth, age 65 and age 85;
Gfr:	General fertility rate (births per 1 000 women aged 20-44);
Tfr:	Total fertility rate (sum of age-specific fertility rates).

For most of the NUTS2 regions the population size and structure by sex and age is available for January 1st 2000 up to January 1st 2007. Main exceptions to this general rule are the NUTS2 regions in Turkey (2007 only), Bulgaria, FYROM, Slovenia (all 2006 and 2007) and the United Kingdom (2000-2004).

The availability of data on internal and external migration is limited and fluctuates strongly. Nevertheless, the available data are generally very detailed and robust. Therefore, they will be useful for the analyses of migration on the NUTS2 level and the preparation of migration scenarios.

Life expectancies at birth, age 65 and age 85 by sex were calculated by NIDI within the framework of a Eurostat project on mortality. They refer to the period 2002-2004 and only the regions of Iceland, Liechtenstein, FYROM and Turkey are missing as well as the French part of Belgium.

Two fertility indicators have been calculated by NIDI, the general fertility rate and the total fertility rate. The first rate is easy to calculate for a number of years because this rate only makes adjustments for the total number of women of childbearing age, but not for the age structure of these women, as the total fertility rate does. However, the outcomes of the less precise general fertility rate will not significantly change the overall picture of fertility differences between EU regions. General fertility rates were calculated for the years 2000 up to 2007. They are missing for the Turkish regions and for the ‘new’ Danish regions only available for 2007.

On the basis of age-specific fertility rates the total fertility rates for NUTS2 regions have been calculated for the year 2005 (UK: 2004). They are missing for Croatia, FYROM and Turkey. The source of the available total fertility rates for older years (1990, 1995 and 1999) is ESPON project 1.1.4 (The Spatial Effects of Demographic Trends and Migration).

Table 1 Demographic and migration data availability, NUTS2 level

	Variables/notes NUTS2 level															
	Popage		OD int		In-mig		Out-mig		Immigration		Emigration		E_0, E_{65}, E_{85}		Gfr		Tfr	
Austria	00-06		00-07		00-07		00-07		01,03,04		01,03,04		02/04		00-07		90,95,99,05	
Belgium	00-06		00-06		01-04		01-04		02,04		02,04		02/04	1	00-07		90,95,99,05	2
Bulgaria	06-07	3	00-07		00-07		00-07						02/04		00-07		05	
Cyprus	00-07		n.a.										02/04		00-05		90,95,99,05	
Czech Republic	00-07		00-07		00-07		00-07		01-04		01-04		02/04		00-07		05	
Denmark	01-07		06-07		00,01,06,07		00,01,06,07		00,01		00,01		02/04		07		90,95,99,05	4
Estonia	00-07		n.a.										02/04		00-07		90,95,99,05	
Finland	00-07		00-07		00-07		00-07		00-04		00-04		02/04		00-07		90,95,99,05	
France	00-06												02/04		00-06		90,95,00,05	
Germany	00-07		02-07		03,06,07		03,06.07		03		03		02/04		00-07	5	91,95,99,05	
Greece	00-07								00				02/04		00-07		90,95,99,05	4
Hungary	00-07		00-07		00-05,07		00-05,07		00,01		00,01		02/04		00-07		90,95,00,05	
Ireland	00-07												02/04		00,01,04,05,07		00,05	
Italy	00-07		00-05		00-05		00-05		02		02		02/04		00-07		90,95,99,05	4
Latvia	00-07		n.a.										02/04		00-06		90,95,99,05	
Lithuania	00-07		n.a.		01	6	01	6	01	6	01	6	02/04		00-06		90,95,99,05	
Luxembourg	00-07		n.a.										02/04		00-05		90,95,99,05	
Malta	00-07		n.a.										02/04		03-05		90,95,99,05	
Netherlands	00-07		00-07		01-05		01-05		02-04		02-04		02/04		00-07		90,95,99,05	
Poland	00-07		00-07		00-07		00-07		02-04		02-04		02/04		00-05		90,95,99,05	
Portugal	00-07								02-04		01	7	02/04		00-07		90,95,99,05	4
Romania	00-07		00-07		00-07		00-07		01-04		01-04		02/04		00-07		90,95,99,05	4
Slovakia	00-07		00-07		00-07		00-07		01-04		01-03		02/04		00-07		90,95,99,05	
Slovenia	06-07		00-07		00-07		00-07		02	8	02	8	02/04		00-07		90,95,99,05	
Spain	00-07		00-07		00-07		00-07		01,03,04		03,04		02/04		00-06		90,95,99,05	
Sweden	00-07		00-07		00-07		00-07		00-04		00-04		02/04		00-07		91,95,99,05	
United Kingdom	00-04	5											02/04		01-03	5	90,95,99,04	4
Iceland	00-07		n.a.												00-05		05	
Liechtenstein	00-07		n.a.										na		00-05		05	
Norway	00-07		00,02,03,05,06		00-03,05-07		00-03,05-07		00-03		00-03		02/04		00-06		90,95,99,05	9
Switzerland	00-07				01-04		01-04		01-04		01-04		02/04		00-07		90,95,99,05	4
Croatia	06-07		n.a.										02/04		02-07			
FYROM	06-07		n.a.		07	6,7,10	07	6,7,10							00-07			
Turkey	07		95-00	11,12	95-00	7,11	95-00	7,11										

Source: Eurostat

Notes

n.a. not applicable

1 Many regions are missing

2 Estimates

3 For BG41 00-07

4 Includes estimates

5 For a small number of regions/years not available

6 Data refer tot NUTS3

7 No age distribution

8 Only for NUTS0

9 Average values for 1986-1990, 1991-1995 and 1996-2000

10 Source: NSI FYROM; data refer to total (internal plus external)

11 Source: NSI Turkey; data for period 95-00

12 Only for NUTS1

NB Changes in NUTS classifications may trouble the comparability of figures

Table 2 presents a review of the available data for the NUTS3 regions:

Pop total: Total population on 1 January;
Births: Absolute number of live births;
Deaths: Absolute number of deaths;
Natural inc: Natural increase (births minus deaths);
Net mig: Net migration (total increase minus natural increase);
Total inc: Total increase (population on 1 January year t+1 minus population on 1 January year t).

For most of the NUTS3 regions the total population figures are available for the years 1990 up to 2007. Main exceptions are Switzerland, Croatia (both 2001-2007) and Malta (2000-2006). Furthermore, the population figures for a considerable number of NUTS3 regions are missing for Poland.

Due to the fact that the population figures for NUTS3 regions in the Eurostat database are averages for calendar years, the situation on 1 January had to be estimated. Besides, they had to be consistent with the available 1 January population figures for the NUTS2 regions. Alternatively, for several countries (e.g. Finland, Netherlands and Norway) the 1 January figures for NUTS3 regions could be provided by the NSI.

Data on births and deaths are generally available for the years 1990 up to 2006. For Germany and Italy there are important gaps in this series. For NUTS3 regions in some other countries the first year for which figures on births and deaths are available is obviously later than 1990 (e.g. Switzerland, Croatia and Malta). Again in Poland the data for many NUTS3 regions are missing.

On the basis of differences in the size of population on 1 January of year t+1 and the size of the population on 1 January of year t the total increase is calculated. The difference between the number of births and the number of deaths results in the natural increase. The remaining part of the increase is called net migration. Hence, net migration is a rest post that may include all kinds of administrative corrections. It is important to keep this in mind when analysing and interpreting the figures in due course. For example, net migration in Poland is more than -400 thousand in 2001 due to census corrections. It may also explain significant differences between the net migration resulting from the flows on NUTS2 level (table 1) and the surplus or deficit that remains after comparing total increase and natural increase.

2.2.3 Availability of economic data

For assessing the relationship between demography, migration and economic development we need regional economic data. Tables 3 and 4 give an overview of the availability of main economic indicators, such as GDP, level of educational attainment, employment and unemployment. In addition for assessing the skill level of migrants we will use data that will be obtained from the Labour Force Survey.

Table 2 Demographic and migration data availability, NUTS3 level

	Variables/notes NUTS3 level											
	Pop total		Births		Deaths		Natural inc		Net mig		Total inc	
Austria	90-06	1	90-05		90-05		90-05		90-05		90-05	
Belgium	90-06	1	90-05		90-05		90-05		90-05		90-05	
Bulgaria	95-07	1,2	95-06		95-06		95-06		95-06		95-06	
Cyprus	90-07		90-05		90-05		90-05		90-05		90-06	
Czech Republic	93-07	1	93-06		93-06		93-06		93-06		93-06	
Denmark	90-08	3	90-07	3	90-07	3	90-07		90-07		90-07	
Estonia	90-07	1	90-06		90-06		90-06		90-06		90-06	
Finland	90-08		90-07		90-07		90-07		90-07		90-07	
France	90-06	1	90-05	4	90-05	4	90-05	4	90-05	4	90-05	
Germany	90-07	1,4	90-99,03-06	4	90-99,03-06	4	90-99,03-06	4	90-99,03-06	4	90-06	4
Greece	90-07	1	90-06		90-06		90-06		90-06		90-06	
Hungary	90-07	1	90-06		90-06		90-06		90-06		90-06	
Ireland	90-07	1,5	98-01,04,05	6	98-01,04,05	6	98-01,04,05	6	98-01,04,05	6	90-06	
Italy	90-07	1,4	90-01,03-05	4	90-01,03-05	4	90-01,03-05	4	90-01,03-05	4	90-06	4
Latvia	90-07	1	90-06		90-06		90-06		90-06		90-06	
Lithuania	90-07	1	90-06		90-06		90-06		90-06		90-06	
Luxembourg	90-07		90-05		90-05		90-05		90-05		90-06	
Malta	00-06	1,7	03-05		03-05		03-05		03-05		00-05	
Netherlands	90-07		90-07		90-07		90-07		90-06		90-06	
Poland	95-06	1,8	95-05	8	95-05	8	95-05	8	95-05	8	95-05	8
Portugal	90-07	1	90-06		90-06		90-06		90-06		90-06	
Romania	90-07	1	90-06		90-06		90-06		90-06		90-06	
Slovakia	95-07	1,9	96-06		96-06		96-06		96-06		95-06	
Slovenia	90-07	1	90-06		90-06		90-06		90-06		90-06	
Spain	90-06	1,4	90-06	4	90-06	4	90-06	4	90-05	4	90-05	4
Sweden	90-08		90-07		90-07		90-07		90-07		90-07	
United Kingdom	93-06	1,4	97-99,01-03	4,6	97-99,01-03	4,6	97-99,01-03	4,6	97-99,01-03	4,6	93-05	4
Iceland	90-08	10	90-07		90-07		90-07		90-07		90-07	
Liechtenstein	90-07		00-05		00-05		00-05		00-05		90-06	
Norway	90-08		90-07		90-07		90-07		90-07		90-07	
Switzerland	01-07	1,2	01-06		01-06		01-06		01-06		01-06	
Croatia	01-07	1,11	02-06		02-06		02-06		02-06		01-06	
FYROM	94-07	1	94-06		94-06		94-06		94-06		94-06	
Turkey	91-07	1			98-07	12					91-06	

Source: Eurostat

Notes

1 For NUTS3 regions estimated (on the basis of available average figures, consistent with population NUTS2 regions)
2 For NUTS2 regions 1991-2007
3 Includes estimates
4 For a small number of regions/years not available
5 Population NUTS2 for 1990-1996 estimated as well
6 For some regions other years available
7 For NUTS2 region 1990-2007
8 Many regions are missing
9 Population NUTS2 for 1995 estimated as well
10 NUTS3 population estimated for 1990-1996
11 All population figures for 2001 are estimates
12 Source: NSI Turkey

NB Changes in NUTS classifications may trouble the comparability of figures

Table 3 Data availability NUTS2 level, GDP, educational attainment and employment

	GDP per inhabitant in				GDP development in				Educational		Employment			
	PPS		Euro		PPS		Euro		attainment		<25		sector	
Austria	03-05		03-05		95-02		95-02		02		02-07		02-07	
Belgium	03-05		03-05		95-02		95-02		02		02-07		02-07	
Bulgaria	03-05		03-05		96-02		96-02		02		03-07		03-07	
Cyprus	03-05		03-05		95-02		95-02		02		02-07		02-07	
Czech Republic	03-05		03-05		95-02		95-02		02		02-07		02-07	
Denmark	05		05		95-02		95-02		02	1	02-07	1	02-07	1
Estonia	03-05		03-05		95-02		95-02		02		02-07		02-07	
Finland	03-05		03-05		95-02		95-02		02		02-07		02-07	
France	03-05		03-05		95-02		95-02		02	2	02-07		02-07	2
Germany	03-05		03-05		95-02		95-02		02	2	02-07	2	02-07	2
Greece	03-05		03-05		95-02		95-02		02		02-07		02-07	
Hungary	03-05		03-05		95-02		95-02		02		02-07		02-07	
Ireland	03-05		03-05		95-02		95-02		02		02-07		02-07	
Italy	03-05		03-05		95-02		95-02		02		02-07		02-07	
Latvia	03-05		03-05		95-02		95-02		02		02-07		02-07	
Lithuania	03-05		03-05		95-02		95-02		02		02-07		02-07	
Luxembourg	03-05		03-05		95-02		95-02		02		02-07		02-07	
Malta	03-05		03-05		98-02		98-02		02		02-07		02-07	
Netherlands	03-05		03-05		95-02		95-02		02		02-07		02-07	
Poland	03-05		03-05		95-02		95-02		02		02-07		02-07	
Portugal	03-05		03-05		95-02		95-02		02		02-07		02-07	
Romania	03-05		03-05		98-02		98-02		02		02-07		02-07	
Slovakia	03-05		03-05		95-02		95-02		02		02-07		02-07	
Slovenia	03-05		03-05		95-02		95-02		02	1	02-07	1	02-07	1
Spain	03-05		03-05		95-02		95-02		02		02-07		02-07	2
Sweden	03-05		03-05		95-02		95-02		02		02-07		02-07	
United Kingdom	03-05	2	03-05	2	95-02		95-02		02		02-07	2	02-07	2
Iceland											02-05		02-05	
Liechtenstein														
Norway											02-07		02-07	
Switzerland														
Croatia	03-05		03-05		00-02		00-02				07		07	
FYROM					98-02		98-02							
Turkey					95-01		95-01							

Sources: Eurostat; ESPON 2013/1/3, DEMIFER Inception report, 11 November 2008, Annex2; European Commission, 2004, A new partnership for cohesion, third report on economic and social cohesion, main regional indicators

Explanation:

GDP: Gross Domestic Product

PPS: Purchasing Power Parities

GDP development: average annual change in %

Educational attainment: persons aged 25-64 with low, medium and high education, in % of total

Employment <25: share of active population younger than 25

Employment sector: share of persons employed in Agriculture, Industry and Services, in % of total

Notes:

1 Only for NUTS0

2 For a small number of regions/years not available

Table 4 Data availability NUTS2 level, unemployment

	Unemployment rate								Development of unemployment rate					
	total		male		female		young		total		male		female	
Austria	05-07	2	05-07	2	05-07	2	05-07	2	99-04		99-04		99-04	
Belgium	05-07	2	05-07	2	05-07	2	05-07	2	99-04		99-04		99-04	
Bulgaria	05-07		05-07		05-07		05-07		03-04		03-04		03-04	
Cyprus	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Czech Republic	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Denmark	05-07	1	05-07	1	05-07	1	05-07	1	99-04	1	99-04	1	99-04	1
Estonia	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Finland	05-07	2	05-07	2	05-07	2	05-07	2	99-04	2	99-04	2	99-04	2
France	05-07	2	05-07	2	05-07	2	05-07	2	99-04	2	99-04	2	99-04	2
Germany	05-07	2	05-07	2	05-07	2	05-07	2	99-04	2	99-04	2	99-04	2
Greece	05-07	2	05-07	2	05-07	2	05-07	2	99-04		99-04		99-04	
Hungary	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Ireland	05-07	2	05-07	2	05-07	2	05-07	2	99-04		99-04		99-04	
Italy	05-07	2	05-07	2	05-07	2	05-07	2	99-04	2	99-04	2	99-04	2
Latvia	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Lithuania	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Luxembourg	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Malta	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Netherlands	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Poland	05-07	2	05-07	2	05-07	2	05-07	2	99-04	2	99-04	2	99-04	2
Portugal	05-07	2	05-07	2	05-07	2	05-07	2	99-04	2	99-04	2	99-04	2
Romania	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Slovakia	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Slovenia	05-07	1	05-07	1	05-07	1	05-07	1	99-04	1	99-04	1	99-04	1
Spain	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
Sweden	05-07		05-07		05-07		05-07		99-04		99-04		99-04	
United Kingdom	05-07	2	05-07	2	05-07	2	05-07	2	99-04	2	99-04	2	99-04	2
Iceland														
Liechtenstein														
Norway	05-07	2	05-07	2	05-07	2	05-07	2	99-04	2	99-04	2	99-04	2
Switzerland														
Croatia														
FYROM														
Turkey														

Sources: Eurostat; ESPON 2013/1/3, DEMIFER Inception report, 11 November 2008, Annex2
Explanation:
young: younger than 25
Development: in percentage points
Notes:
1 Only for NUTS0
2 For a small number of regions/years not available

2.3 Construction of a demographic typology

The typology claims to match the demographic status of European regions. On the one hand the results should be easy to overview and understand and on the other hand easy to update (at least in its basic form, in which the included variables are commonly available and easy to handle). Furthermore, previously constructed ESPON typologies (see chapter 4) will be used to explain the classification result, especially in the scope of the determination of urban regions.

2.3.1 Spatial and temporal principles

According to the DEMIFER project requirements NUTS2 is the priority regional scale for constructing the classification and for specifying the scenarios on future

developments. From the analytical point of view, however, NUTS3 data is preferable and shall be used where available and reasonable. Following this concept a classification based on NUTS3 level or rather (a mixed) NUTS2-3 level will be elaborated after the construction of the final classification on NUTS2 level.

Because of the temporal restriction of the available data the timeframe to be analysed is embedded to the period 1990/2000 to 2008 (latest). This period enables an accurate analysis of the current status and the so connected short-term trends. It is realistic to target the year 2005 for an up-to-date statistical analysis. In this sense the period 2001 to 2005 respectively 1990 to 2005 will be used to cover the short-term and mid-term trends on which the current status (i.e. the year 2005) is based on. The mid-term period (1990 to 2005) can be divided in more and shorter periods, which correspond to historic events or periods. For example the years after 1989/90 meant a unique transition for the former Eastern Bloc countries. In this sense the period 2001 to 2005 meant a not less unique transition for most of these countries, especially the New Member States (thinking of the EU membership pre-accession and accession period). From a historical point of view also amended national legislations could be seen as significant events, e.g. changes in immigration laws usually affect migratory trends.

By the nature of demographic developments long-term analyses are crucial to shed more light on the background of current population dynamics. However, due to the lack of sufficient data this long-term developments will not be included in the construction of the typology, but relevant literature will be used to explain the long-term trends that resulted in the current demographic status.

2.3.2 Input variables

For the first construction of a typology, only crude measures have been used, to be exact: broad age groups and the hence calculated components of population development. The temporal scale is set to 2005. In order to keep the indicators comparable in regard to the different regions, the proportion (not the absolute number) of the age groups was used as an input for the classification. Thereby the age groups relate to the year 2005 (as broad age groups do not change drastically from year to year) and the components of population development refer to the period 2001 to 2005 (for smoothing possible short-term effects, e.g. triggered by policy interventions like changes in national policies regarding immigration or family support).

2.3.3 Method

For the time being the analyses are restricted to population by age and sex and the components of population development (births, deaths and net migration). Even then a wide range of possible variables is given, e.g. simply by figuring out one or more convenient age groups. To include the minimum number of variables it is necessary to compare all (possible) variables with each other. Because these variables still amount to a (all in all) considerable amount, it was feasible to compare them by means of a simple correlation matrix (see Table 5).

Table 5 Correlation matrix of possible input variables for the cluster analysis

Correlations

		pop_0004_05_rel	pop_2039_05_rel	pop_65plus_05_rel	CBR_avg_0105	CDR_avg_0105	NAT_avg_0105	NETMIG_avg_0105	TTL_avg_0105
pop_0004_05_rel	Pearson Correlation	1	,117*	-,624**	,984**	-,574**	,904**	,074	,514**
	Sig. (2-tailed)		,048	,000	,000	,000	,000	,216	,000
	N	284	284	284	284	284	284	284	284
pop_2039_05_rel	Pearson Correlation	,117*	1	-,525**	,222**	-,325**	,302**	,119*	,247**
	Sig. (2-tailed)	,048		,000	,000	,000	,000	,044	,000
	N	284	284	284	284	284	284	284	284
pop_65plus_05_rel	Pearson Correlation	-,624**	-,525**	1	-,645**	,560**	-,684**	,174**	-,207**
	Sig. (2-tailed)	,000	,000		,000	,000	,000	,003	,000
	N	284	284	284	284	284	284	284	284
CBR_avg_0105	Pearson Correlation	,984**	,222**	-,645**	1	-,571**	,912**	,080	,523**
	Sig. (2-tailed)	,000	,000	,000		,000	,000	,181	,000
	N	284	284	284	284	284	284	284	284
CDR_avg_0105	Pearson Correlation	-,574**	-,325**	,560**	-,571**	1	-,857**	-,197**	-,589**
	Sig. (2-tailed)	,000	,000	,000	,000		,000	,001	,000
	N	284	284	284	284	284	284	284	284
NAT_avg_0105	Pearson Correlation	,904**	,302**	-,684**	,912**	-,857**	1	,148*	,622**
	Sig. (2-tailed)	,000	,000	,000	,000	,000		,012	,000
	N	284	284	284	284	284	284	284	284
NETMIG_avg_0105	Pearson Correlation	,074	,119*	,174**	,080	-,197**	,148*	1	,867**
	Sig. (2-tailed)	,216	,044	,003	,181	,001	,012		,000
	N	284	284	284	284	284	284	284	284
TTL_avg_0105	Pearson Correlation	,514**	,247**	-,207**	,523**	-,589**	,622**	,867**	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,000	
	N	284	284	284	284	284	284	284	284

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

On the one hand strong correlations within a dataset are undesirable for cluster analysis, as they represent data redundancy. On the other hand highly correlating variables imply a predictive and descriptive power needed for a classification. In this sense highly correlated variables (at least those who do not share the same denominator) shall not be dropped automatically, but judged on the individual merits of each variable against every other variable (see Vickers et al., 2005:8ff).

In our typology we use the following variables. The two included age groups represent not only the young adult (20 to 39 years / pop_2039) and the elderly population (65 years and older / pop_65plus), but also meet the peak ages of mobility. They also reflect (roughly) a generation step, whereas the 20 to 39 age group matches the prime reproductive age and the 65+ age group indicates the stage of ageing. Looking beyond a strictly demographic point of view, the (share of the) 20 to 39 age group characterises each region in terms of the (potential) economically active population. In general a high proportion indicates a situation where either labour or (potential) labour force is a sufficient resource.

"Migration often occurs in conjunction with some transition in the life course, such as entry in college, a change of job, or retirement. Since these underlying transitions are more frequent at certain ages then at other, pronounced age selectivity can be expected with respect to migration too. Adult migration rates often peak in the young adult ages. A second lesser peak around retirement age has also become apparent in the more developed countries. Migration rates during childhood reflect parents' migration." (Preston et al., 2001:208)

The other two variables used in the cluster analysis represent the population development by components. The natural population change (NAT) per 1000 inhabitants indicates a population increase or decrease based solely on the difference between births and deaths. Net migration per 1000 inhabitants (NETMIG) or crude rate of migration (CRM) is not an empirical measure, because

it results from the difference between total population change and natural population change in a given year, or in this case in the given period 2001 to 2005. It is a quantitative measure indicating a gain or loss of population because of migration. Together, the natural population growth and the net migration amount to the total population change within a region.

Furthermore, the chosen input variables for the cluster analysis were not weighted. Not using weights but being more selective in the choice of the variables, the process of classification can be made much simpler (cp. Vickers et al., 2005:21). To keep the variables comparable (in relation to each other) the original data need to be standardised. For this reason Z-score standardisation was applied before using the variables for the cluster analysis.

The clustering technique was already described in the DEMIFER Inception Report (ESPON, 2008:25): "*The method used for constructing a typology will be hierarchical cluster analyses to gain an overview about the similarity structure of the regional units and to extract a starting configuration of cluster centres which will be improved by a non-hierarchical cluster procedure (see e.g. Vickers et al., 2005). The combination of a hierarchical and a non-hierarchical cluster procedure delivers the most reliable outcome."*

In this sense the result of a hierarchical cluster analysis was refined by a non-hierarchical cluster analysis, using the cluster centres generated with the hierarchical analysis as initial cluster centres for the non-hierarchical cluster analysis. Concerning the hierarchical cluster analysis the Ward method was applied, which combines clusters aiming to minimise the increase of the error sum of squares. Therefore this method follows a bottom-up approach, joining the cases at every step, which lead to the smallest increase of the error sum of squares (cp. Janssen & Laatz, 2007:489f).

Figure 1 (left) shows the increase of the error sum of squares respectively its increase for each cluster number (2 to 12). This increase was then plotted (see Figure 1/right) to identify (visually) the relevant "jump" – the so called "elbow" – in the development of the heterogeneity in relation to each cluster number. This so called "elbow-criteria" can be seen as a support in deciding the number of clusters (cp. Backhaus et al., 2007:430f).

