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DEMOGRAPHIC AND ECONOMIC TRENDS IN A RURAL EUROPE IN TRANSITION*

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Draft Version – Work in Progress

Abstract

Rural Europe is in a phase of vast transition regarded both from a demographic and economic-structural point of view. Studies have shown that demographic development differs a lot when comparing urban regions with more sparsely populated peripheral regions. These diverging patterns is shown to be especially strong in the northern and eastern parts of Europe where a redistribution of people contributes to a concentration process to the metropolitan or big city areas as well as to shrinkage and depopulating. The purpose of this paper is to empirically address these differing demographic development paths by analyzing the influence of key underlying demographic factors on population growth across European rural regions. For the stated purpose the paper applies typologies based on both economic and demographic structure and a cross regional regression model. The economic-structural typology developed within the ESPON/EDORA-project is used to describe and analyze economic-structural factors and a typology based on demographic characteristics that classifies regions as either shrinking or expanding in terms of population is used to address sustainable and unsustainable population changes across Europe. Key findings indicate that migration is the prime driver behind population growth and shrinkage, the age structure is of importance with regard to population changes and there exists an east-west divide between the growing west and declining east where the declining sectors are more frequent. It is also shown that large and densely populated regions have better preconditions for growth and fewer risks for shrinking than small and sparsely populated ones.

Keywords: shrinkage, migration, east-west divide, typologies, economic-structural factors, human capital, density and size-effects.

*This paper is a development of Johansson (2012) that was presented in Nara 2011 and published in Kobayashi, Westlund and Jeong (2012), but focus is here on shrinking regions in rural Europe. The paper is to be presented at ERSAs 2014, special session SJ, Economic development and geographical aspects of population decline.

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1. Introduction

The purpose of this paper is to analyze demographic- and economic structural changes across rural regions in Europe, as well as the connections between these two types of processes. This does however not exclude the relations to urban areas as population changes in rural areas cannot be analyzed without taking the urban population development into account. This is particularly important with regard to migratory movements where urban in-migration, in many cases, is dependent of rural out-migration. It has also been shown that rural areas have different migration patterns where many areas in the surroundings of big cities have experienced a positive population development as an effect of both natural population increase and net in-migration. The opposite is, however, the case in peripheral and remote rural areas where contrary development paths often seem to be the case. Moreover, out-migration also result in eroding reproduction potentials as out-migration of young women accentuate the effects of the drops in fertility. Natural population change has, thus, lost its primacy as the dominant factor behind regional population development both in positive and negative ways as the European regions – urban as well as rural – have been transformed from high fertility societies to low fertility ones. Instead, migration has become the main driver with regard to population development. These processes are all related to the economic-structural changes taking place in both urban and rural regions, which is the focus of this paper.

In order to describe and empirically address the differing demographic development paths and altered preconditions for transformation the paper applies typologies based on both economic and demographic structure and a cross regional regression model. In a first step, a typology based on demographic characteristics that classifies regions as either shrinking or expanding in terms of their population base is used in a descriptive analysis that illustrate sustainable and unsustainable population changes across rural Europe. The unit of analysis is the NUTS 3 regional level and the time dimension is 2001-2012. The economic-structural typology developed within the ESPON/EDORA-project is then used to expand the analysis in terms of economic-structural factors. The purpose is to examine how these two typologies relate to each other and how they can be used jointly in empirical analyses of the factors influencing population change across Europe. Hence, one of the central question addressed in this paper is whether the relative importance of key determinants of population change varies across regions defined as either shrinking or expanding. In order to answer this question we use the analyzed sample of NUTS 3 regions in a cross regional regression framework to estimate a growth equation that indicate the economic and statistical significance of the different underlying components that explain population change.

The paper is organized in the following way: Section 2 provide a background to the paper by analyzing demographic trends in Europe using both the demographic and the economic-structural typology. Section 3 summarizes some of the relevant literature and present the theoretical framework of the underlying factors presumed to influence regional population growth and shrinkage. Section 4 describes the data used in the empirical analysis followed by a description of empirical methodology and regression results. Finally, Section 5 concludes the paper and discusses the hypothesis posed in the paper.