Other than the cluster number, the Ward method also delivers initial cluster centres. Both are needed to refine the result of the hierarchical cluster analysis when using a non-hierarchical cluster analysis. Therefore the K-means method was applied, which requires that the number of clusters is known in advance. This method is supposed to deliver in an iterative process the optimum assignment of objects to the k clusters (cp. Janssen & Laatz, 2007:490). The algorithm repeatedly moves a case from one cluster to another to improve the sum of squares within each cluster (see Vickers, 2006).

Figure 1 Increase of the error sum of squares (Ward method)

error sum of squares	cluster number	coefficient increase
1132	1	323,085
808,915	2	135,69
673,225	3	97,797
575,428	4	68,057
507,371	5	61,591
445,78	6	49,551
396,229	7	33,339
362,89	8	28,996
333,894	9	28,333
305,561	10	24,204
281,357	11	15,952
265,405	12	15,533
249,872	13	

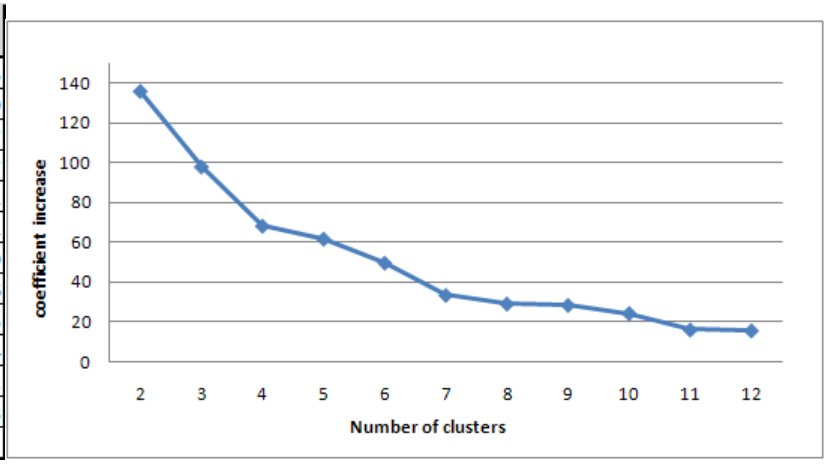


Table 6 Cluster Membership (Ward & K-means Method)

		K-means Method							
		1	2	3	4	5	6	7	Total
Ward Method	1	16	0	6	0	1	1	0	24
	2	0	82	0	1	0	1	0	84
	3	0	1	45	0	0	0	1	47
	4	0	0	0	24	0	0	0	24
	5	0	0	3	6	58	4	0	71
	6	0	2	0	0	0	25	0	27
	7	0	0	1	0	0	0	6	7
Total		16	85	55	31	59	31	7	284

Table 6 demonstrates the changes in the cluster membership (by cases) between the Ward and the K-means method in the specified number of clusters (in this case 7). The so constructed 7 clusters will be illustrated in chapter 4.

2.4 Projection model

We aim to develop a model that tracks internal EU/ESPON, intra-EU/ESPON and extra-EU/ESPON migration and regional population dynamics in the ESPON countries. It will enable population development scenarios to be run based on assumptions about changes of demographic and labour-force related variables, related to socio-economic and environmental developments.

Such a population dynamics model should calculate, under certain conditions, population by country, region, age, and sex simultaneously for all the countries. The word “simultaneously” is crucial. It means we will obtain one, coherent set of numbers – a multidimensional matrix or a complex multilayer table (population by state, region, age and sex), which will not require any further consistency checks or adjustments. The conditions mentioned in the first sentence of this paragraph refer to the assumptions on how components of population change (births, deaths and migration) will evolve in the future. For example we may assume that the intensity of these events (i.e. number of births related to the number of women in certain age group, etc.) will remain on the same level as observed at the starting point from which the model runs. Such a run is called a status-quo projection. We may also define what are the most likely changes of the components of population change. Feeding these most

likely changes into the model would generate a population forecast. Finally we may assume that components of population change will take various, more or less probable values (e.g. mortality rates will decrease or total fertility rates will raise to certain values). Running a model on such particular assumptions gives us a simulation. It is easy to notice that a forecast and a status-quo projection are just special cases of simulations.

Simulations are very handy in what-if analysis. For example they allow for answering such questions as: what would be the population of Germany in 50 years if there were no migration in future? Or how would an increase in fertility rate to 2.1 in the coming 10 years and its stabilization thereafter, *ceteris paribus* other components, impact population numbers and structures. Or what would happen if 50% of all internal migrants in a country migrated to the capital city of this country?

Multinational population projections and forecasts may be conducted in a variety of ways (for discussion see Kupiszewski and Kupiszewska 2008). However, most of multinational projections and forecasts do not look at the regional dimension of population processes and therefore have a limited attraction for decision makers, spatial planners and geographers, who are more interested in population processes in smaller spatial units. They are not suitable for the ESPON regional perspective.

The first to create a model capable of simultaneous handling of interregional (internal) migration and international migration for supranational populations was Philip Rees with colleagues (Rees, Stillwell, Convey 1992), who constructed a population projection model called ECPOP, for the then European Community Member States. The model was a generalization of well known multiregional Rogers-Willekens model (1978). It handled migration on three levels:

- Level 1 - interregional, intrastate migration;
- Level 2 - international migration between the countries;
- Level 3 - international migration from the Rest of the world.

The way how the model handled migration was the main difference in comparison to the traditional multiregional model and was a major improvement in population projection practice. From the methodological point of view, the ECPOP model represented an implementation of the state of the art in population projections theory. It allowed for a coherent and unified treatment of supranational but regionally disaggregated populations, developing Rogers' concepts applied earlier for multiregional models.

In DEMIFER, the starting point for the modelling work will be the MULTIPOLES model, developed by Kupiszewski and Kupiszewska (1996, 2005, 2008) based on the Rees's and Rogers-Willekens models. The MULTIPOLES is a cohort-component female-dominant hierarchical multiregional supranational model of population dynamics. It may be used for forecasts, projections and simulations. The population is disaggregated into sexes and eighteen five-year age groups, i.e. nineteen projection cohorts, with the youngest cohort being the infant cohort (children born during the projection interval) and the cohort 85+ being the oldest one. Geographically, the population is disaggregated into countries and regions. The model is based on movement type population accounts. The rates

appearing in the accounts are defined as the number of events (deaths, migration or births) in a projection period divided by the population at risk, assumed to be equal to the mid-year population or calculated as an arithmetic average of the population of the projection cohort at the beginning and at the end of the projection period. Migration is handled on three levels, as in the ECPOP model:

- interregional intranational migration within each country;
- interregional international migration within the system;
- net migration from the Rest of the world to each modelled country.

On top of population modelling comes labour force modelling, based on the application of the externally assumed sex and age dependent labour force participation rates to the modelled population.

A more detailed, technical description of the MULTIPOLES model is presented in Annex 1. Data needed to run the model has been presented in the Inception report.

The MULTIPOLES model is particularly suitable for the application in the project, because it is designed to consider migration at three levels and it considers not only demographic aspects of population dynamics but also allows for modelling labour force resources. The model will be adapted to the needs of the DEMIFER project.

The following adjustments are envisaged.

1. Separation of the calculation of mortality, fertility and migration rates from the main “computational engine” of the model
2. Modification of the way how the scenarios for the components of population change are formulated.
3. Extension of the model from 18 age groups (up to 85+) to 21 age groups (up to 100+). Such an extension would be beneficial as the ageing process makes the over 85 age population growing fast. However this extension depends on the availability of the regional age and sex structure of population 85 and over and the regional age distribution of deaths for the same age brackets.
4. Modification of the scenario input routines to allow the input of regional scenarios based on typologies.
5. Adaptation of model output to the needs of other DEMIFER activities. The adaptation will concern both the format of the output and the introduction of new variables (indicators).

Geographically, the model will be run for the system composed of all countries covered by ESPON, divided into NUTS2 regions. This assumption may have to be modified due to data unavailability on regional level in certain countries or due to specific requirements of other Activities within DEMIFER. Technically, there is no problem with the definition of the spatial system, as the MULTIPOLES specification allows for setting regions defined as the research requirements dictate. In other words the regional division is some kind of a parameter of the model. There are two restrictions on the design of the geography of the model. First, the spatial units have to be hierarchical, cover the entire population system and be mutually exclusive. Another restriction is that the regions for

which the model will be run must not be too small, in order to keep the magnitude of statistical errors of the estimations of the occurrence-exposure rates under control.

All assumptions concerning the scenarios for the components of population change will be formulated for the regions and the results will be produced for the regions and the countries (the bottom-up approach will be adopted, i.e. the results for the countries will be calculated from the results for the regions).

The model will generate population stocks by age, sex and region over the projection time, and counts of demographic events over time, in 5-year intervals. A range of indicators will be proposed and calculated, in particular the following ones: old-age dependency ratio (ODR), economic old-age dependency ratio (ODRE) and labour market dependency ratio (ODRM)[2]. Alternatively the reciprocal indicators - potential support ratio (PSR), economic elderly support ratio (EESR) and the labour market support ratio (LMSR) [3] (Bijak et al 2004, 2005, 2007, 2008) could be calculated.

A set of simulations will be prepared for the regional typologies developed in the first part of the project. This means that the scenarios for the components of population change will have to be prepared not for all the individual regions but for each region type. The model will start its runs in 2005, for which all potentially available data should be actually available (or possible to estimate). Simulations will cover for the period 2005 (base year) – 2050; outcomes will be described for the short term (2020), mid term (2035) and long term (2050).

To begin with, three population dynamics simulations, further called the reference simulations or scenarios, will be prepared to be used as a reference point for regional and policy scenarios, and for case studies. The first reference simulation will be a *status-quo* projection, where no changes in the age-specific mortality, fertility and migration rates, no changes in net migration from the Rest of the world and constant age-specific labour force participation rates are assumed. The second simulation will be the no migration scenario in which all parameters of the model will be set as in the *status-quo* scenario, except that all migration-related parameters will be set to zero. The third simulation will assume free movement within the ESPON area meaning that all parameters of the model will be set as in the *status-quo* scenario, but no migration to and from the rest of the world will be assumed.

These simulations are not aimed to describe the most likely future, but to show what would be the effects of continuation of demographic trends in the very long

[2] ODR is a ratio of population aged 65 years or more to the population in the aged15-65. ODRE is defined as a ratio of economically inactive population in the age of 65 years or more to the whole active population aged 15 years or more. LMDR is defined as a ratio of the whole economically inactive population to the whole active population, both considering people aged 15 years or more

[3] PSR indicates how many people aged 15–64 in a given population can potentially support one person aged 65 years or more, EESR is defined as the ratio of the whole economically active population aged 15 years or more to the inactive population in the retirement age (65 years or more). LMSR is defined as the ratio of the whole economically active population to the whole inactive population, where both the nominator and the denominator consider people of 15 years or more.

run. The impact of migration will be assessed by comparing the status-quo scenario with the no-migration scenario. Moreover, the results generated in this task will be used in subsequent activities to assess various regional and policy scenarios.

2.5 Scenarios

We begin the scenario preparation by defining the over-arching context for policy making in Europe. This context consists of two dimensions which are part of informed political and intellectual debate throughout Europe, as well as the rest of the world. These dimensions we call "Economy-Environment" and "Distribution-Fairness". Each dimension is represented in Figure 2 by a dichotomy.

At the top end of the Economy-Environment dimension we envisage a situation where sustainable growth has been achieved through technical and social innovation. Problems posed by environmental challenges such as climate change and "the end of oil" have been solved through a combination of renewable technologies and resource conservation made possible by technological breakthroughs and governmental planning.

At the bottom end of the Economy-Environment dimension we envisage a situation where the environmental challenges have not been met and growth as traditionally measured has fallen. Consumption has been cut back because climate change has affected production and because hydrocarbon depletion has occurred with resulting increases in energy prices. A simpler world with many features of the past is a consequence.

Figure 2 The four DEMIFER scenarios

ECONOMY-ENVIRONMENT

Growth enabled by technical and social innovation	GROWING SOCIAL EUROPE High Growth/Collectivism	EXPANDING MARKET EUROPE High Growth/Individualism
Growth limited by environmental constraints	LIMITED SOCIAL EUROPE Low Growth/Collectivism	CHALLENGED MARKET EUROPE Low Growth/Individualism
	Collectivism	Individualism

DISTRIBUTION-FAIRNESS

We combine the two dimensions to form a graph with four quadrants (Figure 2). Each quadrant is described using the dimension dichotomies and also given a general label for easy recognition.

The four scenarios we propose for the DEMIFER analysis are:

- Growing Social Europe (GSE)
- Expanding Market Europe (EME)
- Limited Social Europe (LSE)
- Challenged Market Europe (CME).

Each of these scenarios is associated with a set of policies that we may expect to impact, to a greater or lesser degree, the mortality, fertility, migration and labour force drivers that will be input to the MULTIPOLES projection model. We will combine the impact of these policies with current trends to produce trajectories of key driver variables (e.g. the rate of improvement of mortality intensities). For example, fairly relaxed policies about extra-European immigration might be adopted under the Expanding Market Europe scenario because business demands the labour needed to run the economy, while under the Limited Social Europe scenario concern about "over-population" results in more restrictions. Under the Growing Social Europe scenario policies will focus on effecting convergence at regional level within Member States in well-being, while under Challenged Market Europe divergence in the standards of living of regional populations might occur.

How do we move from the scenarios to trends and policies that affect the future path of the demographic drivers? Here we develop a framework that will enable us to make progress on this front in two tables. Table 7 outlines trends and policies specific to each demographic component and scenario. Table 8 translates the trends and policies into specific numbers for the demographic inputs to the MULTIPOLES projection model. For each scenario we will specify assumptions about the levels of the demographic components for each type of region, using the new demographic typology developed in DEMIFER, rather than for each individual region. It should be stressed here that these tables are highly provisional. Each element needs to be linked to the research evidence base and an operational model for regions and Member States needs to be developed. Note that some of the policies will be Europe in scope, some national and some regional. Trends may also apply at Europe scale, national scale, to clusters of regions or to individual regions. We will explore the degree to which age and gender can be introduced into the scenarios. Since the scenarios include labour productivity, we will be able to analyse the impact of demographic and migration trends on the demographically driven economic product and thus on the competitiveness of different types of regions. The regional typology will be used both to simplify the production of regional scenarios and to analyse the results of the scenarios.

Table 7 Linkage of scenarios to demographic components via trends and policies

Demographic component	Trend or Policy	GROWING SOCIAL EUROPE	EXPANDING MARKET EUROPE	LIMITED SOCIAL EUROPE	CHALLENGED MARKET EUROPE
MORTALITY	Lifestyle: Smoking	Prevalence falls	Trend continues	Prevalence falls	Trend continues
	Lifestyle: Diet/Obesity	No epidemic	No epidemic	Epidemic	Epidemic
	Lifestyle: Drinking	Prevalence falls	Trend continues	Prevalence falls	Trend continues
	Medical advances	Continue	Continue	Slow	Slow
	National Health Inequalities	Reduced	Persistent	Reduced	Persistent
	Regional Health Inequalities	Reduced	Persistent	Reduced	Persistent
FERTILITY	Family versus Individual Goals	Family Goals	Individual goals	Family Goals	Individual goals
	Family Friendly Policies	Strong	Weak	Strong	Weak
	Assisted Conception	Socially supported	Privately supported	Socially supported	Privately supported
	Abortion Law	Permissive	Restrictive	Permissive	Restrictive
	Extra-Europe Effect	High effect	Low effect	Low effect	Low
	National Fertility Inequalities	Reduced	Persistent	Reduced	Persistent
	Regional Fertility Inequalities	Reduced	Persistent	Reduced	Persistent
INTER-REGION MIGRATION	Total Level of Inter-Region Migration	High	Moderate level	Moderate level	Low level
	Origins: Inter-region Out-Migration	Stable	Divergent	Convergent	Divergent
	Destinations: Inter-region In-Migration	Stable	Divergent	Convergent	Divergent
	Explicit Inter-region Migration Policy	None	None	None	None
INTER-STATE MIGRATION	Total Level of Inter-State Migration	High	Moderate	Moderate	Low
	Origins: Inter-State Out-Migration	Stable	Divergent	Convergent	Divergent
	Destinations: Inter-State In-Migrations	Stable	Divergent	Convergent	Divergent
	Explicit Inter-State Migration Policy	Some restrictions	Free migration	Some restrictions	Free migration
EXTRA-EUROPE MIGRATION	Total Level of Extra-Europe Migration	High	Moderate	Moderate level	Low level
	Origins: Emigrations	Stable origins	Divergent origins	Stable origins	Divergent
	Destinations: Immigrations	Stable destinations	Divergent destinations	Stable destinations	Divergent
	Explicit Extra-Europe Migration Policy	Free entry	Selective entry	Moderate entry	Restricted entry
LABOUR FORCE PARTICIPATION	Trends in Participation	Increasing	Increasing	Decreasing	Decreasing
	Pension and Older Worker Policies	Favourable	Stressful	Favourable	Stressful
	Female Participation Policies	Friendly policies	Unfriendly policies	Friendly policies	Unfriendly policies
	FT/PT/Self Employed Policies	High participation	High participation	Moderate participation	Low participation
LABOUR PRODUCTIVITY	Trends in Productivity/Income	Strong growth	Strong growth	Weak growth	Weak growth
	Education & Skills, Points Based System	Strong investment	Weak investment	Strong investment	Weak investment

Table 8 Linkage of scenarios to demographic components: outcomes in levels and distributions

Demographic component	Trend or Policy	GROWING SOCIAL EUROPE	EXPANDING MARKET EUROPE	LIMITED SOCIAL EUROPE	CHALLENGED MARKET EUROPE
MORTALITY	Lifestyle: Smoking	Mortality decrease	Mortality stable	Mortality decrease	Mortality stable
	Lifestyle: Diet/Obesity (mortality change)	Mortality increase	Strong mortality increase	Mortality increase	Strong mortality increase
	Lifestyle: Drinking	Mortality stable	Mortality increase	Mortality stable	Mortality increase
	Medical advances (mortality rate change)	Decrease by 2% pa	Decrease by 1.5% pa	Decrease by 1.0% pa	Decrease by 0.5% pa
	National Health Inequalities	Strong convergence	Strong divergence	Convergence	Divergence
	Regional Health Inequalities	Strong convergence	Strong divergence	Convergence	Divergence
FERTILITY	Family versus Individual Goals	Target TFR +0.2	Target TFR +0.1	Target TFR +0.1	Target TFR - 0.2
	Family Friendly Policies	Target TFR +0.2	Target TFR +0.0	Target TFR +0.1	Target TFR +0.0
	Assisted Conception	Target TFR +0.2	Target TFR +0.1	Target TFR +0.1	Target TFR +0.0
	Abortion Law	Target TFR +0.0	Target TFR +0.2	Target TFR +0.0	Target TFR +0.0
	Extra-Europe Effect	Target TFR +0.2	Target TFR +0.0	Target TFR +0.0	Target TFR +0.0
	National Fertility Inequalities	Convergence	Divergence	Convergence	Divergence
	Regional Fertility Inequalities	Convergence	Divergence	Convergence	Divergence
INTER-REGION MIGRATION	Total Level of Inter-Region Migration	Set levels to 2050	Set levels to 2050	Set levels to 2050	Set levels to 2050
	Origins: Inter-region Out-Migration	Set origin attraction	Set origin attraction	Set origin attraction	Set origin attraction
	Destinations: Inter-region In-Migration	Set destination. attraction	Set destination attraction	Set destination attraction	Set destination attraction
	Explicit Inter-region Migration Policy	No explicit policy	No explicit policy	No explicit policy	No explicit policy
INTER-STATE MIGRATION	Total Level of Inter-State Migration	Set levels to 2050	Set levels to 2050	Set levels to 2050	Set levels to 2050
	Origins: Inter-State Out-Migration	Set origin attraction	Set origin attraction	Set origin attraction	Set origin attraction
	Destinations: Inter-State In-Migrations	Set destination attraction	Set destination attraction	Set destination attraction	Set destination attraction
	Explicit Inter-State Migration Policy	EU policy	EU policy	Some national policy	Some national policy
EXTRA- EUROPE MIGRATION	Total Level of Extra-Europe Migration	Set levels to 2050	Set levels to 2050	Set levels to 2050	Set levels to 2050
	Origins: Emigrations	Set origin attraction	Set origin attraction	Set origin attraction	Set origin attraction
	Destinations: Immigrations	Set destination attraction	Set destination attraction	Set destination attraction	Set destination attraction
	Explicit Extra-Europe Migration Policy	Permissive policy	Permissive policy	Restrictive policy	Restrictive policy
LABOUR FORCE PARTICIPATION	Trends in Participation	Raise rates	Raise rates	Lower rates	Lower rates
	Pension & Older Worker Policies	Raise rates	Lower rates	Lower rates	Lower rates
	Female Participation Policies	Raise rates	Lower rates	Raise rates	Lower rates
	FT/PT/Self Employed Policies	Raise rates	Raise rates	Lower rates	Lower rates
LABOUR PRODUCTIVITY	Trends in Productivity/Income	+2% pa	+1.5% pa	+1.0% pa	+0.5% pa
	Education & Skills, Points Based System	High investment, PBS	Low Investment, no PBS	High investment, PBS	Low Investment, no PBS

3 Demography and migration

3.1 Introduction

The population of Europe is increasing slowly. The number of inhabitants of the European Union equals about 500 million persons. Since 2000 the annual average growth rate has been below 0.5% per year. Migration has been the main source of population growth. Due to low fertility rates, the contribution of natural growth (the balance of births and deaths) to population growth has become very small. The low level of fertility has been the main cause of the ageing of the European population as well. This has been reinforced by the increase in life expectancy in most countries.

Even though fertility rates are below replacement level in almost all European regions there are still considerable differences. Differences in migration across regions are even bigger. In addition to differences in the number of international migrants across regions, internal migration has a positive effect on population growth in some regions, and a negative effect on other regions within the same country.

The ESPON 1.1.4 study 'The spatial effect of demographic trends and migration' presented an overview of demographic trends in European regions in the 1990s (see Annex 2 for more details on the main results). During that period 27% of European regions experienced population decline. The main cause of population decline was negative natural growth, i.e. the annual number of births was smaller than the number of deaths. In 40% of the regions natural growth was negative. In most of these regions negative natural growth was compensated for by positive net migration, but in 10% of the regions this was not enough to cause population growth to be positive. Together with the decline in population growth, the population in most regions has been ageing. The main cause of both developments is the low level of fertility.

Since 2000 fertility rates have increased slightly. However, the rise has not been enough to change the direction of the trends in population growth and ageing. The percentage of regions experiencing population decline has increased further, from 27% in the 1990s to 30% in the years 2000-2006. And the percentage of regions with a high percentage of people aged 65 or over has increased as well. In the 1990s in 60% of the regions the number of people aged 65 or over was 15% or more of the total population. Since 2000 this has increased to over 70%.

Differences in population growth and ageing across NUTS2 regions are caused by differences in fertility, mortality, and internal and international migration. Each of these components of population change have a different effect on population growth and ageing. The level of fertility has a direct effect on population growth but only with a considerable time lag it has an effect on ageing. If fertility has been low for some time, it leads to a reduction in the growth of the working age population. Since most

migrants are rather young, positive net migration has an immediate effect on the growth of the working age population. The level of mortality affects the growth of the number of elderly persons, but only a very small effect on the size of the working age population, except for some regions where mortality rates at middle ages are relatively high. High life expectancy has an upward effect on both population growth and ageing. Differences in the components of population change across European regions may reinforce each other. High out migration tends to go hand in hand with low fertility rates. Regions with low fertility, high life expectancy and negative net migration will experience more ageing than other regions. However, in many cases the demographic components may partially offset each other. Low fertility may be compensated for by net in-migration. Therefore for assessing the impact of fertility, mortality, and net migration on population growth and ageing it is important to examine the effects simultaneously.

This chapter describes the differences in demographic and migration developments across European countries and regions. In section 3.2 we describe the main demographic developments in Europe since 2000 and in section 3.3 we describe the main demographic differences across European regions. Section 3.4 assesses the effect of fertility, mortality, and migration on differences in population growth and ageing across European regions.

3.2 Demographic developments in Europe since 2000

The main demographic developments in Europe are the low rate of population growth and the ageing of the population. The number of inhabitants of the European Union equals almost 500 million (see table 9). The average annual growth rates is below 0.5% per year. Since the 1990s European population growth has mainly been caused by international migration. Some 80% of overall population growth results from migration. The low level of fertility is the main cause of both the slow pace of population growth and population ageing. International migration brings another challenge: increasing population diversity.

Population growth is unevenly distributed across Europe with overall positive growth in western Europe and negative growth in central and eastern Europe. Seven Member States of the European Union reported population decrease between 2000 and 2008: the three Baltic states, Bulgaria, Romania, Hungary and Poland. In Germany population size increased between 2000 and 2002, but has decreased since. Average population growth has been above 1.5% per year in only three EU Member States: Ireland, Cyprus and Spain.

Since 2000 average natural growth has been negative in ten EU Member States and very small (i.e. below 0.1% of population size per year) in 6 others. Thus in more than one half of the EU countries natural growth has been negligible or negative. Ireland was the only country where natural growth exceeded 0.5% of population size per year.

Table 9 Demographic indicators, 2000-2008

	2008	2000-2007			2000-2006		
	population size	average total growth rate	average natural growth rate	average net migration rate	total fertility rate	life expectancy at birth men	life expectancy at birth women
	x million	%	%	%	children per woman	years	years
Austria	8,3	0,50	0,03	0,48	1,38	76,1	81,9
Belgium	10,7	0,51	0,12	0,39		75,5	81,5
Bulgaria	7,6	-0,87	-0,54	-0,33	1,27	68,8	75,7
Cyprus	0,8	1,75	0,42	1,34	1,51	77,2	81,6
Czech Republic	10,4	0,12	-0,09	0,21	1,21	72,4	79,0
Denmark	5,5	0,34	0,15	0,19	1,78	75,2	79,9
Estonia	1,3	-0,29	-0,30	0,01	1,43	66,1	77,3
Finland	5,3	0,31	0,17	0,14	1,77	75,1	82,1
France	61,9	0,63	0,41	0,22	1,92	76,1	83,4
Germany	82,2	0,01	-0,15	0,16	1,35	76,1	81,6
Greece	11,2	0,35	0,01	0,34	1,30	76,4	81,2
Hungary	10,0	-0,22	-0,36	0,14	1,30	68,4	76,9
Ireland	4,4	1,96	0,80	1,16	1,92	75,8	80,8
Italy	59,6	0,58	-0,02	0,60	1,28	77,3	83,2
Latvia	2,3	-0,60	-0,50	-0,10	1,27	65,4	76,2
Lithuania	3,4	-0,53	-0,31	-0,22	1,29	66,0	77,5
Luxembourg	0,5	1,11	0,37	0,74	1,66	75,5	81,5
Malta	0,4	0,94	0,23	0,71	1,40	76,7	81,2
Netherlands	16,4	0,42	0,35	0,07	1,72	76,7	81,3
Poland	38,1	-0,18	0,00	-0,17	1,27	70,4	78,9
Portugal	10,6	0,51	0,06	0,45	1,44	74,3	81,0
Romania	21,5	-0,53	-0,19	-0,34	1,31	68,0	75,3
Slovakia	5,4	0,01	0,01	0,00	1,23	69,9	77,9
Slovenia	2,0	0,24	-0,02	0,26	1,24	73,1	80,7
Spain	45,3	1,54	0,16	1,37	1,30	76,6	83,4
Sweden	9,2	0,45	0,07	0,37	1,69	78,1	82,5
United Kingdom	61,2	0,50	0,19	0,31	1,72	76,2	80,7
EU-27	495,6	0,37	0,06	0,31			
Iceland	0,3	1,49	0,83	0,66	2,02	78,9	82,8
Liechtenstein	0,04	1,08	0,47	0,62	1,47	77,2	82,6
Norway	4,7	0,70	0,32	0,38	1,82	77,0	82,1
Switzerland	7,6	0,72	0,17	0,56	1,42	78,1	83,5
Croatia	4,4	-0,17	-0,22	0,04	1,19	71,5	78,5
FYROM	2,0	0,15	0,35	-0,21	1,66	71,1	75,8
Turkey	70,6	1,32	1,32	0,01			

Net migration has been negative in five countries. In three countries average annual net migration exceeded 1% of population size: Ireland, Cyprus, and Spain. Since 2000 four countries have reported both negative natural growth and negative net migration: Bulgaria, Latvia, Lithuania, and Romania. In four other countries negative natural growth has been

compensated for by positive net migration: Germany, Czech Republic, Italy and Slovenia. In two other countries positive net migration was not high enough to counterbalance negative natural growth: Estonia and Hungary.

Total population size of the four EFTA countries equals 12.7 million. In these countries the population growth rate exceeds the average of the EU Member States. Both natural growth and net migration are higher than in the EU countries. Croatia and FYROM show a varied picture of different combinations of positive and negative natural growth and net migration. In Turkey the natural growth rate is considerably higher than in the EU countries.

Differences in the natural growth rate can be explained by differences in the level of fertility, mortality and the age structure. The level of fertility explains the main part of differences in natural growth across European countries. However, the effect of the age structure is not negligible. For example, even though the total fertility rate (TFR) in France equals that in Ireland and life expectancy is even higher, in Ireland the natural growth rate is twice that in France, due to the young age structure. Another example is the case of Spain and Sweden. In Sweden the TFR is considerably higher than in Spain, but the natural growth rate is lower. The limited effect of mortality on the rate of natural growth is reflected by the fact that several countries with high life expectancies such as Italy and Greece have a very low natural growth rate.

Since the mid 1970s the TFR has been below the so-called replacement level of 2.1 in most European countries. This implies that in the long run natural growth will become negative. The TFR ranges from 1.2 in Croatia, the Czech Republic, Slovakia and Slovenia to 2.0 in Iceland. The fertility levels in central and eastern European countries declined very sharply in the 1990s due to economic insecurities and the demise of family policies. Part of the decline in the TFR was caused by postponement of childbirth. Since 2000 the TFR has been increasing in most European countries since the decline in fertility rates at young ages due to postponement has been slowing down, whereas fertility rates at older ages has been increasing due to a catching up of postponed births. Increasing population diversity through international migration may have an impact on fertility levels. However, even though several migrant groups have higher fertility than the native population, the impact of migrant fertility on the national fertility level tends to be rather small, since migrants form a small fraction of total population, migrant fertility is diverse and fertility rates of many migrant groups are declining.

During the last decades most European countries have observed increases in life expectancy. During the last two decades life expectancy at birth has increased by 0.2 years per year on average, thus an increase by one year every five years. However, in central and eastern European countries the development of life expectancy has not been favourable since the 1990s, particularly for men. In many eastern European countries life expectancy of men is below 70 years, whereas in most western countries it exceeds 75 years. Women live longer than men, but the gender difference varies

strongly across Europe. In the Baltic states women live 11 years longer than men, whereas in many western and northern European countries the difference is below 5 years.

International migration is the most volatile demographic process. It is the most difficult to monitor as reliable data are lacking for many countries and definitions of migration may differ between countries which hampers international comparisons. In many cases net migration is calculated as the difference between total population growth and natural growth rather than as the difference between immigration and emigration. Due to the decrease in fertility levels and the increase in international migration, migration has become the main driver of European population growth.

The MIMOSA project, commissioned by Eurostat, aims to estimate immigration and emigration flows for the EU and EFTA countries according to one harmonised definition. The project will be finished in December 2009. According to preliminary results of the MIMOSA project in the years 2002-2006 on average 2.4 million persons per year immigrated to the EU- and EFTA-countries, whereas 1.0 million persons per year emigrated from the EU- and EFTA-countries to other countries. In addition 1.7 million persons per year migrated between the 31 EU- and EFTA-countries. Table 10 shows estimates of the average migration flows between European countries in the years 2002-2006. These estimates are based on the UN definition of migration. Since most countries use different definitions, the estimated numbers differ from migration statistics reported by the national statistical institutes. The table shows large migration flows from East to West, *e.g.* large flows from Poland to the United Kingdom and Germany, and from Bulgaria and Romania to Spain. Furthermore the table shows relatively large migration flows between neighbouring countries. For example, migration flows between Denmark, Norway and Sweden are relatively large compared with migration flows from the Nordic countries to other European countries. Another example is the large migration from the Czech Republic to Slovakia and *vice versa*. Furthermore migration flows from the UK to France and Spain are large.

Table 10 Migration by country of origin and destination, 30 European countries, 2002-2006

Migration by country of origin and destination, 30 European countries, 2002-2006

From \ To	SE	DK	DE	ES	LV	LT	NL	AT	FI	NO	BE	BG	CZ	EE	GR	FR	IE	IT	LU	HU	PL	PT	RO	SI	SK	UK	IS	CH
Sweden		2906	2195	1577	130	189	602	447	3948	4851	420	34	111	143	594	1117	272	550	135	184	334	123	69	28	32	4419	443	617
Denmark	4884		2273	1225	244	492	496	221	384	2894	423	63	163	121	197	1205	245	676	129	142	665	122	124	25	84	3691	1189	456
Germany	3270	2824		14639	974	1954	8196	15344	1566	1799	3998	7709	7183	520	15636	16474	2055	27692	1428	14051	85322	7408	17133	1785	8359	14862	246	15389
Spain	1024	1053	11220		46	625	3198	645	595	707	3949	2096	223	31	316	12600	2383	4892	397	249	1261	4643	7576	48	159	14958	44	6330
Latvia	318	332	1683	168		835	116	97	196	192	63	15	38	511	21	416	359	241	19	9	158	75	10	3	13	867	26	97
Lithuania	604	648	3669	1938	716		311	161	174	599	214	96	167	114	69	546	3014	604	51	19	410	168	11	10	11	7578	70	144
Netherlands	911	624	10690	4139	46	106		716	316	686	10871	103	306	34	593	3862	628	1327	193	368	943	840	217	45	130	8474	54	1148
Austria	506	265	10857	675	49	129	627		266	130	343	1519	1615	36	602	951	159	1741	71	3477	3941	367	4890	667	2910	1480	40	1365
Finland	3417	382	1236	747	108	130	296	194		829	261	14	47	641	77	408	186	243	82	115	63	36	15	4	9	1366	63	305
Norway	5204	2927	881	1228	74	194	361	87	969		136	36	43	64	57	425	69	158	27	40	222	61	68	5	40	1525	460	149
Belgium	405	449	3272	2997	51	104	5366	278	226	199		42	354	26	103	14818	181	2785	3071	75	2221	116	87	165	277	5680	25	187
Bulgaria	135	103	8264	15082	7	75	426	1585	50	111	162		3044	18	374	1331	58	3449	7	66	1027	38	544	12	877	2059	9	88
Czech Republic	150	204	7270	662	31	84	473	1368	64	102	428	2822		21	364	1698	234	1197	27	203	3638	126	979	84	27799	2313	25	495
Estonia	401	156	633	107	382	133	85	46	2296	179	43	8	30		10	282	80	183	11	22	56	12	15	0	19	995	13	23
Greece	578	209	8819	422	14	42	972	443	96	90	141	181	252	19		1218	54	1632	24	59	2151	34	238	28	188	5135	9	79
France	1029	1298	14195	10594	112	266	2949	914	409	531	11141	396	1661	201	698		1519	11224	4286	595	7984	4067	851	299	1269	46840	153	3305
Ireland	277	241	1401	1618	173	1065	530	153	157	79	982	78	178	64	129	5066		1275	44	76	1699	169	163	13	115	23120	58	420
Italy	565	778	17078	7561	114	298	1680	1622	293	235	3890	326	745	3	429	11349	487		391	351	7205	335	1451	906	1123	10686	50	10980
Luxembourg	88	132	1618	114	6	15	152	69	57	19	1862	7	17	9	29	2332	66	370		18	75	829	21	20	35	334	34	195
Hungary	331	192	13593	560	18	18	588	3269	119	101	503	144	194	56	144	4501	424	1401	22		514	123	1142	60	2258	6381	28	323
Poland	2999	1476	103157	6437	131	519	4748	5307	167	2689	1452	92	3752	6	750	2958	5856	6650	121	86		50	20	17	1830	19944	279	723
Portugal	183	164	5145	9284	25	86	1465	332	67	100	123	18	105	8	16	5043	42	669	2206	11	226		31	23	96	6101	10	77
Romania	361	244	18272	74309	14	18	642	5207	74	219	198	184	1670	17	217	2554	105	51331	24	539	386	68		17	4997	1883	11	102
Slovenia	37	34	1424	108	6	7	80	545	6	10	310	20	67	0	32	240	49	930	64	40	39	16	2		102	309	5	616
Slovakia	102	93	8753	640	16	16	409	3218	22	163	242	117	24356	0	93	614	178	1283	41	696	511	42	24	75		1830	1	2141
United Kingdom	3069	2865	10087	36000	430	2520	5510	1242	1140	1574	4794	414	2190	377	6043	66084	33809	8750	202	5271	17021	2883	1275	252	1598		465	4215
Iceland	471	1338	185	115	23	32	67	34	61	385	27	3	15	6	8	220	14	60	7	2	256	20	4	12	30	523		19
Switzerland	458	423	7062	3827	36	57	720	924	242	179	157	30	629	13	62	4064	93	10112	108	49	1286	91	52	705	1361	1647	16	

Table 11 Old age dependency ratio

	2000	2007	increase
Austria	22,9	25,0	2,1
Belgium	25,5	25,9	0,4
Bulgaria	23,8	24,9	1,1
Cyprus	17,0	17,6	0,6
Czech Republic	19,8	20,2	0,4
Denmark	22,2	23,2	1,0
Estonia	22,4	25,1	2,7
Finland	22,2	24,8	2,6
France	24,6	25,2	0,6
Germany	23,9	29,9	6,0
Greece	24,2	27,6	3,4
Hungary	22,0	23,2	1,2
Ireland	16,8	16,2	-0,6
Italy	26,8	30,2	3,4
Latvia	22,1	24,8	2,7
Lithuania	20,8	22,7	1,9
Luxembourg	21,4	20,7	-0,7
Malta	17,9	19,8	1,9
Netherlands	20,0	21,5	1,5
Poland	17,6	19,0	1,4
Portugal	23,7	25,6	1,9
Romania	19,7	21,3	1,6
Slovakia	16,6	16,5	-0,1
Slovenia	19,8	22,7	2,9
Spain	24,5	24,2	-0,3
Sweden	26,9	26,4	-0,5
United Kingdom	24,3	24,1	-0,2
EU-27	23,2	25,2	2,0
Iceland	17,8	17,6	-0,2
Liechtenstein	14,8	16,8	2,0
Norway	23,5	22,2	-1,3
Switzerland	22,7	23,8	1,1
Croatia	24,4	25,4	1,0
FYROM	14,6	16,0	1,4
Turkey	8,3	10,1	1,8

Note. Number of persons aged 65 or over as a percentage of number of persons aged 15-64 years.

In the next decades all European countries will experience the consequences of population ageing. In Europe the number of people aged 65 or over equals about one quarter of the working age population (table 10). Two decades ago this was one fifth, and according to Eurostat population scenarios this will increase to one half in the next four decades. Since 2000 the old age dependency ratio (i.e. the ratio of the number of people aged 65 or over and the number of people aged between 15 and 65) has increased in most European countries. The increase has been

particularly high in Germany, where the working age population has decreased by 3% since 2000 and at the same time the number of people aged 65 or over has increased by 22%. Greece and Italy have experienced a strong increase in the old age dependency ratio as well, but in these two countries the working age population has not yet declined. In three other countries with a relatively strong increase in the old age dependency ratio (Estonia, Latvia and Slovenia) the size of the working age population has declined.

3.3 Demographic differences across NUTS2 regions since 2000

In the ESPON 1.1.4 project regions were classified on the basis of the criterion whether total population growth, natural increase and net migration were positive or negative. This shows in which regions population growth or decline was caused by positive or negative net migration and by positive or negative natural growth. We will compare the results which 1.1.4 describes for the 1990s with developments since 2000. Subsequently we will analyse differences in fertility, mortality, and migration. Next we describe differences in population growth and ageing and examine how they can be explained by differences in the levels of fertility, mortality, and migration.

3.3.1 Comparisons of 1990s and the period since 2000

The ESPON 1.1.4 project 'The spatial effect of demographic trends and migration' presented a demographic typology based on population growth. The typology distinguished six types of regions depending on the question whether total population growth, natural growth (births minus deaths) and net migration (in-migration minus out-migration) were positive or negative.

Table 12 Percentage of regions in typology of project 1.1.4

Typology of project 1.1.4 based on population growth					
Type	Population growth	Natural increase	Net migration	1990-1999	2000-2006
1	+	+	+	42%	35%
2	+	-	+	20%	27%
3	+	+	-	11%	8%
4	-	-	-	10%	16%
5	-	-	+	10%	10%
6	-	+	-	6%	4%
				100%	100%

Table 12 shows that in the 1990s three quarters of all NUTS2 regions had positive total population growth. Most of these regions had both positive natural increase and positive net migration, but 20% of the regions (category 2) had positive population growth even though natural increase was negative. Thus in 20% of the regions net migration compensated for the excess of deaths over births. In contrast, category 5 shows that in 10% of the regions positive net migration was not high enough to compensate for negative net migration. Some regions have positive

natural increase but negative net migration (categories 3 and 6), but they are only a minority.

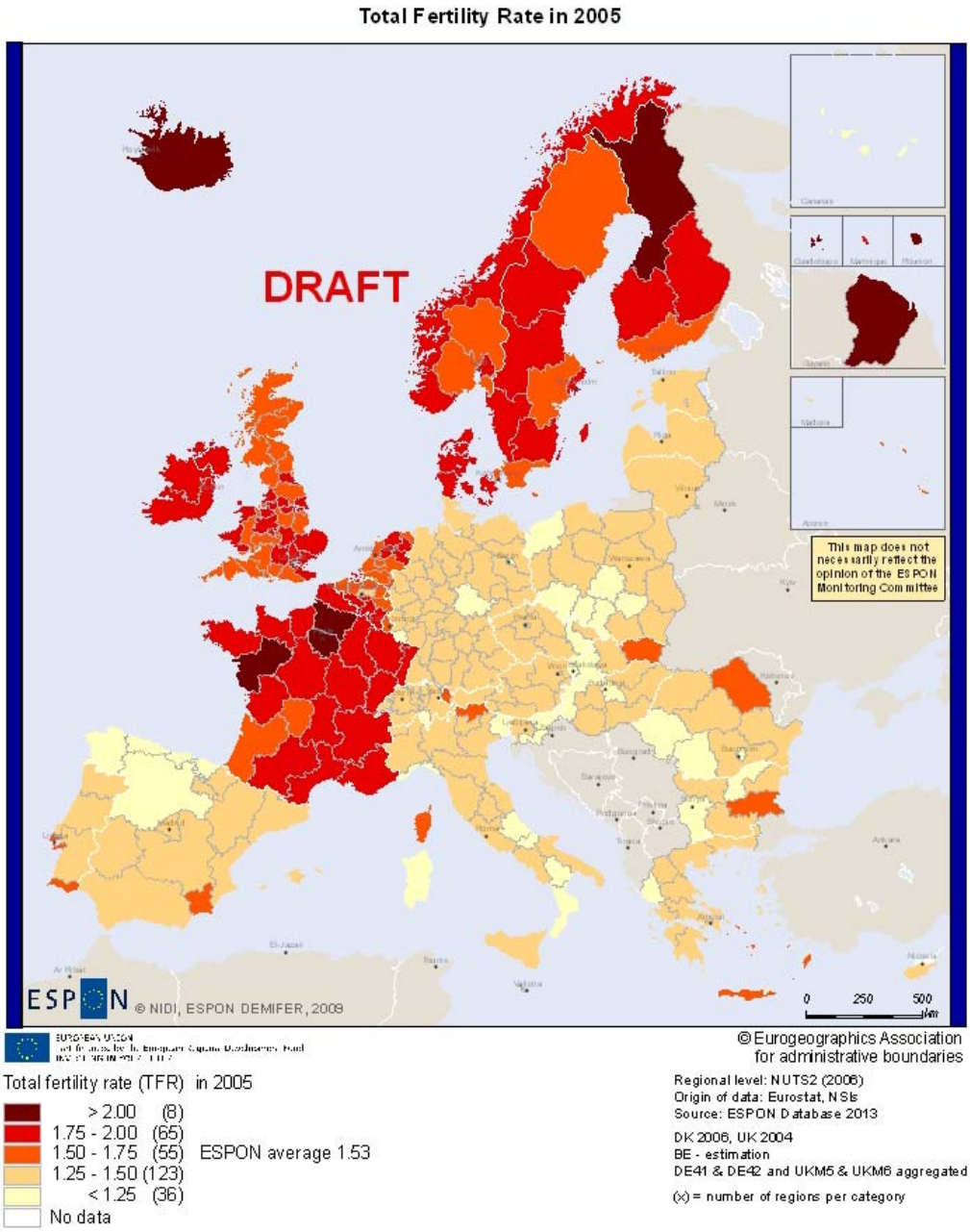
The table shows that net migration has been the main source of population growth since the 1990s. In the 1990s in 72% of the regions net migration was positive, whereas in only 59% of the regions natural increase was positive. Since 2000 the percentage of regions with positive net migration has not changed, but the percentage of regions with positive natural increase has declined to 47%, i.e. less than one half of all NUTS2 regions.

The main cause of the decline in the number of regions with positive natural increase since 2000 has been ageing. The main cause of ageing was the sharp decline in the level of fertility in the last decades of the 20th century. Since 2000 the level of fertility has risen in a number of regions. The percentage of regions with a very low total fertility rate (below 1.25) has decreased from 21 to 12%., whereas the percentage of regions with relatively high TFR (i.e. above 1.75) has increased from 17 to 25%. In a minority of regions the level of the TFR has declined. However, even though the rate of fertility may not decrease further, ageing leads to a reduction in natural increase. Due to the increase in the proportion of elderly people, the annual number of deaths has been increasing. In the 1990s, in one quarter of all regions the percentage of people aged 65 or over exceeded 17.5%. Since 2000 this has increased to 43%. The percentage of the oldest old has increased even more strongly. In the 1990s in 31% of the regions the percentage of people aged 75 or over exceeded 7.5%. Since 2000 this has increased to 57%.

3.3.2 Fertility, mortality and migration

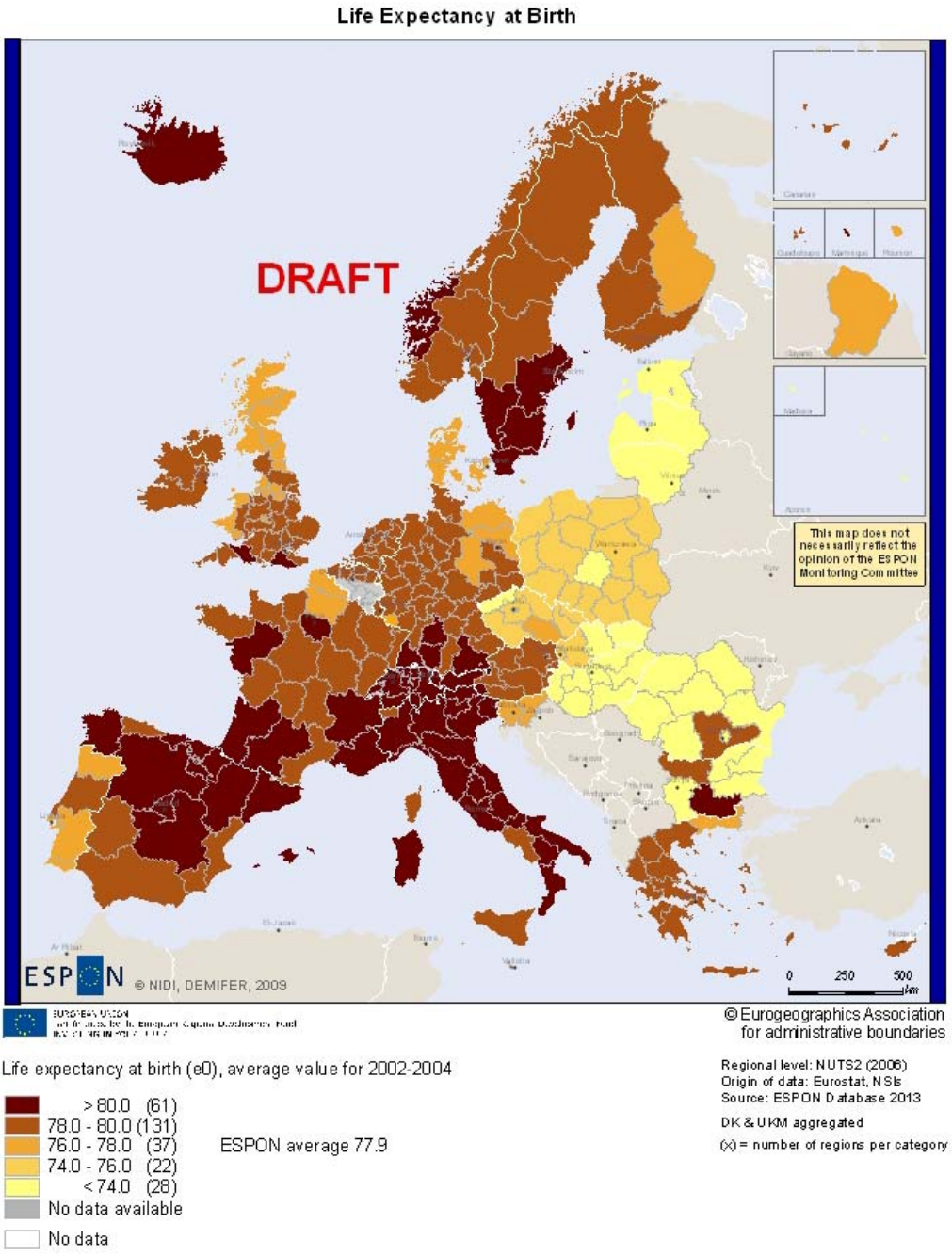
In the last decades of the 20th century fertility rates have declined all across Europe. As a result fertility levels have become rather low in most European regions. In 43% of the regions the TFR is 1.5 or lower (Map 1). Only 8% of European regions have a total fertility rate (TFR) of 2 or higher. TFRs are relatively high in northern regions, and in most regions of France, Ireland and the UK. Low levels of fertility can be observed in most southern, central and eastern regions.