2. Shrinking regions – a long term structural phenomenon?

When analysing shrinking regions in Europe it seems natural to focus on population change. Maps 1 and 2 show the general pattern of demographic change based on the demographic equation during the period 2001-2012 concerning growth as well as decline. Both the central European growth zones and the peripheral edge areas with declining population are clearly identifiable even at a first glance. A lot of studies have shown a polycentric development within the Pentagon, while there instead are indications of monocentric development with respect to demographic development in more sparsely populated peripheral areas. This phenomenon has been and still is especially strong in the northern and eastern parts of Europe where a redistribution of people contributes to a concentration process to the metropolitan or big city areas as well as to shrinkage and depopulating.

Growth zones are in general affected by net in-migration and this is valid for regions in Europe as well as in other parts of the world. Migration – internal as external – has a more dominant impact on regional population change today as a consequence of low fertility rates and top-heavy age structure in many regions. Once again, it must be kept in mind that there is a connection between migratory movements and natural population change. Population growth within the ESPON Space can often only be explained by migration – including immigration – because the balance of births and deaths is negative or negligible with regard to natural population change. This can be observed in Germany, in big city areas in the Scandinavian countries, in northern Italy and in southern England. In these areas the population dynamic is increasingly driven by migration and less by the surplus of births. Today, at regional and local levels migratory movements are, thus, the prime driver behind population change and they have also been of more importance at the national level in recent decades as a consequence of the increased inflow of refugees (Johansson 2009).

Some European peripheries experience population decline as a consequence of negative migratory balances and natural population decreases. In a lot of regions in Eastern Europe, especially in Bulgaria, Romania and the Baltic States, some regions in Hungary and the Eastern parts of Germany as well as in some areas in Greece these tendencies are obvious. Within the Eastern European countries the migratory movements and redistribution of people – especially young adults – is, however, of large importance to explain the regional population changes both in large urban agglomerations and in more peripheral areas.

TFR has declined in every part of Europe since the 1960s and is now below the reproduction rate in almost every country. Since the 1960s a drastic change in the position with regard to TFR-levels has occurred. Countries with traditionally high fertility rates became low-level countries and *vice versa*. The countries with extremely low TFRs today are Spain, Italy, Bulgaria, Slovenia, Hungary, the Czech Republic, Estonia and Latvia. Within these countries wide ‘depopulation’ areas exist, and in some of them regional polarization seems to be on the increase, with declining and growing areas existing side by side.

Economic growth is often consequence of structural changes and this has a key place in the theory of economic growth. This means picking out that part of economic growth that has a

connection with a transfer of the production factors - usually labour - from the less productive to the more productive parts of the economy. Of course growth effects of structural change do not have to be a consequence of transfer of labour in the literal sense but may equally well result from different parts of the economy, with different productivities, developing in dissimilar ways. The classical example is the transition from an agricultural society to an industrial society where the “transfer gains” explained much of the economic growth. This transformation process can even be applied to the development in Europe today and then also in disadvantaged or lagging regions. Here it must be kept in mind that most of the disadvantaged regions in Europe can be characterized as rural areas and many localized in the new member states.

Transfer of production factors – especially labour - from the primary sector to the secondary or tertiary sectors will, thus, stimulate the economic development in positive way with the restriction that the surplus of production factors can be absorbed in the industrial or tertiary sectors. The expanding sectors are usually localized in urban areas and the effect is a transfer of people from rural to urban areas and – in many cases – the gap between urban and peripheral rural areas will be diminished and perhaps also closed but at the ‘cost’ of redistribution of people from rural to urban areas.