Map 1 Total fertility rate (TFR), NUTS2 regions, 2005



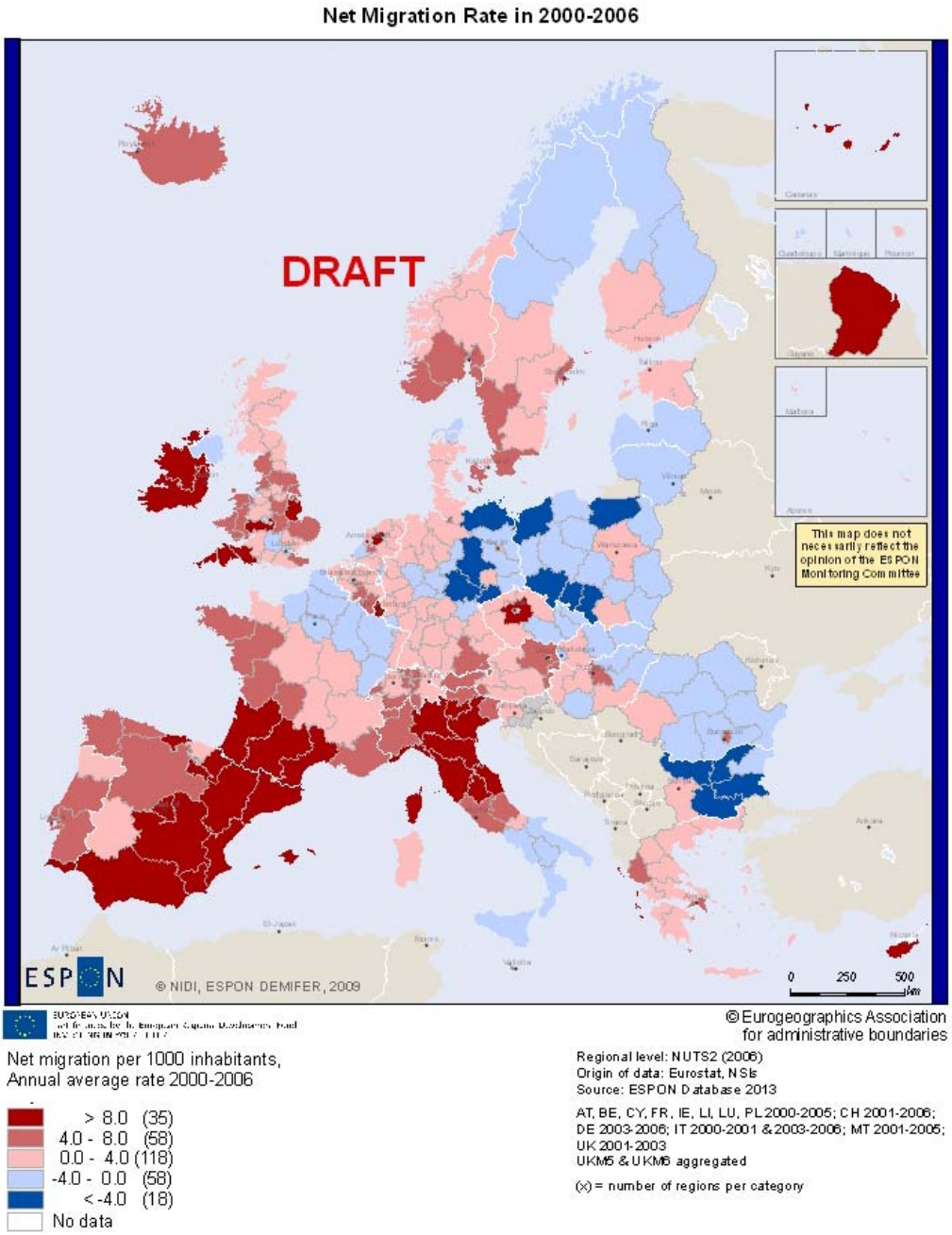
Whereas the low level of fertility is the main cause of ageing, the rate of ageing is reinforced by the increase in life expectancy. In 21% of the European regions average life expectancy is 80 years or over (Map 2). In contrast, 17% of regions have a life expectancy of 76 years or younger. The latter regions can mainly be found in eastern parts of Europe. High life expectancies can be found in both northern and southern regions.

Map 2 Life expectancy at birth (e_0), NUTS2 regions, average 2002-2004



To some extent positive net migration may compensate for the effects of low fertility and high life expectancy on ageing. In over 70% of all regions net migration has been positive (Map 3). Since 2000 net migration has been high in several southern regions, especially in south-eastern regions in Spain and northern regions in Italy. Moreover, Ireland has had high positive net migration. About one quarter of European regions has experienced negative net migration. Many regions in eastern Europe have had negative migration, but several French regions have had negative net migration as well. Furthermore southern regions in Italy and northern regions in Norway, Sweden and Finland have had negative net migration.

Map 3 Annual net migration per 1000 inhabitants, NUTS2 regions, average 2000-2006

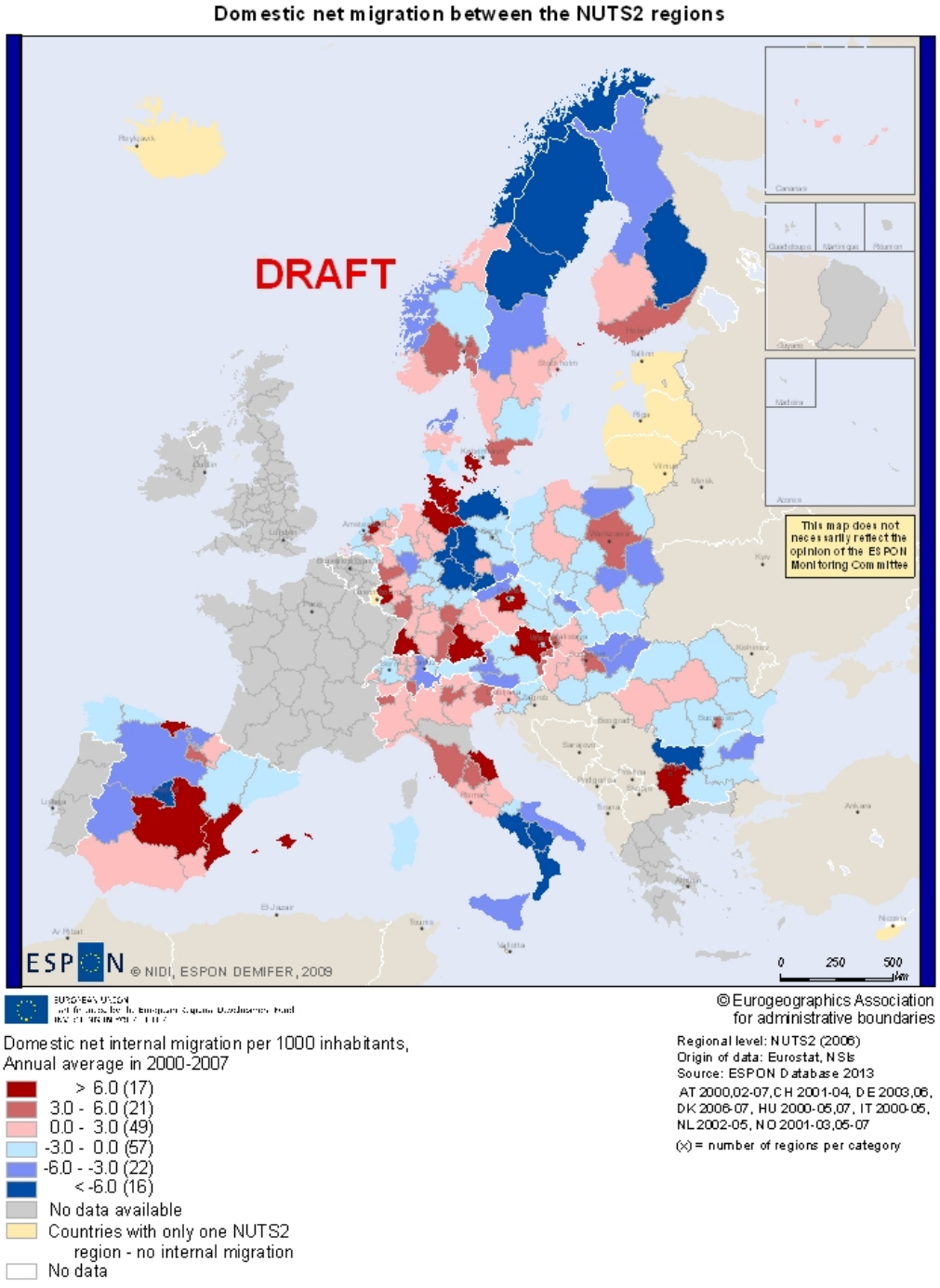


For 182 NUTS2 regions we have recent data on net internal migration (Map 4). Most regions with net migration have had net positive internal migration. However, in several regions in Spain negative internal migration has been compensated for by high international migration.

In about one half of European regions natural growth (i.e. the difference between the number of births and the number of deaths) has been negative since 2000. In 43% of these regions this has been compensated for by positive net migration and total population growth has been positive, but mostly moderate. In 57% of these regions net migration was

either small or even negative, and total population growth was negative. The latter category equals about one third of all European regions. The number of regions where population has grown due to migration only has increased from 20% in the 1990s to 27% since 2000.

Map 4 Annual net internal migration per 1000 inhabitants, NUTS2 regions, average 2000-2007



3.3.3 Population growth

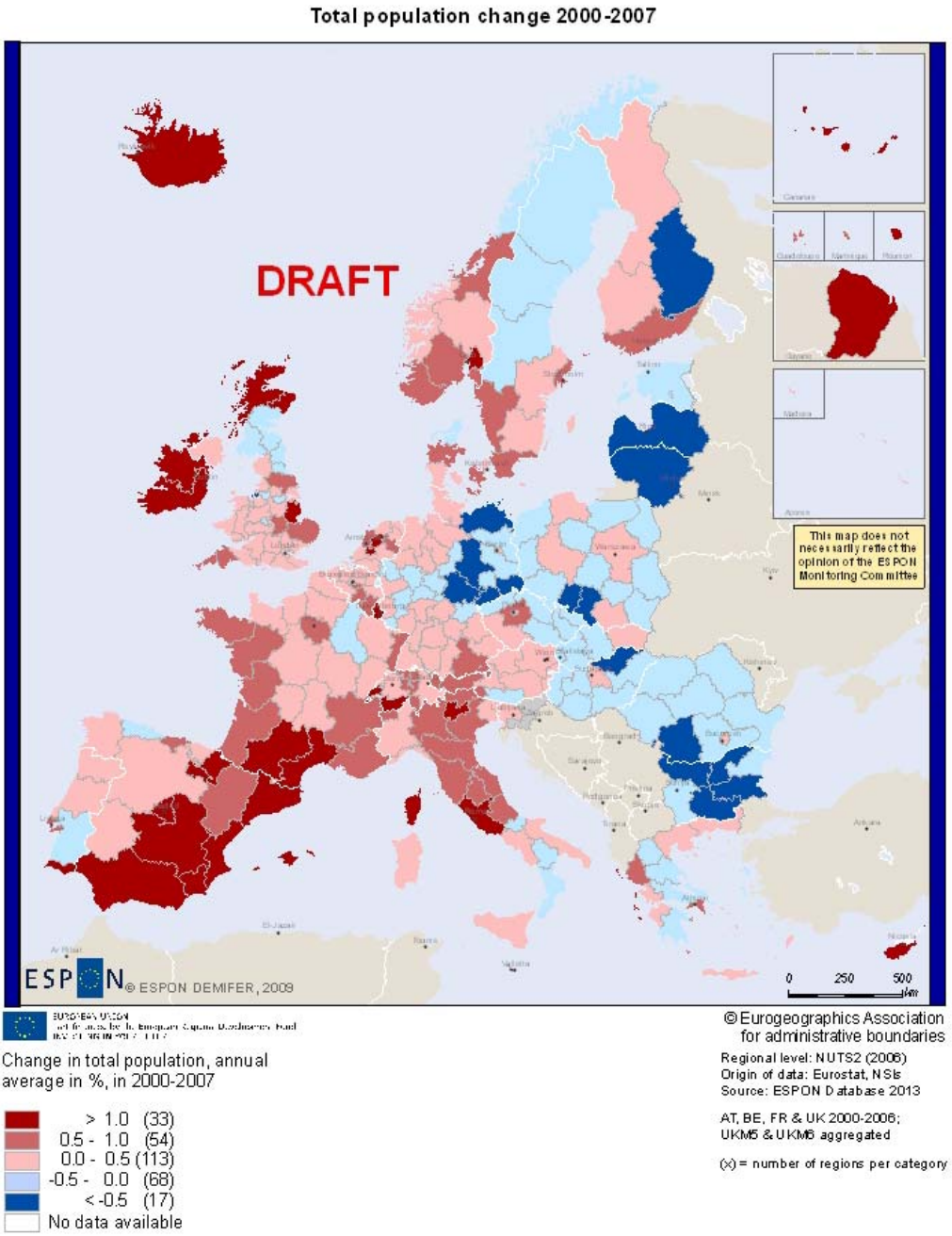
Since 2000 most European regions have experienced low population growth. The low levels of fertility have only partly been compensated for by an increase in net international migration, particularly in western and southern parts of Europe. In one third of the regions annual average population growth has even been negative, whereas in almost 40% of the regions population growth has been positive but below 0.5 percent per year (Map 5). Only one in eight regions has had a population growth above 1%. Population growth has been relatively high in several northern and southern regions. In the north-eastern part Europe population growth has been high in Iceland, Ireland, and northern regions in Scotland. In the southern part of Europe population growth has been relatively high in south-eastern regions of Spain, several southern regions in France, northern regions of Italy, and Cyprus. In addition there are some scattered regions with high population growth in Switzerland, the Netherlands, Norway and Luxembourg.

Population has been declining in north-eastern and eastern European regions as well as several regions in central parts of Europe and some scattered regions in western parts. In the north-eastern part population has been declining in several northern regions in Norway and Sweden and one eastern region in Finland. In the eastern part of Europe population has been declining in the majority of regions. However, in Poland some regions have had moderate positive population growth. Furthermore there has been population decline in a number of eastern German regions. In the other parts of Europe there are several scattered regions who have experienced negative population growth, e.g. some regions in England and Wales, and several regions in Greece. Furthermore individual regions in Portugal, Spain, France, Belgium, the Netherlands and Denmark have had population decline.

In 20% of the regions total population growth has been positive, but natural growth has been negative. In those regions population growth would have declined without migration. This has been the case in western regions of Germany, eastern regions in Austria, northern regions in Italy, and scattered regions in Spain, Greece and the United Kingdom.

In very broad lines the picture could be summarized as follows: population growth has been relatively high in several western and southern regions, and negative in several northern and eastern regions. In most other regions population growth has been moderate.

Map 5 Annual population growth rate, NUTS2 regions, average 2000-2007

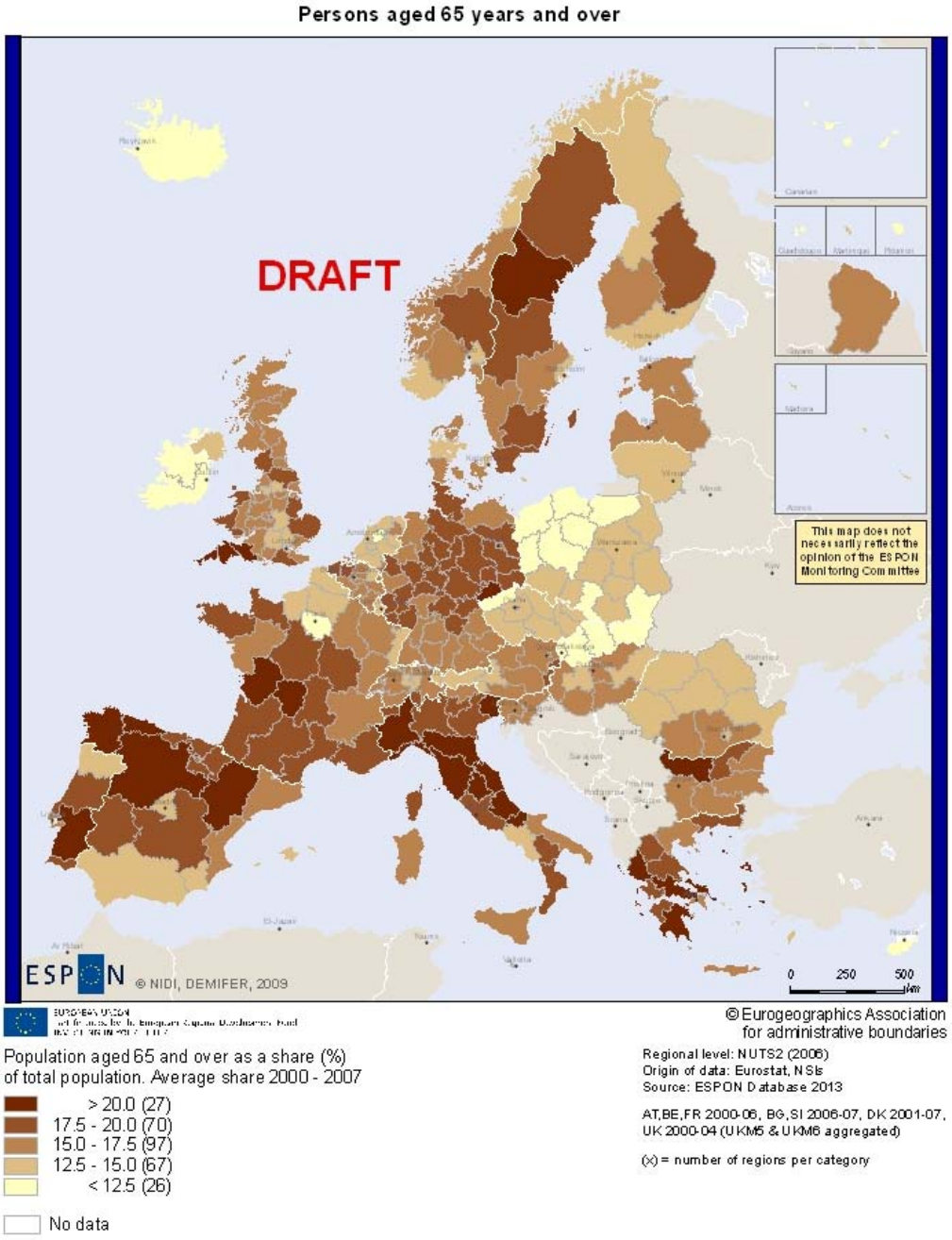


3.3.4 Population ageing

Whereas fertility has reached low levels in most regions, life expectancy has risen strongly in northern, western and southern regions. As a result, population has been ageing in those regions. Even though the development of life expectancy in many eastern regions has not been that favourable, population has been ageing in those regions as well due to very low fertility levels together with negative net international migration.

In 10% of the European regions one fifth of the population is aged 65 or over (Map 6). In almost 60% of the region the percentage of the population aged 65 or over ranges between 15 and 20%. The percentage of people aged 65 or over is high in several northern regions (mainly in Sweden), in central regions (mainly Germany) and in southern regions (several northern regions in Italy and Spain). The rate of ageing is relatively low in Poland, Ireland and Iceland.

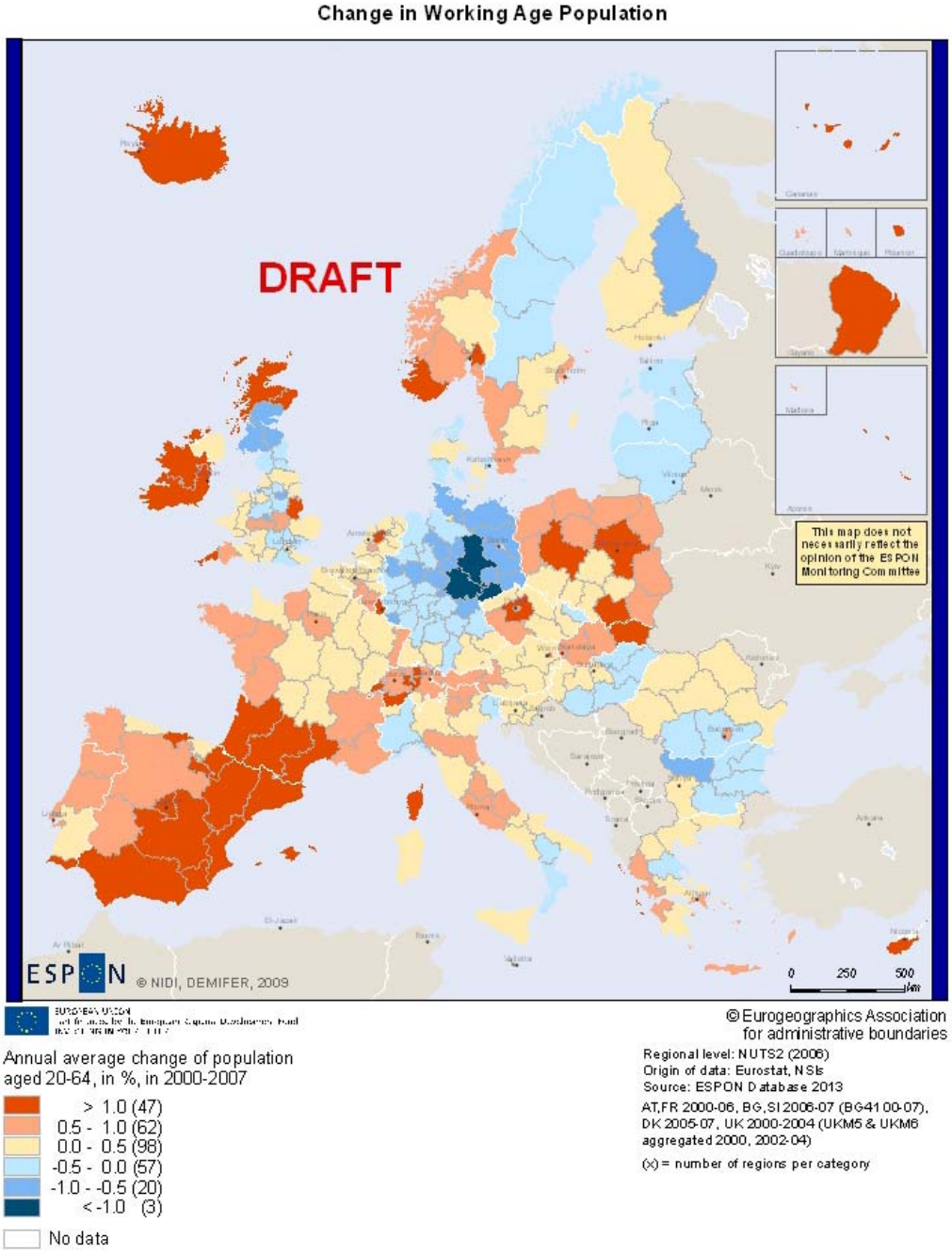
Map 6 Percentage of population aged 65+, NUTS2 regions, average 2000-2007



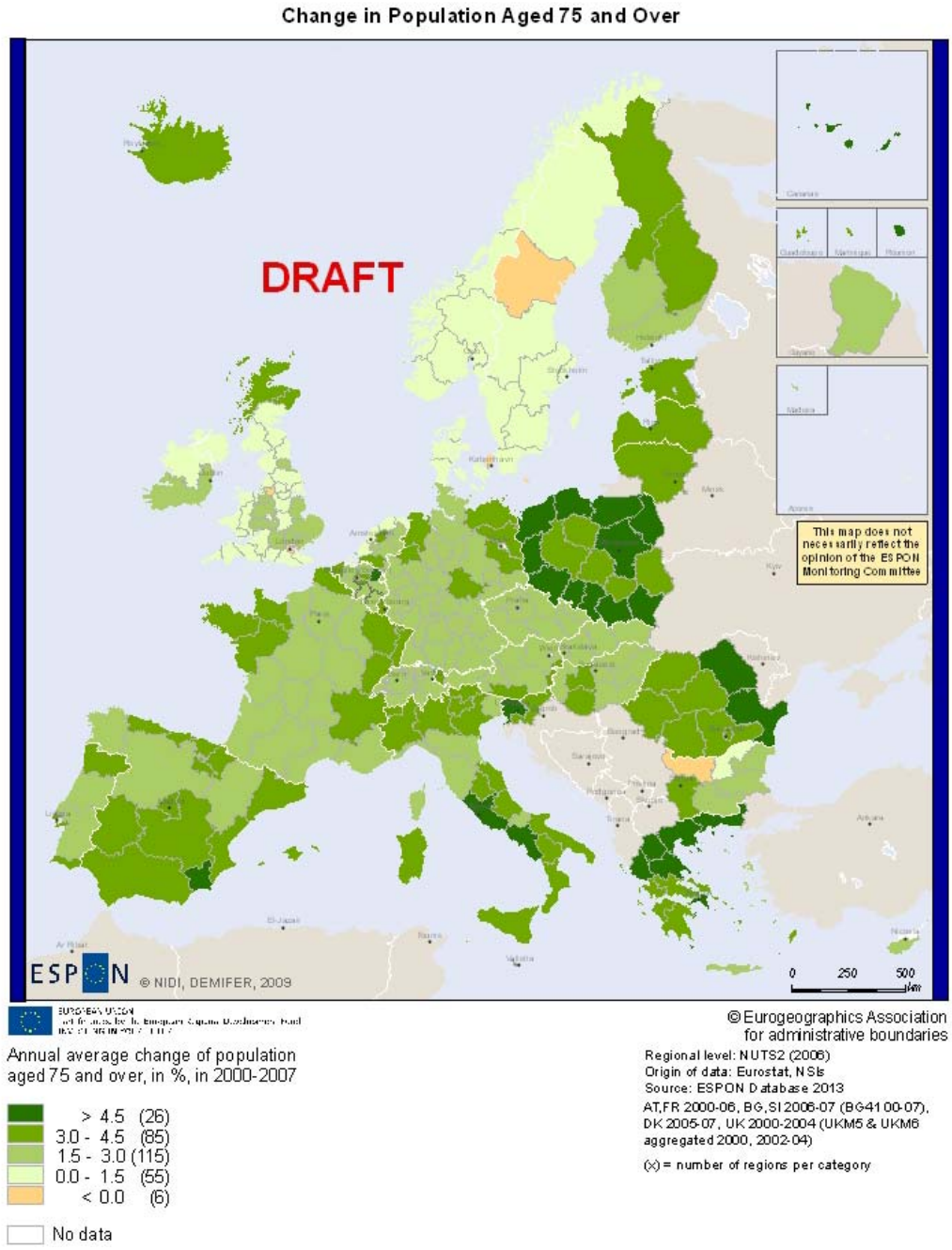
Ageing will have many effects on European societies. Three main affects are the increase in costs of retirement schemes, the slowing down of the growth of the working age population and the increase in the demand of health care and long term care due to the increase in the number of the oldest old. At the national level the increase in the number of people receiving retirement benefits compared with the size of the labour force will be one main challenge for policy makers. Since the financing of retirement schemes is usually organised at the national rather than the regional level, these problems are not so much the object of regional policies. At the regional level ageing may ask for policy interventions because of the decline in the growth of the working age population on the one hand and the increase in the demand of long-term care and health care due to the increase in the number of the oldest old on the other. Since long-term and health care tend to be labour intensive and are strongly related to the area where the oldest old are living, the combined effect of an increase in the number of oldest old and the decrease in the working age population are likely to lead to shortages of labour at the regional level. Thus the growth rate of the working age population and the growth of the number of oldest old are important indicators of ageing at the regional level.

In one quarter of European regions the working age population has been declining since 2000 (Map 7). In one third of the regions the growth of the working age population has been positive, but very moderate, i.e. below 0.5%. Thus in more than one half of European regions the growth rate of the working age population has not contributed much to economic growth. Only 16% of the European regions has experienced annual growth of the working age population of higher than 1%. Since 2000 the size of the working age population has been declining in most regions in Germany, in the eastern regions more strongly than in the western regions. Furthermore, the working age population has been declining in northern regions in Norway and Sweden and in one eastern region in Finland and in the Baltic states. In the eastern part of Europe, several Slovak, Romanian and Bulgarian regions have witnessed a decline in the working age population. In contrast in most Polish regions there has been a moderate growth of the working age population. Growth rates above 1% have been observed in the eastern part of Spain and several southern regions of France as well as in several regions in Ireland, the UK, and Iceland.

Map 7 Annual working age population growth rate, NUTS2 regions, average 2000-2007



Map 8 Annual population aged 75+ growth rate, NUTS2 regions, average 2000-2007



The demand of health care and long-term care increases sharply above age 75. For assessing the effect of ageing on the increase in the demand of care the rise in the number of persons aged 75 or over is a better indicator than the number of people aged 65 or over. Since 2000 the number of people aged 75 or over has risen in almost all European regions. In 40% of the regions the annual average growth has been 3% or higher (Map 8). In only 2% of the regions there has been a decline in the number of oldest old persons. High rates of increase in the number of oldest old are not concentrated in specific geographical areas. Regions

with high growth rates can be found in eastern parts of Europe (e.g. northern regions in Finland and in the Baltic states), in southern parts (e.g. several regions in Italy and Spain), in central parts (e.g. Austria and Switzerland) and in western parts (e.g. western regions in France and northern regions of Scotland).

3.3.5 Assessing the impact of fertility, life expectancy and migration on population growth and ageing

Population growth and ageing are related which each other. First, the decline in population growth and population ageing have one main cause, *viz.* a low level of fertility. Secondly, population ageing has a downward effect on population growth. Ageing does not merely imply an increase in the number of elderly persons, but leads to a decline in the growth rate or even to negative growth of the working age population as well. At the regional level a strong growth in the number of oldest old people who tend to have a high demand of care which is labour intensive, will lead to an increase in labour demand in the area where the oldest old are living. Thus the combination of a strong growth in the number of oldest old and a decline in the size of the working age population will ask for policy interventions.

In eastern parts of Europe there are many regions with a high rate of growth of the oldest old, and negative population growth (see Maps 5 and 8). The working age population grows relatively slowly (Map 7). More than half of these regions have low fertility, low life expectancy and negative net migration (Maps 1, 2 and 5). Other regions with a high growth rate of the oldest old and low population growth can be found in Greece and southern parts of Italy. These regions combine low fertility with above average life expectancy and positive but small net migration.

In Germany many regions have experienced very slow growth or even decline in the working age population. The growth rate of the number of oldest old is close to the average. Most of these regions have low fertility, high life expectancy and below average net migration. Other regions with slow growth of the working age population and average growth of the number of oldest old can be found in England and northern Ireland and in the eastern part of the Netherlands. These regions have high fertility, and average life expectancy and migration.

Several regions have a relatively high growth rate of the number of oldest old but high population growth as well. These regions can be found in the southern eastern part of Spain, in Cyprus, in northern parts of Scotland, and in Ireland and Iceland. These regions have high net migration and high life expectancy.

In contrast, several other regions have a low rate of growth of the number of oldest old, but a low pace of population growth as well. These regions can mainly be found in northern parts of Europe: Norway, Sweden, Denmark, and several regions in England and the Netherlands as well. Most of these regions have average life expectancy and net migration.

Regions in Portugal, in north western parts of Spain, many regions in France, Switzerland, Austria and the Czech Republic combine average values of population growth and ageing. These average values can be caused by different combinations of levels of fertility, life expectancy and net migration. Most of these regions have average life expectancy and net migration. But some have low fertility (e.g. in Portugal and north western regions of Spain), others high fertility (e.g. in France). Even though most of these regions have average net migration, some have high migration, and even though most have average life expectancy, some have high and others low life expectancy.

4 Demographic typology

4.1 Introduction

Regions are affected differently by the ongoing demographic changes with an ageing European population, in addition to migration (see chapter 3). The research and policy questions DEMIFER is aiming to address (see chapter 1) involve, among others, the affects of future demographic developments (i.e. natural development of population as well as migration and changing age structure) and the so related changes in the labour force in different kind of regions. Therefore, it is necessary to identify types of territories, regions and cities that share common development challenges and are affected most (positively or negatively) by the identified structures, trends and perspectives.

To assess the impact of demographic and migration developments on social and economic cohesion we will develop a demographic typology that includes indicators of population growth, the growth of the working age population and population ageing. We will examine the relationship between demographic differences and social, economic and territorial differences for each type of region.

The final classification of European regions will serve as the basis for the models, projections and case studies, which will be elaborated within the DEMIFER project. A first indicative identification of regions is illustrated in chapter 4.3

4.2 Previous typologies

Within several ESPON projects a large variety of different typologies were already developed (see also chapter 3.2). By far not all of them are demographic typologies, but are rather dealing with other variables and purposes. Table 10 offers an overview of the previously developed ESPON typologies. Specified demographic typologies (highlighted in Table 10) can be found mainly in the ESPON project 1.1.4 “The Spatial Effects of Demographic Change and Migration ESPON” (ESPON, 2005c), respectively in the ESPON Territorial Observation No. 1 (ESPON, 2008b) entitled “Territorial dynamics in Europe: Trends in population development“.

4.3 Preliminary results of the typology

A classification of European regions based on the demographic status (2005) and short-term trends (2001 to 2005) was elaborated (see Map 13). Thereby the spatial scope is covering the entire ESPON space of the present 27 EU Member States including Iceland, Liechtenstein, Norway and Switzerland (EU 27+4), while on the regional level NUTS2 is the focus at this stage of the project. Due to missing data for two of the four Scottish NUTS2 regions, it was necessary to display Scotland meanwhile as a single NUTS1 region (UKM).

Table 13 Previously developed ESPON typologies

Typology	Publication (TPG)	Created	Period	Spatial scope	Regional level	types
FUA (functional urban area)	ESPON 1.1.1	2003/04	2000	EU 27+4	NUTS 3	3
MEGAs	ESPON 1.1.1	2003/04	2001	EU 27+4	NUTS 3	4
Intra-urban settlement structure	ESPON 1.1.1	2003/04	2002	EU 27+4	NUTS 3	4
NUTS 3 FUAs	ESPON 1.1.1	2003/04	2003	EU 27+4	NUTS 3	6 (19)
Urban-rural	ESPON 1.1.2	2003/04	1986-01	EU 27+CH	NUTS 3	6 (10)
Cross-border functionality and participation	ESPON 1.1.3					
Population development by components	ESPON 1.1.4	2003	1996-99	EU 27+4	NUTS 23	6
Population development by components with share of elderly population	ESPON 1.1.4	2003	1996-99	EU 27+4	NUTS 23	6
Migratory balances by age	ESPON 1.1.4	2003	1995-00	EU 27+4	NUTS 2	27
Depopulation (direct and indirect)	ESPON 1.1.4	2003	1955-99	EU 27+4	NUTS 23	5
Accessibility and GDP	ESPON 1.2.1	2004	2000/01	EU 27+4	NUTS 23	8
Infrastructure endowment	ESPON 1.2.1	2004	2000/01	EU 27+4	NUTS 23	4
Household telecommunications access and uptake	ESPON 1.2.2	2004	2001-04	EU 27+4	NUTS 2	6
Business telecommunications access and uptake	ESPON 1.2.2	2004	2001-04	EU 27+4	NUTS 2	6
Combined household and business telecommunications development	ESPON 1.2.2	2004	2001-04	EU 27+4	NUTS 2	6
Broadband penetration	ESPON 1.2.2	2004	2001-04	EU 27+4	NUTS 2	3
Introduction of Competitive provision	ESPON 1.2.2	2004	2001-04	EU 27+4	NUTS 2	2
Broadband penetration / Introduction of Competitive provision	ESPON 1.2.2	2004	2001-04	EU 27+4	NUTS 2	6
Hazard potential and vulnerability	ESPON 1.3.1	2005	1999-2003	EU 27+4	NUTS 3	9
Regions by type of impact of ICTs policies	ESPON 2.1.1	2004	1981/91-2001 (2001-2021)	EU 27+4	NUTS 3	4
Lagging Regions	ESPON 2.1.1	2004	1981/91-2001 (2001-2021)	EU 27+4	NUTS 3	3
Regional R&D performance	ESPON 2.1.1	2004	1981/91-2001 (2001-2021)	EU 27+4	NUTS 3	5
R & D and innovation capacity	ESPON 2.1.2	2004	1997-2000	EU 27+4 / EU 15	NUTS 2	5 (6)
Rural Areas (EU 15 / N 12)	ESPON 2.1.3	2004	1989-2001	EU 27+4	NUTS 3	10/7
Dominant Structural funds spending	ESPON 2.2.1	2004	1994-1999	EU 15	NUTS 3	4
Structural Fund spending and (change or) regional performance ranking	ESPON 2.2.1	2003	1998	EU 15	NUTS 2	9
Sectoral Economic structure in the Candidate Countries	ESPON 2.2.2	2005	1998-2003	ACC 12	NUTS 3	3
Regional conditions based on potentials and bottlenecks	ESPON 2.2.2	2005	1998-2003	ACC 12	NUTS 3	4
Settlement Structure	ESPON 3.1			EU 27+4	NUTS 3	3 (9)
Synthetic typology of joint demographic and economic evolutions	ESPON 3.4.1	2005	1950/54-1996/00	global	countries	5
Synthesis of the regional insertion in the world economy	ESPON 3.4.1	2005		EU 27+4 in global view	NUTS 2	4
Economic typology of European regions	ESPON 3.4.2	2002	(1995-) 2002	EU 27+4	NUTS 23	7 (20)
Population development by components	ESPON Territorial Observation No. 1	2008	2001-05	EU 27+4	NUTS 23	6
Typologies yet to be developed						
Urban / metropolitan regions	Compilation	2009		EU 27+4 + CCs		
Rural regions	Compilation	2009		EU 27+4 + CCs		
Sparsely populated regions	Compilation	2009		EU 27+4 + CCs		
Regions in industrial transition	Compilation	2009		EU 27+4 + CCs		
Cross-border regions	Compilation	2009		EU 27+4 + CCs		
Mountainous regions	Compilation	2009		EU 27+4 + CCs		
Islands	Compilation	2009		EU 27+4 + CCs		
Coastal regions	Compilation	2009		EU 27+4 + CCs		

Young Potentials (Type 1, N=16)

This type, consisting of 16 regions can be characterised by its young age structure and the consistently positive population development of both components: a positive natural population development and a positive net migration. The age groups 20-39 and 65+ clearly show higher respectively lower proportions compared to the EU 27+4 average. The prevailing population increase is driven by an above (EU 27+4) average natural increase and the strongest positive net migration rates overall.

Geographical distribution: Besides the Republic of Ireland, Cyprus, Vienna and Flevoland region, this type can be found on the Spanish mainland and islands (Canaries and Balears) and in South Portugal.

Euro Standard (Type 2, N=85)

Euro Standard is including nearly 30% of all NUTS2 regions, displaying values close to the EU 27+4 average for all four variables. Compared to the (EU 27+4) average the age structure of the Euro Standard type is slightly older. Although the natural balance is (not dramatically) negative, the total population is increasing due to a predominately positive migratory balance. Within this type the variations are very small.

Geographical distribution: This type is a distinct West and North European type, which can be found in Scandinavia, the United Kingdom, the Benelux countries, South and West France, western parts of Germany and also in Switzerland, North Italy and the South East of Austria).

Family Potentials (Type 3, N=55)

This type is also very close to the EU 27+4 average, but shows some clear differences in regard to Euro Standard (Type B). Compared to the EU 27+4 average the age structure is younger and the natural balance is the highest overall. The migratory balance is varying, but still positive in most of the regions. This results in a significant increase of the total population.

Geographical distribution: Besides occurrences in South Europe (South Italy, Malta and the Lisbon region) and the island of Martinique, Family Potentials show a similar distribution compared to Euro Standard (type B) and can also be found mainly in West and North Europe: in Scandinavia, the United Kingdom, the Benelux countries, North and East France, Switzerland and West Austria).

Challenge of Decline (Type 4, N=31)

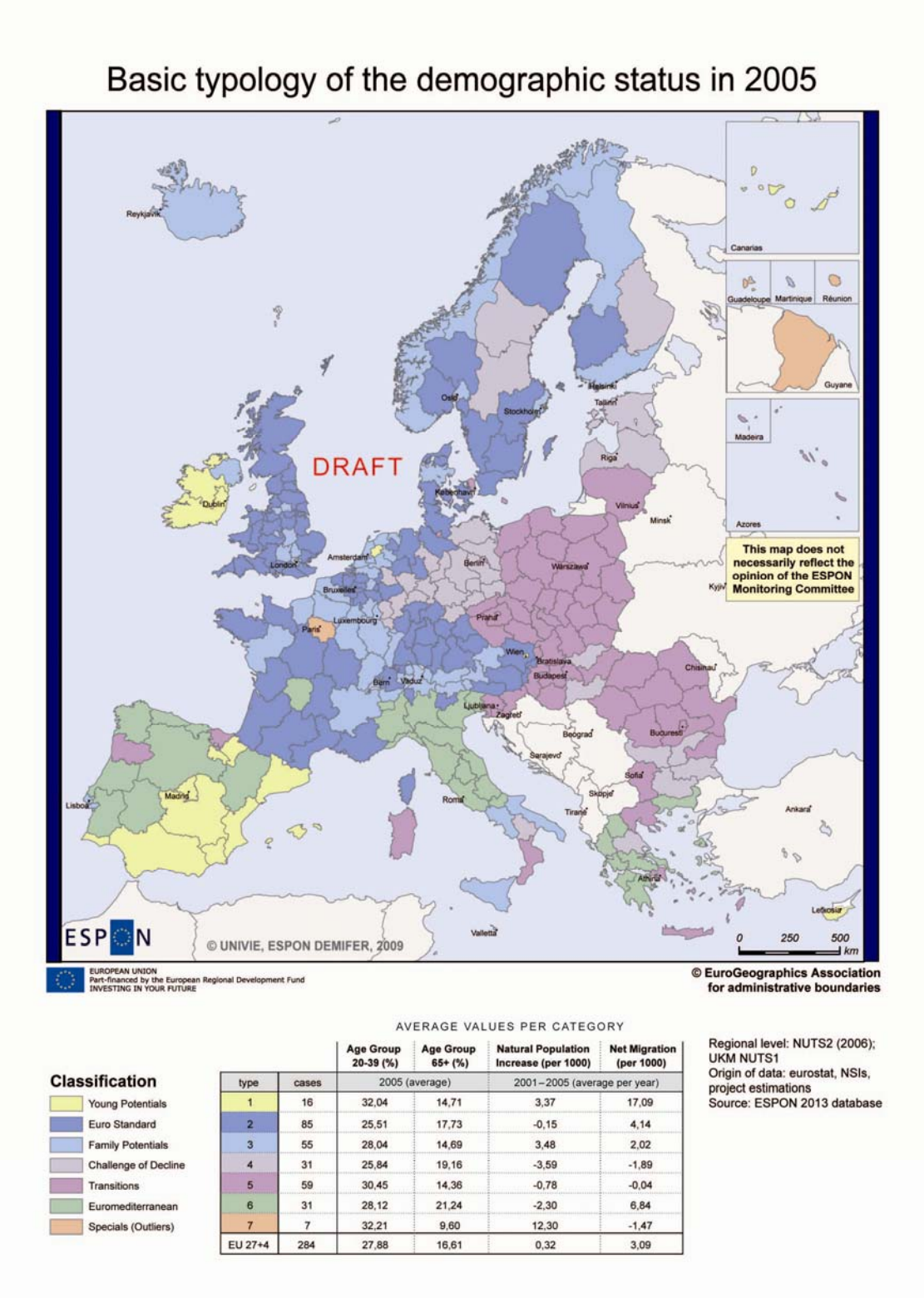
Regions belonging to this type face some kind of a demographic problem and can at best be characterised with the term stagnation. Due to a negative natural and a negative migration balance the EU 27+4 depopulation regions are concentrated within this type, which is also confronted with the second highest share of elderly people (behind type 6).

Geographical distribution: Besides East Germany, this type includes also the peripheral regions of Scandinavia and some parts of West Germany, South Italy and mainland Greece. The most problematic regions are situated in East European countries (Bulgaria, Hungary as well as Latvia and Estonia).

Transitions (Type 5, N=59)

The Transition type of regions shows a younger age structure compared to the EU 27+4 average, due to higher respectively slightly lower shares of people in the 20-39 and 65+ age groups. Both the natural and the migratory balance are on average slightly negative, resulting in a minimal but overall total population decrease. This type offers a high variation concerning natural population development and net migration rates. That is why regions with both positive and negative natural as well as migration balance can be found.

Map 9 Basic typology of the demographic status, EU 27+4 (2005)



type	cases	Age Group 20-39 (%)	Age Group 65+ (%)	Natural Population Increase (per 1000)	Net Migration (per 1000)
		2005 (average)		2001–2005 (average per year)	
1	16	32,04	14,71	3,37	17,09
2	85	25,51	17,73	-0,15	4,14
3	55	28,04	14,69	3,48	2,02
4	31	25,84	19,16	-3,59	-1,89
5	59	30,45	14,36	-0,78	-0,04
6	31	28,12	21,24	-2,30	6,84
7	7	32,21	9,60	12,30	-1,47
EU 27+4	284	27,88	16,61	0,32	3,09

Geographical distribution: Most notably this type can be found in the New Member States (NMS) of Central and Eastern Europe (CEE), but also in Greece, South Italy, on the Iberian Peninsula as well as on the islands of Madeira and the Azores.

Euromediterranean (Type 6, N=31)

Within this type the share of the elderly population surpasses clearly the (EU 27+4) average, but the proportion of the population aged 20-39 is still high. Despite this high amount of young adults in their reproductive age, the number of births is below the (EU 27+4) average. Adding the higher share of elderly people and the so connected relatively higher numbers of deaths, the population of this kind of regions would decrease, if there wouldn't be a significantly positive (but strongly varying) net migration.

Geographical distribution: This type of regions can be found exclusively in the South of Europe: in large parts of Greek, North Italy, North East Spain, Portugal and also in France (Limousin region).

Specials (Outliers) (Type 7, N=7)

This special type is a summary of outlier regions. Some feature significantly different age structures, like Inner London (43% of the population is in the age group 20-39) and Guyane (with a share of elderly/65+ of just 3,7%). The other five outlier-regions (Paris region, the Spanish exclaves of Ceuta and Melilla, as well as the French overseas islands of Guadeloupe and Réunion) are characterised by very high respectively low shares of people in the 20-39 and 65+ age groups as well as a very strong positive natural population balance.

5 Reflection on response on the Inception Report

Annex III of the contract includes comments by the Evaluation Committee and the Sounding Board on the project proposal of DEMIFER. Section 9 of the Inception Report discussed how DEMIFER will deal with the comments. On the basis of comments by members of the ESPON Monitoring Committee, the European Commission, the Managing Authority, and the Sounding Board, the ESPON Coordination Unit 2008 prepared a response to the Inception Report (dated 4 December 2008). The response focused on five key points:

1. Five elements of contractual demands were not given enough attention in the Inception Report:
   - Aspects related to human capital and skills.
   - Interrelationship between demography and economic performance.
   - General overview of data situation.
   - Assessment of data situation for EU candidate countries.
   - The definition of a limited number of case studies, focusing on a good geographical coverage of the ESPON territory.
2. The methodology should be clarified.
3. Interlinkages with other ongoing ESPON projects should be improved.
4. The focus on the policy demand should be strengthened.
5. The TPG should invest substantially in filling data gaps or find solutions to overcome data problems.

This chapter will clarify how these issues have been dealt with in this interim report or will be dealt with in the draft final report of the DEMIFER project.

5.1 Contractual demands

5.1.1 Human capital

The Inception Report did not give enough attention to aspects related to human capital and skills and their importance for the development of the regions in Europe.

In analysing the impact of demographic and migration developments on economic cohesion, it is not sufficient to look at changes in the total size of the working age population. Changes in labour force participation rates and the skill level are important as well. A labour force with appropriate levels of skills and training is key to increasing productivity. One way of achieving this purpose is to implement education and training policies, but these are not the subject of DEMIFER. The focus of DEMIFER will be on assessing how migration flows affect human capital of regions. Internal migration may cause a redistribution of skill levels across regions. The same applies for international migration between European countries. Inflow of skilled migrants from outside Europe may enhance human capital in those regions that attract those migrants without affecting other European regions. Thus internal migration and international migration between European countries have different consequences for the

distribution of skill levels across regions than migration from and to outside Europe.

The skill level of migrants affects the work force in two ways. First, labour force participation rates vary with skill level, thus skilled migrants tend to have higher labour force participation rates. Second, in-migration of highly skilled persons will have a positive impact on the average skill level of the population, whereas out-migration of highly skilled persons will have an adverse effect. The extent to which European regions will succeed in attracting skilled migrants depends on economic and social developments in those regions and in other parts of the world and on the implementation and effectiveness of European immigration and integration policies. DEMIFER will develop scenarios based on alternative assumptions about economic developments in European regions and in the rest of the world and assumptions about the effectiveness of policies aimed at affecting international migration flows and policies affecting the direction of internal migration. By means of comparing the results of the scenarios we will assess the effects of different economic developments and of different policies on changes in the work force. We will take into account the effect of skill level of migrants on the level of labour force participation and productivity rates. The specification of the scenarios will be based on data on differences in the skill level of migrants across regions that will be obtained from the Labour Force Survey. These data will not provide enough detail for each individual region, but the typology developed within DEMIFER will allow us to analyse LFS data for types of regions. Note that the typology of regions will be used for specifying the assumptions on demographic parameters, migration flows, and labour force participation rates underlying the scenarios

5.1.2 Interrelationship between demography and economy

The Inception Reported mentioned the relationship between demography and economic performance in a relatively superficial way. It is important to examine how demography affects regional economies and to assess the impact of regional economic performance on demography.

In the economic literature theoretical and empirical studies of the relationship between demography and economy tend to focus on either the relationship between population growth and ageing on the one hand and economic growth on the other or on the economic benefits of migration (see also section 4.3 of the Inception Report and Annex 3 to this interim report). However useful these studies may be, they only provide partial results. In analysing the relationship between demographic and economic differences across regions it is important to note that the relationship is mutual. On the one hand the levels of fertility and mortality and the direction of migration flows are affected by economic conditions, on the other hand changes in population growth and ageing (which depend on developments in fertility, mortality and migration) affect both the supply and demand side of the economy of regions.