The definitions of rural areas are manifolds and this results also in differing development paths concerning their localization and economic structure. Many rural areas have more in common with urban areas and the dividing line is more the population density than the employment structure. These regions that have taken advantage of the possibilities connected to the development towards the New Rural Economy (NRE) are often well-being regions characterized by gentrification and growth. Increasingly rural development policy thinking has been evolving according to far more complex notions of rural territories and rural economic life, taking into consideration the great variety of rural situations and contexts and the profound changes that have been taking place in rural Europe during the last decades. Many rural areas have also been shown to “out-perform” urban areas, many rural areas have been transforming in profound ways regarding socio-economic structure and economic base as well as regarding their regional contexts and roles and in many cases the very notion and concept of rurality as a territorial quality is challenged (SERA 2005, Johansson 2012, 2014).

Despite these tendencies, rural areas in peripheral areas in sparsely populated areas with a high share of the population dependent of the primary sector are in a quite another situation characterized by low incomes and lagging economic structure and small or none potentials to endogenous economic growth. Instead, rural exodus and depopulation have characterized these types of rural areas. The slow-down of the metropolitan population growth has not stimulated the development in these kinds of rural areas. The peri-urbanization process is quite another thing and seems more or less absent in these disadvantaged rural regions. The development of rural areas will thus be a central ingredient in this study as these areas are of great importance with regard potentials for as well as hampering factors concerning transformation and development in the disadvantaged areas. The effects of integration and globalization are then central ingredients in the story of “advantage of backwardness” as well as “missed opportunities” or “no” opportunities at all.

A lesson to be learned from the narrative above is that when discussing shrinkage from a territorial point of view it is more or less necessary to use a long-term perspective and to differ between structural transformations and business cycles. This is perhaps more important when focus is on regional demographic development than other structural phenomena such as economic and social changes as demographic changes often also are a cohort phenomenon – large cohorts have quite other impact on regional development than small. In this way, regional shrinkage can in many ways be seen as a cohort phenomenon especially with regard to the age group 18-30 when the migration intensities are as highest. The structural perspective is, thus, the primary reason for choosing a period as long as possible, in this paper the years 2001-2012 depending of the possibility/impossibility to construct continuously available data series and then to minimize the number missing data at NUTS3-level. A longer time perspective would of course be preferred but data problems stopped this.

The definition of shrinking regions that is used here is the annual changes from January 1 2001 to January 1 2013 – a twelve-year period. For simplicity's sake the annual perceptual changes have been used as an indicator for shrinking or expanding regions – i.e. by the annual decline over the whole period (this is in line with other used definitions, see e.g. EC 2006, Ministry of Interior, Hungary 2011). This means that yearly fluctuations are hidden but the long-term development are highlighted. Series for the periods 2001-2008 and 2008-2013 are also constructed in order to investigate if there are a structural break 2008 or not but these series are not used here as a consequence the restricted number of pages to our disposal.

Some lessons can, thus, be learned from the historical transition with regard differing stages of growth concerning the leading and lagging from regions. This is valid from a historical point of view as well as cross-section comparisons of the situation today. Different regions in Europe are simultaneously in different development stages – some are still in more or less in some form of agricultural state while others are in the post-industrial phase. This is valid concerning comparisons between nations as well as within nations and this is valid especially for the disadvantaged regions in the European periphery compared to the more advantaged regions in Central and Northern parts of Europe. Without a long-term perspective the analysis of shrinking regions would be hampered and the effects of different economic stages would be hidden. A longer perspective would of course be a favor as there are time-lags in the transformation processes between differing parts of Europe between countries as well as within countries. It must be kept in mind that growing and shrinking regions have been natural ingredients in economic and regional transformation processes as a consequence of different growth preconditions and development stages. This is valid for relations between countries as well as within countries. A long-term perspective will then facilitate the analysis and detect the effects of time-lags in the transformation phases in a more comprehensive and analytical way.

In order to compare growing and shrinking regions the development paths concerning population sizes and the social-economic structures are used. The first typology is based on the demographic equation and the second typology is the EDORA economic-structural typology where the rural Europe is split in four different types with differing rural characteristics (for a more in-depth description see EDORA 2010, Copus and Johansson 2010).

2.1 Sustainable and unsustainable population changes - A demographic typology

In the ESPON 2006 project 1.1.4; “Spatial effects of demographic trends and migration”, a typology based on the demographic equation (i.e. *regional population change* = *natural population change* + *net-migration*) was produced. The six-fold typology comprised of combinations of the three demographic components. The result is a summary of the demographic situation in each region and the preconditions with regard to future population trends, shedding light on issues such as sustainability, population growth, depopulation and ageing. The typology was first presented in ESPON 1.1.4 and covered the period 1996-1999. It has since then been updated, developed and extended in relation to the period 2000-2005, in Copus *et.al.* (2006), Johansson (2009) and in combination with the EDORA Structural Typology in Copus and Johansson (2010). In this study the estimations have been developed to include almost every NUTS3-region (N=1294) within the “ESPON space”¹. As “shrinkage topics” are a relatively new in regional science any explicit and straightforward common definition of “shrinkage” is not stated. Instead operational definitions are used as a consequence of the topic that are analyzed (for a discussion see e.g. Ubareviciene *et. al.* 2014, Hoeckfeld 2012, Haase *et. al.* 2013). The demographic typology has been used here in order to identify growing and shrinking regions (types 1-3 and 4-6 respectively). This has also been done in some other studies concerning shrinking regions but without any explicit discussions like that in Table 1 with regard to demographic characteristics in the six types and then concerning the differing preconditions (European Parliament 2008, Ministry of Interior, Hungary 2011).

The estimations of natural population development are based on the number of births and deaths during the investigated period. Both total and natural population development include consequently the same number of years. The same will also be the case concerning the estimations of the migration balances. At regional level – in this case NUTS3 – it is, however, difficult to separate international migration from internal inter-regional migration as the migration variable is estimated as a residual. The six different types are presented in Table 1 where the types 4-6 consist of shrinking regions.

¹ ESPON covers the EU27 plus “partner countries”, the principal ones being Norway, Switzerland, Lichtenstein, and Iceland but Croatia and Denmark are here excluded as a consequence of shortage of data.

Table 1: A schematic typology with regard to sustainable demographic development

Type	PT	PM	PN	Regional characteristics
1	PT>0	PM>0	PN>0	Double positive regions - In-migration and young population/"high" TFR. High sustainability both in short and long term. The most favorable case
2	PT>0	PM>0	PN<0	Growth regions with natural decrease - In-migration of people with low TFR. Natural population decrease because of top-heavy age structure and/or low TFR. Dependent on in-migration. No sustainability in long term – weak reproduction potential.
3	PT>0	PM<0	PN>0	Growth regions with out-migration - Out-migration and young population/"high" TFR and natural population increase. Short term – sustainability. Long term – eroding sustainability because of top-heavy age structure (out-migration).
4	PT<0	PM<0	PN>0	Declining regions with natural increase - Out-migration but still young population/"high" TFR. Traditionally high fertility regions. Falling TFR -> low sustainability
5	PT<0	PM>0	PN<0	Declining regions with in-migration - In-migration and lop-sided age structure (old population)/low TFR. In-migration of elderly people and/or singles, low reproduction potential. Dependent on in-migration. Low sustainability both in short and long run.
6	PT<0	PM<0	PN<0	Double negative regions - Out-migration and lop-sided age structure with old population/low TFR. No sustainability in short as well as long term. Depopulation. The worst case.
PT= Total population change PM=Net-migration PN= Natural population change TFR = Total Fertility Rate				

Source: ESPON 1.1.4, Copus et.al. 2006, Johansson 2009, Copus and Johansson 2010.

The Demographic typology and the distribution of the differing types are presented in Map 1 and Table 2.