Differences in the size of natural growth across regions partly depend on economic differences since both the level of fertility and life expectancy

are affected by economic developments. Generally there is a positive relationship between the level of life expectancy and economic conditions. The level of fertility tends to be positively related with economic conditions as well, but there is no simple clear-cut linear relationship. The reason is that if there is a lack of child care facilities there may be a negative relationship between fertility and labour force participation of women. This may explain why well-off regions in northern Europe have a high level of fertility, whereas regions in the northern part of Italy have a low level of fertility.

The direction of both internal and international migration flows are affected by economic differences across regions and countries, particularly differences in the labour market. Regions with a high employment rate and a low rate of growth of the working age population may be expected to be confronted with a shortage of labour, whereas other regions have high unemployment rates. Thus internal migration from the latter to the former regions may be beneficial for both regions. However, the level of internal migration may not be as high as would be preferable due to the increase in labour force participation of women which may make it more difficult to migrate, since in many cases employment of two people is involved.

Both natural growth and migration affect economic developments, but whereas migration may have a direct effect on the size of the work force, fertility only has an effect in the long run. In most countries changes in mortality do not directly affect the size of the work force, since mortality rates below age 65 are low, but as several regions in eastern parts of Europe have relatively high mortality rates below age 65, a reduction in mortality at middle ages would have an effect on the size of the working age population in those regions. Increases in life expectancy at older ages lead to an increase in the number of oldest old, which has an effect on the demand of health care and long term care. In this respect it is important to make a distinction between the 'young elderly' and the 'oldest old'. As many people in the first years after retirement are in reasonably good health they may provide informal care. This will not be visible in the labour force participation rates, but it may well help in bridging the gap between the increase in the demand of care caused by the increase in the number of oldest old and the decrease in the growth rate of the working age population. It is important to note that due to the effect of the post war baby boom in the next decades the number of 'young elderly' will rise strongly, but that in the long run these people will become the oldest old. Thus whereas in the coming decades we may expect an increase in the supply of informal care, in the long run the gap between supply and demand of care may well increase sharply.

The effect of migration on the size of the working age population is more direct than that of fertility or mortality. However, the effect of migration on the work force depends on the skill level of migrants. If there is a mismatch between the skill level of migrants and labour demand, migration may lead to an increase in unemployment rather than in employment. Thus training policies may be needed in addition to policies stimulating mobility of labour. In the long run technological progress may

decrease the need of internal migration. However, one may assume that the supply of long term care will remain labour intensive. For that reason in regions that show a strong increase in the growth rate of the number of oldest old and a decline in the growth rates of the working age population policy makers will be confronted with a challenge.

The mutual relationship between demography and economy will be taken into account in DEMIFER as follows. First, on the basis of the demographic typology we will analyse the relationship between demographic and economic indicators for the different types of regions. Both on the basis of these empirical analyses and on the basis of empirical results from the literature, we will make assumptions on the future levels of fertility and mortality and the direction of internal and international migration flows for each of the types of regions in each of the scenarios. In addition we will make assumptions on the level of labour force participation and the growth of labour productivity. As the scenarios reflect different future economic developments, the differences across the regions reflect the effect of economic developments on the demographic indicators. Second, comparisons of the results of the scenarios will show how population growth, population ageing and the growth of the work force vary across regions. Since we include assumptions about differences in the growth of productivity across scenarios the analysis will include differences in changes of demographically driven economic product across regions and thus the effect of demographic and migration developments on the competitiveness of regions. These results will be used to assess which policy options would be most effective for which types of regions under which economic conditions.

5.1.3 Data situation

Annex 2 of the Inception Report includes comprehensive information on the data situation but does not give a general overview. Moreover, the Inception Report does not give enough attention to the data situation for the EU candidate countries. The TPG should reflect on the possibility to include these countries in the analysis.

Tables 1 and 2 in Chapter 2 give an overview of availability of demographic data for the 27 EU Member States, the 4 EFTA countries and the 3 EU candidate countries on the NUTS2 and NUTS3 level respectively. Tables 3 and 4 give an overview of the economic data that are useful for DEMIFER.
For the EU candidate countries useful regional data are available, but at this stage we did not yet find data which are detailed enough for these countries to be included in the calculation of the scenarios. Thus further exploration of the data situation for candidate countries is needed before we can conclude whether or not these countries can be included in the scenarios.

5.1.4 Case studies

In defining case studies it is important to ensure a good geographical coverage.

The selection of case studies will be based on the demographic typology of regions described in Chapter 4 of this report. We will select a region from each of the types for a case study. One important criterion for the selection will be a good geographical coverage.

5.2 Methodology

The Inception Report gave a relatively light description of the methodology that will be used to reach the objectives for each activity. The Interim Report should clarify how the key policy questions will be answered. It should be taken into account that concerning migration flows there is an increasing interdependence of countries. Interdependence should be taken into account in developing and implementing migration policies at all levels.

Chapter 2 describes the methodology of the development of the typology and the scenarios and the model for calculating the scenarios.

The interdependence of countries and regions will be taking into account in analysing and projecting international and internal migration. International migration will be distinguished by country of origin and destination. The origin-destination interaction will be estimated on the basis of results from the MIMOSA project. Internal migration will be distinguished by region of origin and destination.

5.3 Interlinkages with other ongoing ESPON 2013 Programme

5.3.1 Edora

EDORA may provide input on the development of rural areas for the definition of case studies in peripheral rural areas.

Direct and close cooperation between EDORA and DEMIFER projects may be difficult, as they differ in subject of research and in geographical scale (NUTS3 vs NUTS2) in which research is conducted. In addition such cooperation would involve large teams, what is costly in terms of labour time and management overheads. The fact that timetables of projects are not coordinated is another constraint. However the results of EDORA research, if available at the time of taking decisions, may be used as a complimentary resource in the selection of DEMIFER's case study regions. Another potential area of cooperation is in data collection, however the differences in scope and the regional level will limit this cooperation.

5.3.2 Foci

FOCI may deliver output that can be of direct use for DEMIFER, in particular for the analysis of regional migration flows, the influence of the urban system and the definition of case studies in metropolitan areas.

The FOCI (Future Orientations for Cities) project (Espon Applied Research Project 2013/1/1) aims at analysing:

- the functionality, trends and opportunities of European cities in terms of competitiveness, social cohesion and environment;
- the relation of cities to their hinterland, especially their role as growth poles/motors;
- the existing and potential « polycentric » inter-city cooperation for increasing competitiveness and service provision" and it aims "
- to use the results of these analyses to develop scenarios of the possible future development paths of cities in order to provide input to the policy making process." (Inception Report, p.4).

The work package 'State of European Cities' will track the economic profiles, social cohesion, demography, environment and accessibility developments in European cities. Some of these themes are also at the centre of interest of the DEMIFER project.
An exchange in form of a joint workshop before the formulation of the Draft Final Report might be of mutual interest and benefit.
The activity 'Case studies' in DEMIFER will attempt to include preliminary results of the FOCI project. In the selection of the case studies the presence of a city included in the FOCI project might be a criterion.

5.3.3 Database project

DEMIFER should discuss with the ESPON Database project questions related to missing data, data harmonisation in FYROM and Turkey and changes in the NUTS versions.

At the moment the contacts between DEMIFER and the ESPON Database project have been related to harmonization issues. DEMIFER have used the latest available data in all maps and figures and the spatial representation is based on the NUTS 2006 division. All the maps and data fields are produced after the latest given instructions. Because those instructions are still provisional documents, word "draft" has been used in maps.
DEMIFER will continue to cooperate with the ESPON database project in order to keep the project up to date on mapping and data related issues after the programme guidelines. In order to secure the quality of the project, a lot of cooperation is needed to present the latest – and harmonized – data for whole ESPON space, and within the other ESPON projects. In the data fields provided by DEMIFER FYROM and Turkey are included when the data has been available on Eurostat, but because those areas are not included in the ESPON MapKits, are those areas not shown on maps.

In the later phase the data in internal ESPON database, mastered by the ESPON database project, can be useful for DEMIFER in order to use identical figures with the other projects and fill the data gaps.

5.4 Focus on policy demand

The Interim Report should put more emphasis on the policy demand referring to the Lisbon Strategy, the Territorial Agenda and the Commission's Green Paper on Territorial Cohesion. In particular the effects of migration on regional competitiveness and cohesion should be addressed.

Population ageing will lead to a reduction in the growth of the working age population. This may well have implications for economic growth. The Lisbon strategy aims at long term economic growth, full employment, social cohesion and sustainable development. In order to achieve the Lisbon goals the ageing of the working age population asks for policies aimed at increasing the size of the working age population, raising employment rates and improving productivity growth. In order to increase the size of the working age population, policy options may vary from migration policies aimed to attract skilled migrants to family policies aimed at raising fertility levels. In order to raise employment rates policies may aim to increase labour force participation of women, raise retirement age and to achieve higher labour force participation of migrants. In order to increase productivity, training policies are aimed to increase human capital.

Even though population ageing will affect regions all across Europe, different types of regions will be affected in different ways. Regions where the working age population is declining and where the employment rates are high will be confronted with labour shortages whereas in regions where the working age population is still increasing and the employment rate is low, unemployment may be high. Policies aiming to stimulate migration from the latter to the former type of regions could improve growth in the former regions and reduce unemployment in the latter. But it is not self evident that this will reduce regional disparities. Rather regional disparities may increase. Thus the future effects of migration on cohesion are not unambiguous. For that reason it is necessary to examine alternative scenarios.

The Territorial Agenda of the European Union aims to strengthen territorial cohesion by promoting polycentric developments and urban-rural partnerships. City regions should cooperate with each other and with medium and small-sized towns in rural and peripheral areas. Local authorities facing population decline and ageing should cooperate to maintain services and infrastructure in order to make regions attractive. Since it is uncertain to what extent the territorial policies will be effective, DEMIFER will specify alternative scenarios. These scenarios are based on alternative assumptions about future developments in economic trends, innovation and climate change on the one hand and alternative assumptions about the implementation and effectiveness of regional cohesion policies on the other. DEMIFER will compare scenarios in which

policies will succeed in narrowing regional disparities with scenarios in which well-off regions will benefit more than lagging regions. For example, in one scenario internal migration will contribute to economic cohesion by a reduction in regional differences in human capital and economic growth whereas in another scenario internal migration will lead to increasing disparities as urban regions will benefit from internal migration of skilled young people at the cost of rural and peripheral regions. In addition, in one scenario European countries may succeed in competing with the US, Canada and Australia in attracting skilled migrants, whereas in another scenario Europe hardly succeeds in selecting migrants according to skills and experiences. Furthermore, one scenario may assume that active immigration policies aimed at admitting skilled migrants from outside Europe are coordinated among European countries, whereas another scenario may assume that competition between countries and regions leads to an increase in differences in the success of attracting skilled migrants. Other policy options of which the effectiveness may differ between scenarios are labour market policies aimed at increasing labour force participation of women, reducing early retirement and increase employment rates of migrants, training policies aimed at improving human capital and labour productivity, and innovation policies aimed at improving productivity as well.

5.5 Data issues

The TPG should invest in filling data gaps and the use of proxies to overcome data problems. Contact should be established with ECPs from countries where significant gaps exist.

For running the DEMIFER simulations we need the following data:

- data on population stocks and deaths by age (eighteen five-year age groups; the last half-open age group is 85+), sex and region;
- births by sex of the child born, and region and age of the mother (from 15-19 years to 45-49 years; births from mothers younger than 15 and older than 49 years are counted in the adjacent age groups);
- a full migration matrix (by region of origin, region of destination, age and sex) for internal migration;
- a matrix of international migration between the modelled countries (by country of origin and country of destination);
- net migration for exchanges between each of the countries within the system and the Rest of the world;
- some information about the age and sex structure of international migrants.

The major challenge of DEMIFER is the limited and often not very robust data regarding migration. So far, migration data have been collected for inter-regional migration in three partial arrays: origin-destination flows, out-migration totals by age and in-migration totals by age. From these partial arrays the full origin-destination-age array of migration flows will be estimated to yield the origin-destination-age rates of migration needed in the projection model (using log-linear models). Also included in the database are total emigration and immigration flows by age. These refer to all international migration from and to EU Member States. We will use a

new estimate of migration flows between the countries of the EU (based on age-specific Mimosa data) to extract inter-state intra-Europe migration. Taking the total of these flows by origin from total emigrations and the total of these flows by destination from total immigrations will yield estimates of extra-Europe emigration and extra-Europe immigration. We will use available Eurostat data to make a regional distribution of these estimates and will explore the possibilities to use information on stocks to estimate the regional distribution of flows in case no regional data on flows are available. Where needed, we will also use some simple extrapolations, to harmonize the years covered in the database.

6 Description of further proceeding towards the Draft Final Report

In this final chapter of the report, we describe point by point the implementation of the projects activities to be carried out towards the Draft Final Report. A more detailed overview, including a list of deliverables, is included in Annex 4.

6.1 Demography (NIDI)

- Disentangling the effects of internal and international migration.
- Distinguish international migration flows between European countries by country of origin and destination.
- Use results of the Mimosa project to estimate missing data or to adjust available data.
- Analyse demographic and migration developments at the NUTS3 level.
- Apply a decomposition of demographic change by age for assessing the effects of differences in fertility, mortality, and migration on changes in the size of the working age population and on the number of elderly people.

6.2 Typology (UNIVIE)

- Elaborate one final demographic typology with more refined variables.
- Add the linkage of economic performance to the typology (based on LFS data and socio-economic indicators).

6.3 Model (CEFMR)

- Preparation of a list of changes needed in the MULTIPOLES model
- Development of a test version of the MULTIPOLES_v4.0 model
- Preparation of the assumptions and datasets for the reference scenarios; estimation of missing data.
- Preparation of the reference scenarios (status-quo, no migration, no migration from outside 31 modelled countries) and analysis of the results.
- Writing up a report on the multi-level model and the reference scenarios.

6.4 Policy scenarios and implications (NEAA and University of Leeds)

- Consultation on and validation of the policy scenarios
- Build a secure evidence base for the statements embodied in Table 7 and the translations of those statements into numerical scenarios
- Build models for specifying the 2005-2050 trajectories of the demographic drivers for the four DEMIFER scenarios.
- Handle migration using SIM and log-linear modelling frameworks.
- Liaison with the Data preparation teams (Nordregio and NIDI) to add missing data for the United Kingdom and to provide advice on the best way to extend inputs, where relevant, to ages beyond 85.

- Validation of outputs.
- Analysis of scenario outputs in relation to the key DEMIFER research questions

6.5 Database, indicators and maps (Nordregio)

- Update all data files whenever applicable.
- Filling gaps in data series (time series, NUTS division, indicators); focus on origin-destination related migration data on regional level.
- Collect, calculate and harmonize more economic data.
- Support case study activities (data and mapping).
- Continue cooperation with the ESPON database and other projects.
- Prepare working and final maps for DEMIFER activities.

6.6 Case studies (CNR)

- Translate the output of the policy oriented activities into specific regional settings.
- Bring together the various activities of the project and illustrate the results and impacts at a regional and sub-regional level.
- Describe the effects of demographic change and migration in specific regional settings.
- Show the interdependence of regions regarding interregional migration, migration between countries in the EU/ESPON area and international migration to/from other countries.
- Translate the results of the scenarios into a specific regional setting.
- Formulate a standard outline for the case studies.
- Select the most representative regions of each type of the typology, aiming at a balanced geographical coverage.

6.7 Dissemination (Nordregio)

- Support the use and dissemination of the results achieved in the DEMIFER.
- Further discuss and elaborate the envisaged dissemination strategy with the ESPON Coordination Unit in order to avoid overlaps with and repetition of activities organised at the ESPON Programme level.
- Organize in cooperation with the ECP networks, a limited number of working seminars.
- Prepare a number of policy briefs.

Annex 1 Technical description of MULTIPOLES

1 Overview

The MULTIPOLES is a cohort-component, hierarchical, multiregional, supranational model of population dynamics. It may be used for forecasts, projections and simulations. The population is disaggregated into sexes and eighteen five-year age groups, i.e. nineteen projection cohorts, with the youngest cohort being the infant cohort (children born during the projection interval) and the cohort 85+ being the oldest one. Geographically, the population is disaggregated into countries and regions. On top of population modelling comes labour force modelling, based on the application of externally assumed labour force participation rates to the modelled population.

The MULTIPOLES model has been specifically designed to model a population system composed of a number of countries and regions, and in particular to facilitate the modelling of the impact of international migration on population dynamics, in addition to modelling the impact of the other population change components: births, deaths and internal migration. Migration is handled on three levels:

- interregional migration within each country;
- interregional international migration within the system;
- net migration from the Rest of the world to each modelled country.

An important feature of MULTIPOLES is that the projections are prepared simultaneously for all the countries of the system, instead of projecting population of each country separately. The maximum number of countries and regions that can be modelled has been set to 30 countries, 50 regions in a country, and 160 region in the whole system. These limits may be changed (but the computer code has to be recompiled). Projections can cover up to ten intervals of five year duration each, so a 50 years period maximum.

The MULTIPOLES software has been developed and improved in the period 1996-2004 within a variety of research projects. It was written FORTRAN and compiled to run under the MS Windows operating system. The most recent version of MULTIPOLES, described in this document, dates back to October 2004. In addition to projection calculations, this version can be used to perform replacement migration calculations, however this feature has not been described here.

A number of assumption have been made when designing the model, as indicated further. They were a compromise between the modelling needs of the research projects in which the model was used and data availability. These assumptions may be not appropriate for some applications – in such cases the MULTIPOLES model should be modified to meet the new requirements.

2 How does MULTIPOLES software work?

The projection model used in the MULTIPOLES software is based on the movement type population accounts (see Section 3.4). The demographic rates appearing in the accounts are defined as the number of events (deaths, migration or births) in a projection period divided by the population at risk, assumed to be equal to the mid-year population or calculated as an arithmetic average of the population of the projection cohort at the beginning and at the end of the projection period.

The sequence of operations in MULTIPOLES is as follows

1. Data input.
2. Calculation of the benchmark fertility, mortality, out-migration and emigration rates.
3. Projection loop for population stocks:
   - Update of the demographic rates according to the scenarios;
   - Update of net migration from the Rest of the world according to the scenario;
   - Calculation of the population at the end of the current projection step for all the age groups except the youngest one;
   - Calculation of the number of births during the current projection interval and the size of the youngest age group at the end of the projection step;
   - Calculation of the dependency ratios;
   - The above steps are repeated until the end of the projection period is reached.
4. Labour force calculations.
5. Output of the results.

Input data are prepared as a set of text (ASCII) files. The list of required data is given in Section 4 and 5.

The output files are text files that can be loaded into Excel or a mapping software for further analysis. They include information on projected population and labour force numbers (by region, sex and age), on projected numbers of demographic events in each region in each projection period, as well as the values of various indicators such as the old-age dependency ratio. The contents of the output files is presented in more detail in Section 6.

3 The mathematical engine of MULTIPOLES

3.1 Notation

The following notation has been used in the equations below:

t time;
g sex index (f – females, m – males);
a age group index;
00 index of the youngest age group (children born during the projection interval);

A+ index of the oldest, open-end age group, covering persons of age A or more;
ir, jr region (for migration variables: origin and destination region);
is, js country (for migration variables: origin and destination country).

$P_{ag}^{(is,ir)}(t)$ – Population in age group *a*, sex *g*, in region *ir* in country *is* at time *t*.

$B_g^{(is,ir)}(t)$ – Births in sex *g* in region *ir* in country *is* over one the period (*t*,*t*+5);

$D_{ag}^{(is,ir)}(t)$ – Deaths in age group *a*, sex *g*, in region *ir* in country *is* over the period (*t*,*t*+5);

$d_{ag}^{(is,ir)}(t)$ – Death rate in age group *a*, sex *g*, in region *ir* in country *is* in the period (*t*,*t*+5);

$M_{IRag}^{(is,ir)(is,jr)}(t)$ – Internal migration from region *ir* to region *jr* in country *is* in age group *a*, sex *g*, over the period (*t*,*t*+5) (subscript IR denotes interregional internal migration);

$m_{IRag}^{(is,ir)(is,jr)}(t)$ – Rate of out-migration from region *ir* to region *jr* in country *is* in age group *a*, sex *g*, over the period (*t*,*t*+5);

$M_{ISag}^{(is,ir)(js,jr)}(t)$ – International migration from region *ir* in country *i*s to region *jr* in country *js* in age group a, sex g, over the period (*t*,*t*+5) (subscript IS denotes interstate migration);

$m_{ISag}^{(is,ir)(js,jr)}(t)$ – Rate of emigration from region *ir* in country *i*s to region *jr* in country *js* in age group a, sex g, over the period (*t*,*t*+5);

$M_{EXTag}^{(is,ir)}(t)$ – Net migration from the Rest of the world to region *ir* in country *i*s in age group *a*, sex *g*, over the period (*t*,*t*+5).

$f_{ag}^{(is)}$ – Labour force participation rate in age group *a*, sex *g*, country *is*

Whenever we talk about the country of origin or the country of destination of migrants, we have in mind the previous country of residence and the next country of residence.

3.2 Calculation of the benchmark rates

Benchmark fertility and mortality rates are calculated within MULTIPOLES for each region, sex and projection cohort. The calculations are based directly on the input data on births, deaths and mid-year population by region, sex and age. Similarly, the destination-specific out-migration rates are calculated for each region, sex and projection cohort using the internal migration flow matrices by origin region, destination region, sex and age.

Sex, age and destination specific emigration rates are estimated for each region in the system using the input data on mid-year population of the region (by sex and age) and the following information on the flow between the relevant two countries: total flow, share of males in the total flow and

the age distribution for each sex. When estimating the rates for each region, it is assumed that the sex and age distribution of emigrants is uniform across all the region of the sending country and that migrants are distributed among the destination regions proportionally to their population.

It is worth to note that while it is assumed that the input data on births, deaths and migration are provided for the period-age observation plan and one-year period, all the rates (fertility, mortality, out-migration and emigration) are calculated for the period-cohort observation plan and a 5-year time interval, as required for the projection calculations.

The reference values of the labour force participation rates by country, sex and age (thirteen 5-year age groups, from 15 till 75+ years of age) have to be specified in an input file. It is assumed that labour force participation rates below the age of 15 years are equal to 0.

3.3 Scenario setting

Mortality scenarios are set in terms of sex and country specific life expectancy at birth for each projection interval. Additionally, information on the type of mortality rates change is used, with four possible types: a reduction in all ages, a reduction in the 0-19 age groups, a reduction in 20+ age groups, and an increase in 20+ age groups. In the scenario setting subroutine of the MULTIPOLES model, the mortality rates for the appropriate age groups are uniformly increased or decreased in order to achieve the forecasted life expectancy level. When this cannot be achieved with the forecasted type of mortality rate change, an error message is generated and the scenario has to be modified.

Fertility scenarios are defined through country-specific total fertility rates for each projection interval. It is assumed that fertility rates change by the same factor in all age groups and regions of the given country.

Scenarios concerning **internal migration** and **international migration within the system** are set in terms of multipliers, so that the rates for the next projection period are obtained as a product of a multiplier and a relevant migration rate taken from the preceding projection period. For internal migration, the multipliers depend on the destination region only. The same multiplier is applied to all out-migration rates concerning migration to this destination, irrespective of the age, sex and region of origin of migrants. For international migration, the multipliers depend on the country of origin and country of destination of migrants, but do not depend on the age, sex or region.

Scenarios for **international migration between the system and the Rest of the world** are defined in terms of the net migration (average absolute number per year) from the Rest of the world to each country in each projection period. It is assumed that the age and sex structures are the same as specified in the reference year data. Period-age input data are recalculated into the appropriate 5-year period-cohorts. Moreover, it is

assumed that net migrants are distributed among the regions of the destination country proportionally to their population.

The above approach was taken in the MULTIPOLES model in order to minimise data requirements, but it puts considerable limits on the flexibility of the model. It would be straightforward to replace the assumption that internal migration multipliers depend on the destination region only by the assumption that they depend on the sending region only, although the program would have to be recompiled.

Labour force scenarios are set through country, sex and age specific multipliers by which labour force participation rates assumed for the preceding projection period are multiplied. It is assumed that labour force participation rates are the same across all regions within the given country.

3.4 Projection equations

Projection equations for all projection cohorts except the youngest and the oldest one have been derived using the following equations as a starting point:

$$P_{a+5}^{(is,ir)}(t) = P_a^{(is,ir)}(t) - D_a^{(is,ir)}(t) - \sum_{jr \neq ir} M_{\mathrm{IR}a}^{(is,ir)(is,jr)}(t) - \sum_{js \neq is} \sum_{jr} M_{\mathrm{IS}a}^{(is,ir)(js,jr)}(t) + \sum_{jr \neq ir} M_{\mathrm{IR}a}^{(is,jr)(is,ir)}(t) + \sum_{js \neq is} \sum_{jr} M_{\mathrm{IS}a}^{(js,jr)(is,ir)}(t) + M_{\mathrm{EXT}a}^{(is,ir)}(t),$$

$$d_a^{(is,ir)}(t) = \frac{D_a^{(is,ir)}(t)}{0.5(P_a^{(is,ir)}(t) + P_{a+u}^{(is,ir)}(t+5))},$$

$$m_{\mathrm{IR}a}^{(is,ir)(is,jr)}(t) = \frac{M_{\mathrm{IR}a}^{(is,ir)(is,jr)}(t)}{0.5(P_a^{(is,ir)}(t) + P_{a+u}^{(is,ir)}(t+5))},$$

$$m_{\mathrm{IS}a}^{(is,ir)(js,jr)}(t) = \frac{M_{\mathrm{IS}a}^{(is,ir)(js,jr)}(t)}{0.5(P_a^{(is,ir)}(t) + P_{a+u}^{(is,ir)}(t+5))}.$$

As a result, the following matrix equation has been obtained and are used in MILTIPOLES:

$$\mathbf{P}_{a+5}(t+5) = [\mathbf{I} + 0.5\mathbf{M}_a(t)]^{-1}[\mathbf{I} - 0.5\mathbf{M}_a(t)]\,\mathbf{P}_a(t) + [\mathbf{I} + 0.5\mathbf{M}_a(t)]^{-1}\mathbf{M}_{\mathrm{EXT}a}(t).$$

In the above equation the sex index was omitted. **I** is the identity matrix, $\boldsymbol{P}_a$(t) is a vector composed of populations in age group *a* in all individual regions at time *t*:

$$\boldsymbol{P}_a = [P_a^{(1,1)}, \ldots, P_a^{(1,nr(1))}, \ldots, P_a^{(is,1)}, \ldots, P_a^{(is,ir)}, \ldots, P_a^{(is,nr(is))}, \ldots, P_a^{(ns,1)}, \ldots, P_a^{(ns,nr(ns))}]^{\mathrm{T}},$$

where *nr*(*is*) is the number of regions in country *is*.