Some more or less tentative conclusions about the geographic development paths can be drawn from Map 1. At a first glance the east-west dividing line is obvious with a growing west and shrinking east but even in the Northern periphery many regions can be characterized as shrinking. It is also indicated that the low fertility rates and natural population decline are hampering factors for a lot of European regions and especially then for the rural regions in Eastern Europe. The same is valid concerning migratory movements that reinforce the vicious circle in these regions. On the other hand migration is also the prime driver behind the overwhelming shares of the regions with a population growth. Migration has taken the dominant position in population development with respect to positive as well as negative population changes in most countries. The east-west divide is even more obvious in Map 2 where only aggregate 'growing' and 'shrinking' regions are shown.

The result of the population development is, however, from a territorial cohesion point of view, not positive. As the population increase is concentrated to western and central parts of Europe and the population decrease to the peripheral parts there are tendencies to an unbalanced population development within the ESPON space and thus also an eroding territorial cohesion.

It must also be kept in mind that a large part of the migratory movements consists of international migration. In this paper it has not been possible to separate internal from external migration at regional level as migration is estimated as a residual in the demographic equation. Many studies have, however, shown that the international migration to Europe has increased during the past decades (see e.g. ESPON 1.1.4, 3.4.1, ESPON/DEMIFER 2010). The character of the international migration has also shifted in character from labour to refugee immigration. This larger flow of foreign immigrants can also in many cases explain the increasing importance of migration in the population development and the concentration to the large urban agglomerations in the 'old' EU-member states.

In Table 2 the population size of the types are also estimated and related to the number of regions. From these figures it is also possible to see if large and small regions are over- or underrepresented within the six types. One way to analyze if various large regions are over- or underrepresented in the different types is to relate the relative distribution of the total population to the relative distribution of the number of regions. An index is then created by calculating the share of people in the relevant types in types i divided with the share of total number of regions in types i , and then multiply it with 100. If the result is over/under 100 the share of the population is higher/lower in the type i compared to the distribution of the total number of regions and vice versa. The size index (SI) can thus be written as:

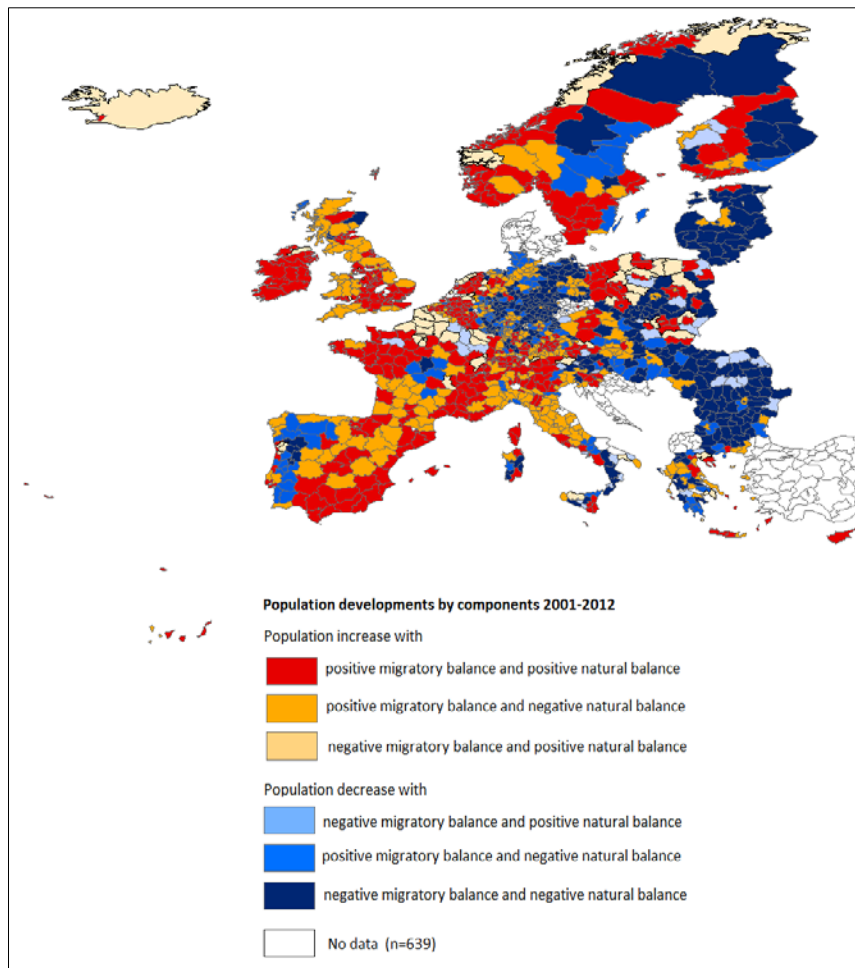
$$SI = (P_i/R_i) * 100 \quad (F1)$$

SI (Size Index) = weighted index according to size

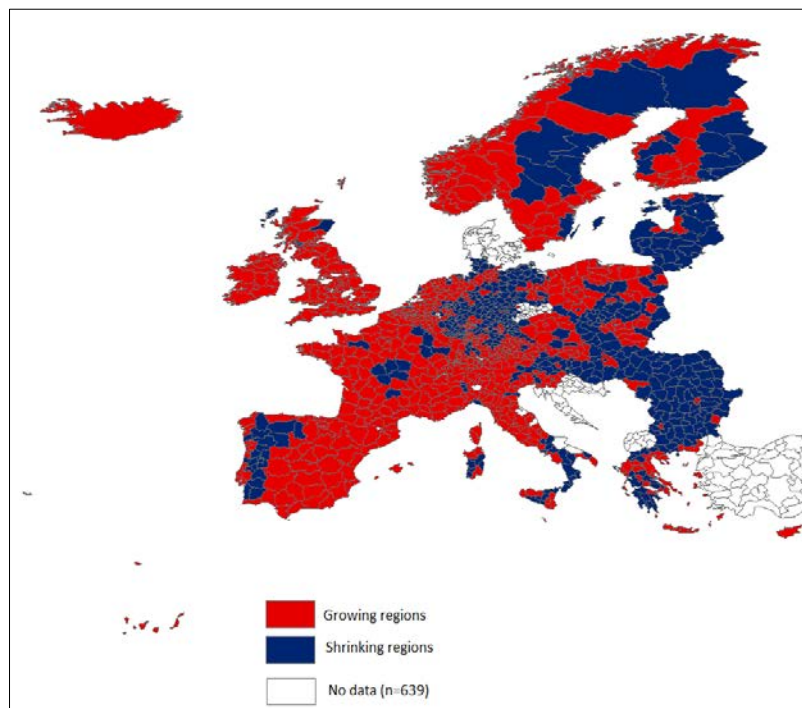
P_i = share of the total population in type i (percent)

R_i = share of all regions in type i (percent)

The over- and underrepresentation with relation to population size is shown in Table 2.



Map 1. The demographic typology for the period 2001-2012 (NUTS3, N=1294). Based on annual population change 2001-2012. Source: Estimations based on data from Eurostat.



Map 2. Growing and shrinking regions within the ESPON Space. Based on annual population change 2001-2012. Source: Estimations based on data from Eurostat.

From Table 2 it seems obvious that Type 1 is the most frequent, both with regard to number of regions and size of population. Growing regions take the lion's share - 61,5 percent of the regions consisting of 72,1 percent of the population within the ESPON. This means that the size has some importance for growing or might be an effect of growth in the long-term. 'Big is beautiful' seems then to have some relevance even for growing.

From the data used in these estimates it seems also obvious that Type 1 are frequent in the Pentagon, metropolitan areas in the Nordic countries and regions with good climate and amenities – e.g. the southern part of Spain. As was indicated above this type is, from a sustainable point of view, the most favorable, particularly in long-term. From other studies it has been shown that rural areas localized in those densely populated areas display the same preconditions for sustainable population development as the urban ones (ESPON 1.1.4 2005, Johansson and Kupiszewski 2009). This is also valid for Type 2 where small – often rural – regions are attractive from an in-migration point of view. From other studies it has been shown that both intermediate and predominantly rural areas are overrepresented in Type 2 (SERA 2005, Johansson and Kupiszewski 2009). This is also an indication that rural regions are automatically not synonymous with shrinking regions. Instead it is a hint about the importance of localization in differing macro regions – rural areas localized in well-being growing countries and macro regions will be growing and rural areas in problematic and declining countries and macro regions are more predestined to be a shrinking region.