Similarly, $\mathbf{M}_{\mathrm{EXTa}}(t)$ is a vector composed of net migration flows in age group *a* to all individual regions. Matrix $\mathbf{M}_a(t)$ depends on death rates, out-migration rates and emigration rates in all the regions. The diagonal elements of the matrix $\mathbf{M}_a(t)$ are defined as follows:

$$M_a^{(is,ir)(is,ir)}(t) = d_a^{(is,ir)}(t) + \sum_{jr} m_{\mathrm{IR}a}^{(is,ir)(is,jr)}(t) + \sum_{js}\sum_{jr} m_{\mathrm{IS}a}^{(is,ir)(js,jr)}(t).$$

The non-diagonal elements have the form:

$$M_a^{(is,ir)(is,jr)}(t) = -m_{\mathrm{IR}a}^{(is,jr)(is,ir)}(t) \text{ for } ir \neq jr,$$
$$M_a^{(is,ir)(js,jr)}(t) = -m_{\mathrm{IS}a}^{(js,jr)(is,ir)}(t) \text{ for } is \neq js.$$

For the oldest age group, the projection equation is:

$$\mathbf{P}_{A+}(t+5) = [\mathbf{I} + 0.5\mathbf{M}_{A+}(t)]^{-1}[\mathbf{I} - 0.5\mathbf{M}_{A+}(t)]\,\mathbf{P}_{A+}(t) + [\mathbf{I} + 0.5\mathbf{M}_{A+}(t)]^{-1}\mathbf{M}_{\mathrm{EXT}A+}(t) +$$
$$+ [\mathbf{I} + 0.5\mathbf{M}_{A-5}(t]^{-1}[\mathbf{I} - 0.5\mathbf{M}_{A-5}(t)]\,\mathbf{P}_{A-5}(t) + [\mathbf{I} + 0.5\mathbf{M}_{A-5}(t)]^{-1}\mathbf{M}_{\mathrm{EXT}(A-5)}(t).$$

The youngest projection cohort comprises children born during the projection interval. The equations used to derive the projection equation for this cohort are:

$$P_0^{(is,ir)}(t+5) = B^{(is,ir)}(t) - D_{00}^{(is,ir)}(t) - \sum_{jr\neq ir} M_{\mathrm{IR}00}^{(is,ir)(is,jr)}(t) - \sum_{js\neq is}\sum_{jr} M_{\mathrm{IS}00}^{(is,ir)(js,jr)}(t) +$$
$$+ \sum_{jr\neq ir} M_{\mathrm{IR}00}^{(is,jr)(is,ir)}(t) + \sum_{js\neq is}\sum_{jr} M_{\mathrm{IS}00}^{(js,jr)(is,ir)}(t) + M_{\mathrm{EXT}00}^{(is,ir)}(t),$$

$$d_{00}^{(is,ir)}(t) = \frac{D_{00}^{(is,ir)}(t)}{0.5P_0^{(is,ir)}(t+5)},$$

$$m_{\mathrm{IR}00}^{(is,ir)(is,jr)}(t) = \frac{M_{\mathrm{IR}00}^{(is,ir)(is,jr)}(t)}{0.5P_0^{(is,ir)}(t+5)},$$

$$m_{\mathrm{IS}00}^{(is,ir)(js,jr)}(t) = \frac{M_{\mathrm{IS}00}^{(is,ir)(js,jr)}(t)}{0.5P_0^{(is,ir)}(t+5)},$$

$$b_a^{(is,ir)}(t) = \frac{B_a^{(is,ir)}(t)}{0.5(P_{a\mathrm{f}}^{(is,ir)}(t) + P_{(a+5)\mathrm{f}}^{(is,ir)}(t+5))},$$

$$B_g^{(is,ir)}(t) = 0.5\, s_g^{is} \sum_a b_a^{(is,ir)}(t)[P_{a\mathrm{f}}^{(is,ir)}(t) + P_{(a+5)\mathrm{f}}^{(is,ir)}(t+5)].$$

In the above formulae, subscript f refers to females, $b_a^{(is,ir)}(t)$ are fertility rates and s_g^{is} is the proportion of children of sex *g* among newborn children in country *is*.

The resulting projection equation for the youngest group is then:

$$\mathbf{P}_0(t+5) = [\mathbf{I} + 0.5\mathbf{M}_{00}(t)]^{-1}[\mathbf{B}(t) + \mathbf{M}_{\mathrm{EXT}00}(t)].$$

3.5 Labour force and dependency ratio calculations

Labour force calculations are performed by applying country, sex and age specific labour force participation rates to the regional populations. Labour force participation rates and labour force numbers refer to the active population, i.e. employed and unemployed.

Three dependency ratio indicators are calculated for each country (but not for individual regions): old-age dependency ratio (ODR), economic old-age dependency ratio (ODRE) and labour market dependency ratio (LMDR). ODR is a ratio of population aged a_2 years or more to the population in the age between a_1 and a_2 years. ODRE is defined as a ratio of economically inactive population in the age of a_2 years or more to the whole active population aged a_1 years or more. LMDR is defined as a ratio of the whole economically inactive population to the whole active population, both considering people aged a_1 years or more. The following formula are used

$$\mathrm{ODR}(is) = \sum_g \sum_{a_2}^{A+} P_{ag}^{(is)} \Big/ \sum_g \sum_{a_1}^{a_2-5} P_{ag}^{(is)} \ ,$$

$$\mathrm{ODRM}(is) = \sum_g \sum_{a_2}^{A+} P_{ag}^{(is)} (1 - f_{ag}^{(is)}) \Big/ \sum_g \sum_{a_1}^{A+} P_{ag}^{(is)} f_{ag}^{(is)} \ ,$$

$$\mathrm{LMDR}(is) = \sum_g \sum_{a_1}^{A+} P_{ag}^{(is)} (1 - f_{ag}^{(is)}) \Big/ \sum_g \sum_{a_1}^{A+} P_{ag}^{(is)} f_{ag}^{(is)} \ .$$

The age limit parameters a_1 and a_2, the same for all the countries, are set by the user in an input file. The typical values are 15 and 65 years.

4 Data requirements for the reference year

The following main groups of data are required as an input to the MULTIPOLES software:

- Region and country names and codes;
- Population stocks;
- Births;
- Deaths;
- Internal migration;
- International migration within the system;
- International migration from the Rest of the world;
- Labour force activity rates.

The input statistics may be either data observed in a reference year or, if not available, the estimates. Formally, these data - further referred to as “the data for the reference year” or “the data for the benchmark year” - do not have to reflect the situation at the starting point of the projection (although they will in most applications), but they should set the reference levels of the relevant quantities, against which the scenarios will be formulated.

The requirements for the input data concerning the scenarios for all the components of population change and for the labour force variables are presented in Section 5.

4.1 Population stock, death and birth statistics

Data on **population stock** have to be provided for each region in each country for the middle of the reference year, by 5-year age group (eighteen period-age groups, up to 85+) and sex.

Data on the number of **deaths** during the reference year are required for each region in each country, by 5-year age group (eighteen period-age groups, up to 85+) and sex.

Data on the number of **births** during the reference year have to be provided for each region in each country, by 5-year age group of the mother (seven period-age groups between 15 and 49 years of age). Either data on births for each sex separately or for both sexes together may be provided. If birth data for at least one region concern both sexes together, then the proportion of males in all births should be specified in an input file as well. This parameter is specified only once and is used for all the regions for which birth data by sex were not provided in the input file.

4.2 Internal migration statistics

Data on internal migration in the reference year are required as full origin-destination-age-sex (ODAS) matrices for each country, with eighteen 5-year age groups. If the full ODAS matrix is not available, the estimates must be prepared externally: the MULTIPOLES model does not have any built-in modelling of the redistribution of the volume of internal migration flows for the reference year (however, the out-migration rates are calculated in the model – see further). Given a variety of data available in individual countries, the external strategies for estimating missing information on internal migration flows are usually country-specific.

4.3 Data on international migration within the system

The MULTIPOLES model has been designed having in mind the common problems with international migration data in all the countries. Consequently, the data requirements are smaller than for internal migration. In particular, no region-specific data on international migration has to be provided for the benchmark year.

For international migration within the system MULTIPOLES requires the following data for the benchmark year:
- OD matrix of flows between the countries;
- Share of males for each OD pair;
- Typical distributions of migration rates by age (eighteen 5-year age groups up to 18+);
- Age distribution or type of age distribution for each ODS.

Based on this information and simple assumptions about the distribution of migrants across the origin and destination regions, the full ODAS matrix

of emigration rates - for the flows between the individual regions – is estimated in MULTIPOLES (see Section 3.2).

4.4 Data on net migration from the rest of the world

As in the case of international migration within the system, data on migration flows from the Rest of the world are requested on the country level only and the estimates for each region are made within MULTIPOLES. The following input data are needed:
- Proportion of males in net external migration to each country from the Rest of the world;
- Typical distributions of the number of external migrants by age (eighteen 5-year age groups up to 18+);
- Type of age distribution of net external migrants for each country and sex.

4.5 Labour force statistics

An input file concerning labour force must include labour force participation rates by country, sex and thirteen 5-year age groups (from 15 to 75+ years of age).

5 Data requirements for the scenarios

The following data have to be provided for each projection interval.
- Total fertility rate, by country;
- Life expectancy at birth, by country and sex;
- Type of mortality rates change, by country and sex: 0 – no change, 1 - reduction in all ages, 2 - reduction in the 0-19 age groups, 3 - reduction in 20+ age groups, 4 - increase in 20+ age groups;
- Multipliers for internal migration rates, by destination region. These are the multipliers by which the out-migration rates from the preceding projection step are multiplied in order to obtain the rates for the current projection step;
- Multipliers for international migration within the system, by origin and destination country. These are the multipliers by which the emigration rates from the preceding projection step are multiplied in order to obtain the rates for the current projection step;
- Net external migration from the Rest of the world during one year (on average), by country;
- Multipliers for the labour force participation rates, by country, sex and thirteen 5-year age groups (from 15 to 75+ years of age).

6 Output files

The main output files include the following results for the end of each 5-year projection interval:
- Total population by country and sex;
- Population by country, sex and 5-year age group (up to 85+);
- Total population by region and sex;

- Population by region, sex and 5-year age group (up to 85+);
- Labour force by country and sex;
- Labour force by country, sex and broad age group (15-25, 25-40, 40-65 and 65+);
- Labour force by country, sex and 5-year age group (up to 75+);
- Labour force by region and sex;
- Labour force by region, sex and broad age group (15-20, 25-40, 40-65 and 65+);
- Labour force by region, sex and 5-year age group (up to 75+).

In addition, various auxiliary data calculated in the model, such as cohort-specific fertility, mortality and migration rates are written into an output file. This files contains also the accounts for each projection interval for each region. These accounts include:

- Population at the beginning of the projection interval;
- Population at the end of the projection interval;
- Births;
- Deaths;
- In-migration;
- Out-migration;
- Immigration (from within the system);
- Emigration (within the system);
- Net migration from the rest of the world.

Please note that in the current version of MULTIPOLES only national accounts are written into a dedicated output file, while the regional accounts are printed into the main auxiliary output file, together with other auxiliary information.

There is also a separate output file with the values of the old-age dependency ratio (ODR), the economic old-age dependency ratio (ODRE) and the labour market dependency ratio (LMDR).

Annex 2 Previous ESPON study in the field of demography and migration

The main objective of the ESPON 1.1.4. project *The spatial effect of demographic trends and migration* was to describe and explain the demographic developments in the European ESPON countries. The study focused on population growth and decline with specific attention to the impact of migration and fertility on demographic sustainability, competitiveness and territorial and social cohesion.

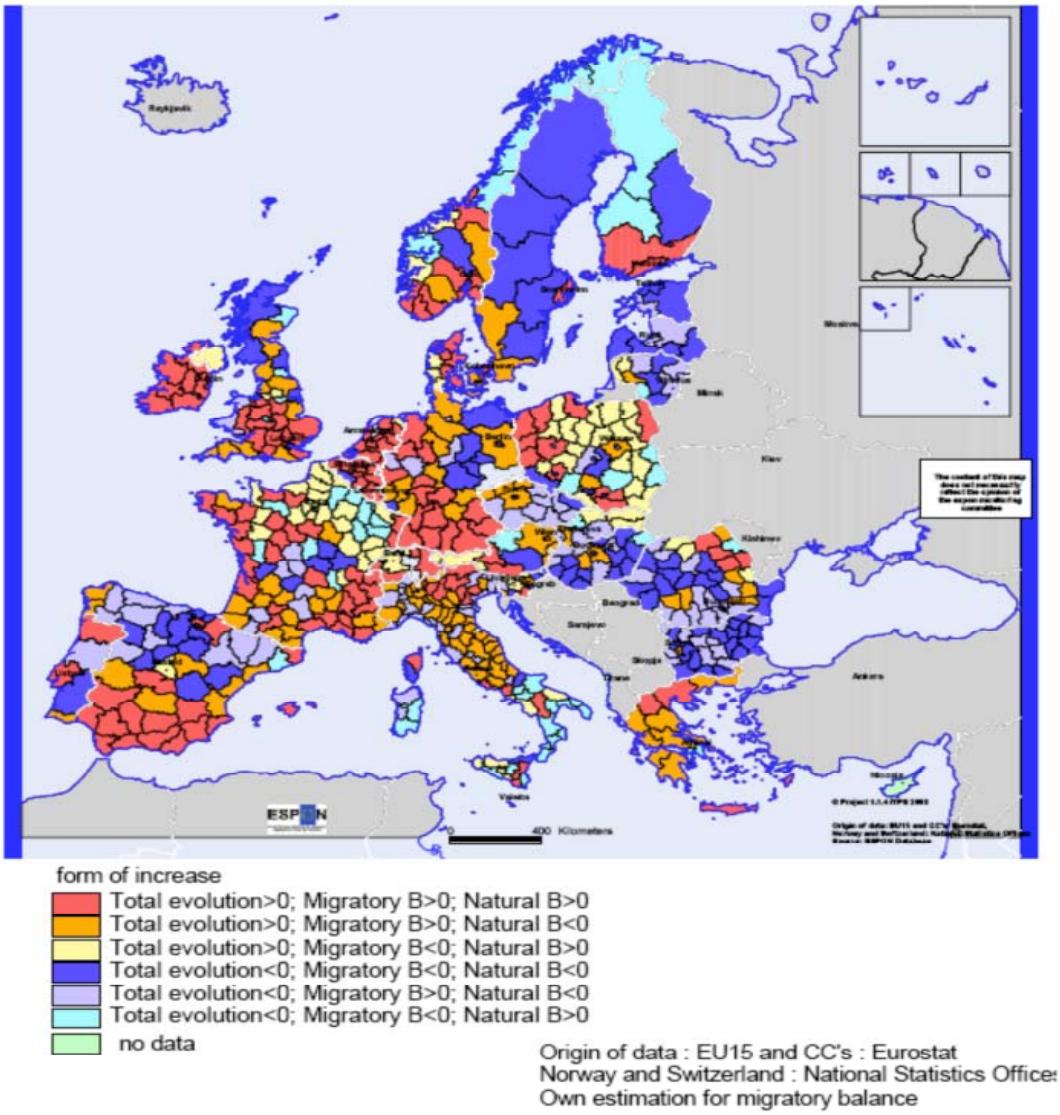
In order to classify the regions with respect to the total population growth, natural population growth and net migration, a base typology consisting of six different combinations was constructed – see Map 1 (ESPON, 2005c:11f). For this purpose the size of net migration was not calculated from in-migration and out-migration data but calculated as the difference between population growth and natural growth.

The six individual categories were determined by sharp thresholds: either positive or negative balances between 1990-2000:

1. population growth, positive net migration and natural increase: this type contains areas of in-migration with a young population and high fertility (high sustainability in the short and long term)
2. population growth, positive net migration and natural decrease: these are areas of in-migration and low fertility due to a disproportionate age structure or to low TFRs (no sustainability in long term)
3. population growth, negative net migration and natural increase: areas of out-migration with a young population and high fertility (sustainability in the short-term)
4. population decline, negative net migration and natural decrease: areas of out-migration with an old population and low fertility TFR (depopulation with no sustainability)
5. population decline, positive net migration and natural decrease: areas of in-migration with an old population and low fertility (depopulation with low sustainability in the short and long run)
6. population decrease, negative net migration and natural increase: areas of out-migration but still with a young population and high fertility (sustainability depending on persistent high TFRs)

To cover all regions, wherever possible NUTS3 regions were taken, otherwise NUTS2 or NUTS1 regions were included.

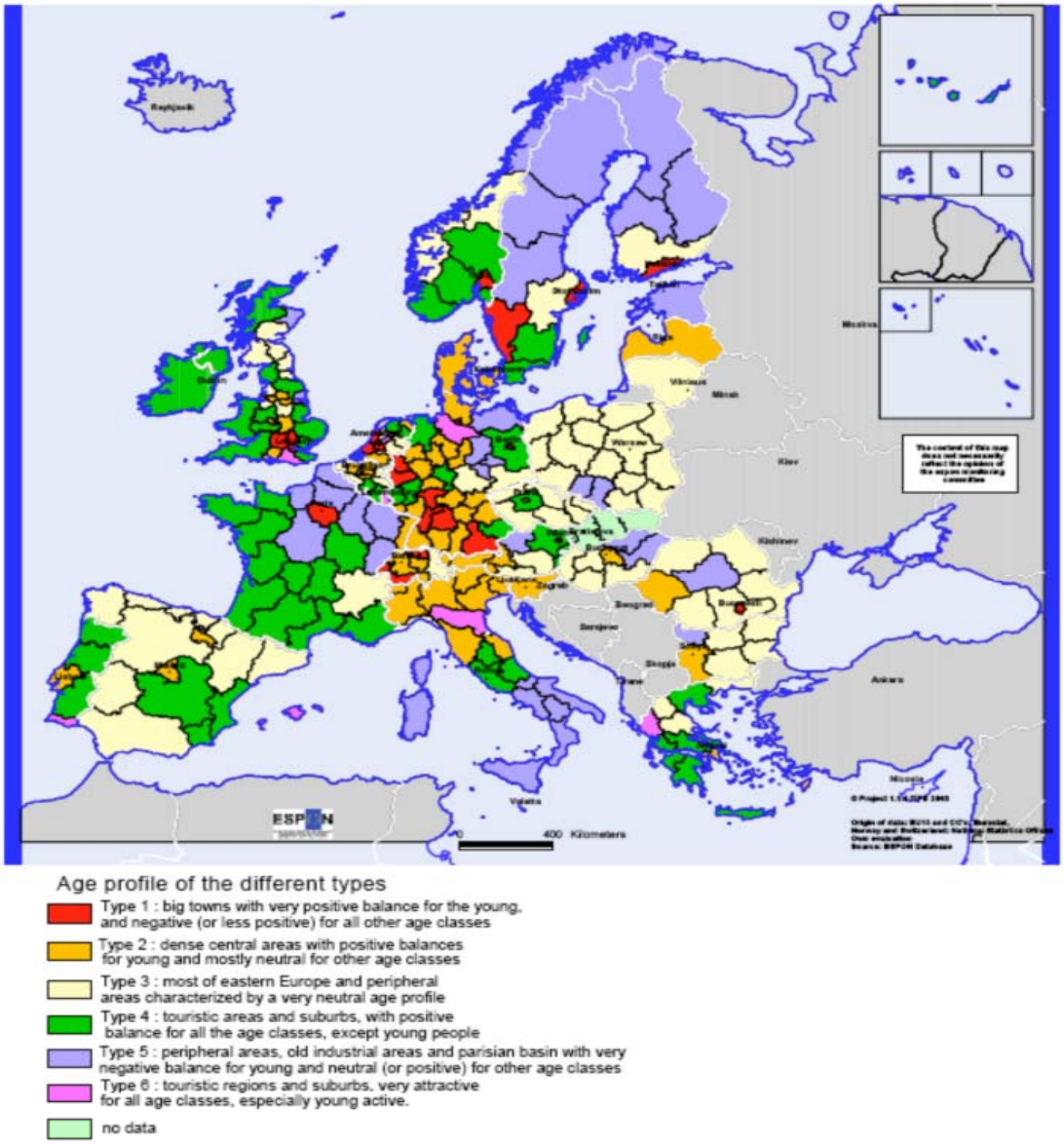
Map 10 Components of population increase, 1996-99 (taken from ESPON, 2005c – Map 3.2; p. 66)



In addition to overall population development, special attention was paid to migration balances in the second half of the 1990s. Balances in three different age groups were distinguished: young actives (aged 17.5-27.5 years), middle ages (aged 32.5-37.5) and old active and pensioners (aged 52.5-67.5). Using migration balances, the following typology was developed (see Map 2):

1. big towns attractive to young people;
2. dense central areas attractive to young people;
3. large urban suburbs unattractive to the young;
4. touristic areas and suburbs attractive to all ages except the young;
5. areas with very limited mobility together with some departures of the young (most of Eastern Europe and peripheral areas);
6. economic dynamic areas of very high immigration, especially for young active people (touristic areas and suburbs attractive to all ages, especially the young)

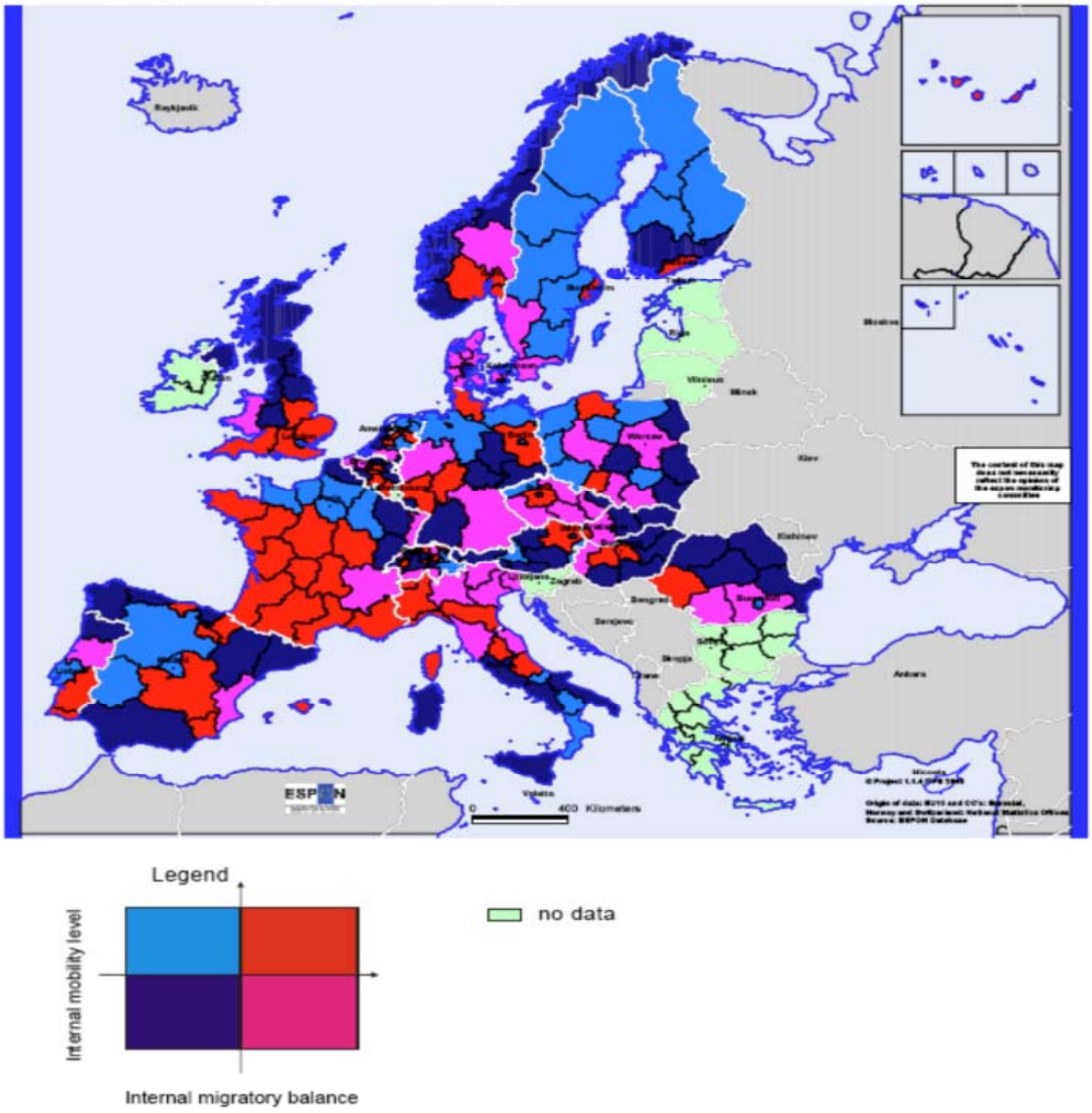
Map 11 Typology of migratory balances by age classes, 1995-2000 (taken from ESPON, 2005c – Map 3.12; p. 105)



In order to distinguish between attractive regions with a high level of mobility and regions with few in- and out-migrations only, a further typology was constructed combining migration balances and level of mobility (defined as the sum of the inflow and outflow divided by the total population). This resulted in four types (see Map 3; ESPON, 2005c:13f):

1. regions with a positive migration balance and high mobility: peri-urban zones, Western and Southern France, Southern England;
2. regions with a positive migration balance and low mobility: for instance regions in the north of Italy, Bavaria;
3. regions with a negative migration balance and high mobility: some metropolitan areas (Paris, Berlin), Northern England, Northern Scandinavia;
4. regions with a negative migration balance and low mobility: old industrial regions, rural regions of Eastern Europe.