This is also clearly illustrated by Type 6 that is the worst case from a sustainable point of view. Total population decrease in combination with natural population decrease and net out-migration is not a good starting point in order to create good possibilities for sustainable population development. As much as 24 percent of the regions with 17,5 of the inhabitants within the ESPON Space are in this situation, and the rural areas are overrepresented in comparison with the total figures. This is valid both for number of regions and population size. Many of these (rural) regions are located in the European periphery. Large parts of Sweden and Finland, the Baltic States, Hungary, Eastern Germany, parts of Poland, Spain and Portugal are to be found in this category. Many of these are also characterized as some form of rural areas. The common dominator with regard to these rural shrinking regions is sparse population and few inhabitants.

Table 2: The distribution among the types with regard to number of regions and population size.

2001-2012	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Number of regions (N=1294)	31,5	25,1	4,9	3,0	11,5	24,0
Population Size (N=1294)	42,7	20,4	9,0	3,4	7,0	17,5
Size/numbers	135,3	81,6	185,1	111,4	60,6	72,9
Index: 100=neither/nor						

Source: Source: Estimations based on data from Eurostat. Note: Denmark and a few other NUTS 3 regions are not included due to missing data.

2.2 Rural Europe – an economic/structural typology

In the ESPON/EDORA-project an economic/structural typology with regard to the ESPON Space was clustered based on 18 economic and structural variables. For a more in-depth discussion about the variables and the clustering can be seen in EDORA 2010 and Copus and Johansson 2010 (this paragraph is also based on EDORA 2010 and Copus and Johansson 2010).

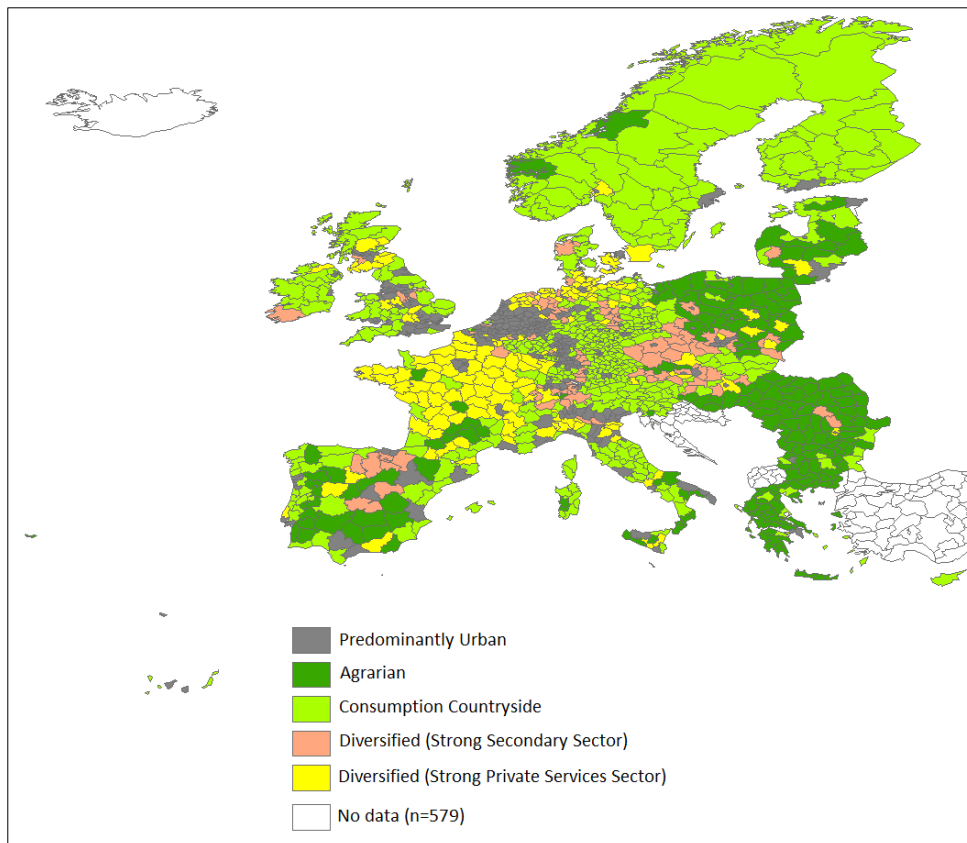
The principal findings with regard to the EDORA-types are (see also Maps 2):