Map 12 Typology crossing mobility and migratory balances, 1995-2000 (taken from ESPON, 2005c – Map 3.13; p. 107)



The project assessed the effect of low fertility and migration flows on population growth. In short it showed that:

1. total fertility rates (TFR) was below the reproduction level of 2.1 child per women in all ESPON countries and in almost every NUTS2 and NUTS3 region; especially low TFRs were found in Southern and Eastern Europe;
2. a lot of regions experienced natural population decrease; this is not only dependent on total fertility rates, but also on the age structure of the population;
3. migration became the main source of changes in population size in many regions;
4. young persons migrated to large urban areas while persons in the upper middle age moved to areas with pleasant surroundings;
5. depopulation was caused by a combination of low fertility and high out-migration; many depopulation areas were in the peripheral parts of the EU;

6. regions with population growth will need a continuous in-migration to maintain growth, otherwise also these regions will be confronted with population decline;
7. the future need of immigrants from outside Europe will be higher in the new Member States than in the old, however, immigration from outside the EU cannot provide a solution to the decline in population size.

DEMIFER builds on the results of the ESPON 1.1.4 project by updating the data and extending the analyses. We compare the results described by the previous study for the 1990s with more recent data and examine to what extent demographic developments have changed since 2000. Since ageing is a process of change over time, our indicators focus on changes in the age structure rather than on the percentage of elderly people. Ageing does not only imply growth in the number of elderly people, but a decline in the growth of the size of the working age population as well. For that reason we include an indicator of the growth of the working age population. We will explain differences in population growth and ageing by comparing the levels of fertility, life expectancy and net migration. The total fertility rate and life expectancy are better indicators of the causes of differences in population growth and ageing than the natural growth rate, since the latter indicator is affected by ageing itself. In addition we will distinguish net migration by internal and international migration.

Annex 3 The interrelationship between demography and economic performance

In the latest revision of the UN World Population Prospects Europe is expected to see a lowering of its share of the world population to 6 per cent as compared to 11 per cent today and almost 22 per cent in 1950. The total fertility rate is also assumed to fall in Europe, creating relatively more elderly persons, a relatively smaller labour force and a relatively lower share of children and young adults (UN 2007). Only three major areas in the world, however, are considered to see a continued population increase until 2050: Western Asia (i.e. Middle East, Turkey and sub-Caucasus), Northern Africa and India (Rauhut 2004).

At a regional level, European developments however show many differences. Some regions will experience a decreasing population, due to ageing and the out-migration of young adults, while other regions will continue to experience a population increase, with a relatively young population, a relatively high fertility and an in-migration of, especially, young persons (ESPON 2007).

Developments in Europe are related to what is happening in other parts of the world, not only in economic terms but also as regards demographics. Globalisation matters, also when it comes to the development in economic-demography. Europe's relatively small population can maintain a relatively high welfare level since globalisation enables an international division of labour, with the result that production can be allocated to geographical areas in the world with the most favourable comparative advantages. One example of this is that labour intensive production can be allocated to countries where labour is cheap, while specialised and capital intensive production is placed in Europe.

The implications of this development undoubtedly however have an influence on demographic development. Migrants from all parts of the world want to move to the relatively wealthy countries. As such, long-distance migration flows to Europe can be understood in the perspective. In addition, fertility in Europe is, however, influenced by the relative wealth of this continent: the higher education and wealth, the lower demand for children and vice versa. Thus, it must be remembered that Europe does not show a homogenous demographic development. That Europe and its regions remain an integrated part of the global economy is a basic condition for the relative wealth of Europe, while its labour force remains competitive in terms of competence and wage levels.

At a regional level in Europe, the potentials of individual regions may be closely linked to the issue of demographic change for their future economic, social and demographic development. In the future it can be expected that regional development policies will take demography into account to a greater extent than is the case today.

The process of ageing is not a new phenomenon. Since the 18th century life-expectancy at birth has steadily increased and mortality has been postponed to higher ages due to e.g. new technology for disease control (Easterlin 1996, Foss & Juvkam 2005). Parallel to this process the fertility rates have dropped, especially during the 20th century. This is not only a European but rather worldwide phenomenon. Increased life-expectancy at birth has had an impact on ageing, but the major cause is the very low fertility – the base in the population pyramid has simply become smaller and smaller (Bengtsson & Scott 2005).

The process of ageing is not only a simple function of a higher life-expectancy at birth and fertility rates below the replacement ration (about 2.1 children/woman). To understand the process of ageing it is important to discuss on what geographic level – global, national, regional or local - the analysis is made and whether migration is included in the analysis or not. At the regional and local levels ageing (a higher life-expectancy at birth and very low fertility rates) can be augmented be the out-migration of young adults and an in-migration of persons in the upper middle-ages and pensioners. The result will be an even more distorted age-structure. Furthermore, a strong in-migration of young adults to one municipality in a region can conceal the ageing problems and distort the age-structure in the rest of the region (ESPON 2005).

The best way to fight ageing is to increase fertility. This is, however, a long-term measure, since it will take about 20-25 years until today's newly born children will be in the labour force and become productive. Immigration can only provide short-term, and uncertain, mitigation to ageing (Bengtsson & Scott 2005, ESPON 2005).

What implications ageing will have on economic performance are unclear (Foss & Juvkam 2005). The demographic changes to come will generate significant challenges for our societies – at all levels and in most aspects of our lives (from infrastructure and housing issues to labour supply and pension schemes). Notwithstanding this however much that passes for research into the effects of demographic change is often highly partial and generally short-sighted often culminating in "alarmist" conclusions and providing a clarion call for significant policy changes based, ultimately, on rather thin scientific justification. There is then a need for a more historical as well as a more holistic perspective to be taken.

The concept of 'depopulation' is far from clear. Most often the word is used almost synonymously with population decline, but sometimes it is reserved for population decline of a certain enduring nature, or even more narrowly confined to processes that carry ominous signs of socio-economic impacts. In one or more of these senses of the concept, 'depopulation' has been discussed from time to time during most of the former century – in national and European terms as well as with reference to sub-national uneven territorial development.

Depopulation may be regarded as a special course of development in the process of population change, often indicated by certain probable demographic implications or impacts with a problem potential (for

instance the so-called ageing of the population and the labour force, increasing dependency ratios, labour shortage, decreasing demographic vitality and natural growth potential etc.,) and associated with long-term demographic process (notably the "modern" fertility decline and sometimes – and even combined with – enduring territorial patterns of uneven selective migration). To be able to indicate the presence of processes with depopulation potential, a relevant territorial scale and a reasonable temporal perspective are needed (ESPON 2005).

Migration trends seem to imply accelerating depopulation and ageing in sparsely populated rural and peripheral regions and in regions lagging in economic and labour market performance. Competitiveness policy will need to recognise the regional changes of the labour supply and the actual characteristics of the labour-force available in different types of regions. As the population will become increasingly older in certain areas the labour market will need to adjust. Even consumer needs and preferences probably change in the wake of demographic transformation while certain areas will be relatively more influenced by the upper segment of the age-pyramid. Ageing will not however impact uniformly on regions. Given the diversity of the impact on regions, the necessity to 'adapt to their demographic circumstances' will require different measures in different regions. This requires statistical analysis and research to be carried out at a more detailed territorial scale taking into account the fact that demographic trends are only a single factor among a very large and complex set of factors influencing socio-economic development, and – after all – probably the slowest and most predictable factor, traditionally considered to be the outcome rather than the cause of socio-economic change (ESPON 2005).

There is not one general theory on migration, but many. They are all based upon different assumptions, and they reach different conclusions on the impact of international migration on economic growth, unemployment, labour force participation, wages, taxes, and transfers. Therefore it is not surprising that there is no general consensus in respect of the economic benefits of migration (Rauhut et al. 2008).

Actually, we have a limited knowledge on what impact changes in the age structure and immigration have on economic performance. To large extent the limited knowledge is available at the national level, while only fragmented knowledge exists at a regional level. Relatively little knowledge however exists regarding the impact ageing, labour immigration and fertility have on regional development.

The ESPON countries are not the only geographical area in the world facing these kinds of problems – they are a global problem. In a study by the U.S. National Research Council three specific problems were highlighted in respect of policy implications and policy recommendations:

"First, there are uncertainties about how some of the demographic forces will play out /…/ Second, because population ageing generally is a gradual phenomenon, its socioeconomic consequences tend to appear gradually as well, and in some cases with a high degree of predictability /…/ Third,

most statements about ageing individuals tend to reflect averages and mask a great deal of diversity in the population" (National Research Council 2001, p. 2).

The first point refers to the extent to which technological changes will interact with demographic changes and how demographic change will change our way of life which, in turn, will interact with e.g. ongoing technological change. The second point deals with the fact that even if we accept the reality of an ageing society we retain the ability to adjust policies, lifestyles, infrastructure, the labour market etc., to make the transition easier. Finally, the third point touches upon the fact that the analyses only deal with national analyses of the average population. Significant levels of individual diversity (e.g. gender, class, education, ethnicity), as well as regional and local diversity, however, also exist. This point also deals with the problem of the definition of "elderly"; who is an "elderly" person? Someone who has passed 50? Over 65 years old? Or someone over 80 years old?

Depending on how these three problems are dealt with the policy implications and policy recommendations in respect of demographic change and population ageing will vary, not only in the U.S., but also in the ESPON countries.

What we do know is that demographic ageing is not a phenomenon that has suddenly been aroused. During the 20th century, fertility has fallen sharply in most of the countries of the Western World while life expectancy has increased as people live longer. A simple indication of this is the higher median age of the population. This trend was pointed out by a number of demographers as far back as the 1940s (Notestein et al. 1944, Kirk 1946, Hofstee 1950). An example of the difficulties in interpreting the interrelationship between ageing and economic performance can be taken from the Nordic countries: although the median age has increased from 20 to 40 years since the mid-18th century and life-expectance has doubled, from roughly 40 to 80 years, this period of ageing has lead to an exponential increase in the GDP/capita and the aggregated welfare in these countries. Simultaneously, the share of persons 65+ years has increased dramatically (Rauhut & Kahila 2008). This development will most likely appear when analysing other European countries. The logical conclusion, contrary to common belief, is that ageing is good or is at least not negative. This example does, however, say nothing on the kind of interrelationship; are we talking about a direct or indirect causality, at which territorial level does the interrelationship exist, and are the short- and long-term effects divergent? Answering these questions may show that the interrelationship is very complex and multifaceted.

The aim of this deliverable is to give an overview on the interrelationship between demography and economic performance. As demography includes a large number of aspects, the focus in this deliverable lies on the age-structure, ageing, immigration and emigration.

The deliverable proposes to answer the following questions: (1) What is the interrelationship between changes in the age-structure/ageing and economic performance? (2) What is the interrelationship between migration – both immigration as well as emigration – and economic performance? (3) Which are the methodological considerations when analysing the interrelationship between demography and economic performance? (4) What is the territorial impact of the interrelationship between demography and economic performance? An attempt to construct a typology with regard to the territorial impact of the interrelationship between demography and economic performance will be made.

The deliverable will present an overview on the interrelationship between the age-structure and economic performance, both how the age-structure influences economic performance and how economic performance influences the age-structure. Subsequently, the interrelationship between migration – both immigration and emigration – and economic performance will be outlined. Furthermore, we will discuss some important methodological questions when analysing the interrelationship between, on the one hand, the age-structure and migration, and, on the other hand, economic performance.

Finally, the interplay between demography, migration and economy is outlined and some policy options on the interrelationship between demography, migration and territory with regard to economic performance are discussed.

Annex 4 Detailed description of further proceeding towards the Draft Final Report

Demography (NIDI)

- In assessing the impact of migration on demographic differences across European regions, the effects of internal and international migration will be disentangled.
- International migration flows between European countries will be distinguished by country of origin and destination. Results of the Mimosa project will be used to estimate missing data or to adjust available data.
- Analyses of demographic and migration developments at the NUTS3 level will be added.
- For assessing the effects of differences in fertility, mortality, and migration on changes in the size of the working age population and on the number of elderly people, we will apply a decomposition of demographic change by age.

Typology (UNIVIE)

- Based on the basic demographic typology (see chapter 4) one final demographic typology will be elaborated with more refined variables. Beyond that there are two ways to construct a combined demographic and socio-economic typology – both based on the final demographic typology (final cluster solution):
  - Extension of the demographic data set with socio-economic variables to construct an extended typology with the method of cluster analysis.
  - Linkage of the demographic typology with LFS data. In this case the LFS data will not be included in the typology, instead used as dependent variables for a further illustration of the classification result achieved by the cluster analysis.
- Due to the mutual relationship between demography and economy (see section 5.1.2), adding economic variables to the demographic data set of the typology ("extension") would complicate the interpretation of the classification. Therefore the typology will be based on demographic variables only (including migration). After the typology has been set, a description of the economic performance of the types (based on LFS data) will be added in a later stage (based on LFS data).
- As already mentioned in the DEMIFER Inception Report (ESPON, 2008:31) the final cluster solution will be used as a starting point for analysing the most recent Labour Force Survey (LFS). Although the LFS variables cannot be used as input variables for the cluster analysis due to its sample structure, the LFS will be a useful and innovative source to describe the cluster solution more accurately ("linkage"). The combination of the typology with the LFS will offer new insights in the principal research question of DEMIFER: How do demographic and migratory flows affect European regions and cities?

Model (CEFMR)

- Meeting with the University of Leeds team to discuss the interaction between Activity 3 (Multilevel model) and Activity 4 (Scenarios) – 30 June 2009 in Leeds.
- Preparation of a preliminary list of changes needed in the MULTIPOLES model
- Development of a test version of the MULTIPOLES_v4.0 model
- Preparation of the assumptions and datasets for the reference scenarios; estimation of missing data.
- Preparation of the reference scenarios (status-quo, no migration, no migration from outside 31 modelled countries) and analysis of the results.
- Writing up a report on the multi-level model and the reference scenarios.

Policy scenarios and implications (NEAA and University of Leeds)

- Consultation on and validation of the scenarios
  We will consult about the validity of the scenarios and on the likely trends and policies to be associated with each scenario. This will be implemented through an online expert questionnaire (and possibly by a Workshop). Participants will be invited to complete an online, web-based questionnaire on future trends in European regions in demographic, social, economic and environmental factors. The questionnaire will be modelled on a demographic expert group questionnaire developed by Wolfgang Lutz (Lutz 2007) as part of the European Framework 6 MicMac project (NIDI 2009) and adapted for use by the UK's Office for National Statistics (ONS 2008, Shaw 2008).
- Build a secure evidence base for the statements embodied in Table 7 and the translations of those statements into numerical scenarios
  - We will analyse the extensive literature on demographic trends and on the impact of policy on those trends across Europe.
  - We will analyse the DEMIFER database for ESPON countries and regions, 2000-2007 to establish the most recent trends (e.g. rising fertility in the UK and Nordic countries).
  - We will analyse the degree of convergence or divergence in demographic behaviour at country level relative to the European average, at region relative to the national averages and at regional cluster level.

  There is a considerable literature on inequality (mainly at country scale) and its relationship with other outcomes such as health, measured by life expectancy and infant mortality (Wilkinson and Pickett 2006, 2009 review a host of national and a few subnational studies of inequality and health; Montero-Granados et al. 2007 on life expectancy and infant mortality rate for Spanish provinces; Ezzati et al. 2008 on LE for US counties, Norman et al. 2008 on IMR for UK Local Authorities). Methods of calibrating increasing or decreasing inequalities have been developed in the economic literature: the most relevant is "sigma convergence" which measures changes in the dispersion of an outcome variable (e.g. LE, IMR) between a start and finish year.

- Build models for specifying the 2005-2050 trajectories of the demographic drivers for the four DEMIFER scenarios
  We will build models that translate the trends and policies associated with the four scenarios into trajectories of the drivers for countries and regions. We will focus on differences across types of regions using the new demographic typology developed in DEMIFER.
- The following division of labour has been agreed in terms of the component drivers for both the assembly of the evidence base and the model building:
  - Mortality: Leeds
  - Fertility: NEAA
  - Inter-Region Migration: Leeds
  - Inter-State Migration: NEAA and NIDI
  - Extra-Europe Emigration: Leeds
  - Extra-Europe Immigration (including skill levels): NEAA
  - Labour Force Participation: NEAA and CEFMR
- Migration can be handled using the SIM (Stillwell 2008, Van Wissen et al. 2008) and log-linear modelling frameworks widely used to investigate the structure of migration flow arrays (Willekens 1980, 1999, Willekens et al. 1981, Raymer et al. 2006, 2007, 2008, Raymer and Rogers 2006, 2007 and 2008). The inter-state migration estimates generated in the MIMOSA project (Raymer 2007, 2008) can be used as the starting point for developing scenarios for migration between ESPON countries.
- Liaison with the MULTIPOLES population projection team (CEFMR)
  NEAA and University of Leeds will liaise closely with CEFMR to ensure compatibility of the scenario key driver outputs and the inputs needed for the MULTIPOLES projection model. We have already agreed some changes in the model inputs (e.g. a switch from forecast life expectancy to mortality improvement rates, e.g. an extension of the age groups in the projection from 85+ to 100+).
- Liaison with the Data preparation teams (Nordregio and NIDI)
  The Leeds team will deliver missing data for the United Kingdom for the ESPON database and provide advice on the best way to extend inputs, where relevant, to ages beyond 85.
- Validation of outputs
  The NEAA and Leeds teams will check the scenario projections for internal validity (revising inputs where needed) and also compare them with other available projections:
  - IOM/CEFMR reference scenarios
  - Eurostat EU Member State projections
  - United Nations country projections
  - Eurostat NUTS2 regional projections
  - IIASA European projections.
- Analysis of scenario outputs in relation to the key DEMIFER research questions
  The NEAA and Leeds teams will analyse a set of indicators built from the projection outputs that show how the country and regional populations will change in age structure, dependent populations and the labour force under the various scenarios. The starting point will be the set of indicators developed previously by IOM/CEFMR (Bijak et al. 2005, 2007, 2008). We must add to this analysis a consideration of the

regional variability in those indicators across the 271 regions being studied. By including employment rates and labour productivity we can assess the impact of demographic and migration developments on changes in the demographically driven economic product. Measuring the degree of inequality and its changes across regions will make possible a judgement about which scenarios contribute to cohesion (less inequality) and which to competitiveness (more favourable labour force indicators) in particular types of regions.

Database, indicators and maps (Nordregio)

- All the data used in the project have also been stored to intern sharepoint site from where all the project partners can easily assess the data. When ever any updates are available, these are stored in the sharepoint files.
- Support case study activity (data and mapping)
- Continue the cooperation with the ESPON database and other projects
- During the coming months, the database project will concentrate to:
  - Filling the data gaps in the time series
  - Filling the data gaps related to changes in NUTS division
  - Update the data fields (if any additional years are available)
  - Calculating indicators after the needs of other activities of the project
  - Collect, calculate and harmonize more economical data related to project
- Prepare working and final maps for other activities
- The main focus will be put on the origin-destination related migration data on regional level where there still are remarkable holes and quality gaps in the datasets.

Case studies (CNR)

- Since detailed data especially regarding internal and international migration are not available for all regions, case studies will provide in depth analyses for specific regions for which detailed data are available. In addition case studies are useful for analysing different types of regions. The case studies bring together the activities 'Demography and migration', 'Typology of regions and cities' and 'Policy implications' and illustrate what it all implies for a number of selected areas.
- The activity 'Case studies' has a twofold aim: it contributes to the first two research activities focusing on the aspects of internal and international migration, and translates the output of the policy oriented activities into specific regional settings. The case studies bring together the various activities, connecting the implementation of the analyses, the development of the typology, the scenario building and the formulation of the policy implications and illustrate the results and impacts at a regional and sub-regional level.
- The first aim of the case studies activity is the description and understanding of the effects of demographic change and migration in specific regional settings. The case studies permit the testing of specific hypotheses and they serve to highlight specific arguments.

They allow analysing the relationship between socio-demographic structure (age structure, migratory background), demographic processes (natural change and migration), labour force changes, socio-economic structure, human capital, and competitiveness and cohesion. The focus of the case studies remains the analysis of migration data at the regional level. The case studies will show the interdependence of regions regarding interregional migration, migration between the countries in the EU/ESPON area and international migration to/from other countries.

- The second aim of the case studies activity is translating the results of the scenarios into a specific regional setting, based on the previously conducted in-depth analysis and the downscaling of the scenarios. This will offer the possibility to read the results of the DEMIFER project through regional and sub-regional dimensions.
- During the preparation phase of the Activity 'Case Studies' a standard outline for the case studies will be formulated. The formulation of a standard outline reflects the desire to ensure comparability among the case studies. At the same time case studies will differ from each other and focus on specific research questions identified in other activities of the DEMIFER project.
- The selection of the case studies will be representative regarding the demographic and migration development and regarding the typology of regions. The selection will aim at a balanced geographical coverage. However, case studies will not allow for a complete coverage of the diversity of the European regions. The case studies will represent the types defined in activity 2 of the DEMIFER project (Typology of regions and cities). As soon as a preliminary version of the typology will be available, the most representative regions of each type will be identified, from which the case studies will be selected.

Dissemination (Nordregio)

- The objective of the work package on dissemination is to support the use and dissemination of the results achieved in the DEMIFER project. Dissemination activities of the project will be interrelated and coordinated with respective activities by the ESPON Programme (see The ESPON 2013 Operational Programme, Priority 4 on the capitalisation of the results from the project activities).
- DEMIFER will mainly address the two prime target groups mentioned in the ESPON 2013 Programme: 1) the European level involving policy makers in European Institutions and programmes and representatives of Member States dealing with territorial development and relevant sector policies, and 2) transnational, regional and local policy makers and practitioners involved in the development of territories.
- We intend to organize in cooperation with the ECP networks, a limited number of working seminars. Furthermore, we envisage to prepare a number of policy briefs to discuss several policy options taking into account the impact of demographic and migratory flows on competitiveness and socio-economic developments of European regions and cities as well as on the realisation of economic, social and territorial cohesion in Europe.

- The results and conclusions of the scientific research within the project will be formulated in relation to policy orientations present at European level. We will present a number of policy options (not recommendations) with their consequences to allow policy makers to base their choices on scientific results. References to future policy options will take into account European Cohesion Policy orientations, in particular expressed in the Community Strategic Guidelines on Cohesion 2007-2013 and the Fourth Report on Cohesion (European Commission, 2007).
- In order to avoid overlaps with and repetition of activities organised at the ESPON Programme level, the envisaged dissemination strategy will be in due course further discussed and elaborated with the ESPON Coordination Unit.

Envisaged output

DEMIFER will produce the following output:
- a Draft Final Report (deadline 30 April 2010);
- a Final Report (deadline 30 September 2010);
- a number of deliverables (output of the different activities of Work Package 2):
  - D1 Report on effects of demographic and migratory flows on European regions
  - D2 Report on causes and impacts of migration on European regions
  - D3 Typology of regions
  - D4 Report on the multilevel scenario model
  - D5 Report on reference scenarios including a discussion of regional population and labour force simulations, as well as the detailed numerical results
  - D6 Report on scenarios and a database of scenario drivers
  - D7 Report assessing the effects of demographic developments on regional competitiveness and cohesion
  - D8 Report on the climate change and resource depletion scenarios and a database of scenario drivers
  - D9 Report on policy implications
  - D10 Database
  - D11 Atlas of maps
  - D12 Report on case studies
- raw data and indicators to be included in the ESPON database;
- one or more typologies of regions;
- outcomes of scenarios;
- an atlas of maps;
- policy briefs.

A full description of the content of the (Draft) Final Report is included in Annex III of the contract. Each research activity within Work Package 2 has its own deliverables. All deliverables and other types of output (data, indicators, typologies and maps) form the building blocks for the final report. The policy briefs will be short notes highlighting one by one the different issues discussed in the final report.

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