Predominantly urban regions are primarily localized in Pentagon – the area that is delimited by London-Paris-Milan-Munich-Hamburg-London. Other predominantly urban regions are often to be found in capital regions and larger city regions as at the Spanish east coast (Barcelona and Valencia) or in the “old” British big city industrial districts (e.g. Liverpool, Manchester, Newcastle and Birmingham) – cities and regions that are in huge transformations economically as well as socially.

Agrarian regions are concentrated in a peripheral eastern and southern arc, stretching from the Baltic States, through Poland, Slovakia, Romania, Bulgaria and Greece, Southern Italy, southern France, southern and western Spain, and eastern Portugal (Alentejo).

The rest of the European space seems to be characterized by a patchwork of three types of rurality, *Consumption Countryside*, *Diversified (with Strong Secondary Sector)* and *Diversified (with Strong Private Services Sector)*. Of these the last seems to be to some extent associated with the most accessible areas and also the one that is most associated with the NRE.

Consumption Countryside regions are often closely associated with Agrarian ones but are also populated by people employed in the industrial and service sectors where a large share of the working people are dependent of wages and salaries. Indeed some Mediterranean regions, especially in Greece, meet according to the EDORA-estimations and rural delimitations the criteria for both types. Consumption Countryside regions cover much of Sweden and Finland, more accessible coastal areas of the Baltic States, parts of Slovenia, Austria, much of eastern and southern Germany, large parts of central and southern Italy, Corsica, southern and central France, eastern and northern Spain, the coastal regions of Portugal, and most of the less densely populated parts of the UK and Ireland.



Map 3. The EDORA Structural Typology, 2011 version.

The Diversified (Strong Secondary Sector) regions are found in the Czech Republic, Slovenia, and Slovakia, northern and Eastern Germany, around Madrid, and in northern Spain, and the English Midlands. These regions can also be seen as industrial regions that in many cases are in a state of deindustrialization and transformation. Especially in the new member states they seem to be in a stagnating or retarding phase and lose people both as a consequence of natural population decrease and out-migration.

The last category – Diversified (Strong Market Services) is evident in northern and central France, northern Germany, southern Denmark, the Skåne region in the south of Sweden, parts of central England, southern Scotland, and in a few regions of Spain and Italy. In the New Member States this type of region is associated with regions close to national capitals (Budapest, Bucharest, Vilnius). As mentioned above this category is the one that is most associated with the NRE.

2.3 The demographic and the EDORA economic/structural typologies – different types, different outcomes

In this part of the study the Demographic types are cross-tabulated against the Structural types in order to investigate the differences between the five Structural types for sustainable population development and depopulation. Some conclusions can be drawn based on the tables below and consisting of almost all regions within the ESPON Space with the exception of Iceland. The number of regions and the size of the different Structural types are shown in Table 3 below.

Table 3: Size distributions of the five Structural types.

Structural Types, N=1294	% of N	% of size	Size index
0. Predominantly Urban	31,2	42,6	136,4
1. Agrarian	16,3	14,0	85,8
2. Consumption Countryside	33,7	23,5	69,9
3. Diversified (strong secondary sector)	7,2	6,6	91,7
4. Diversified (strong market services)	11,5	13,2	114,8

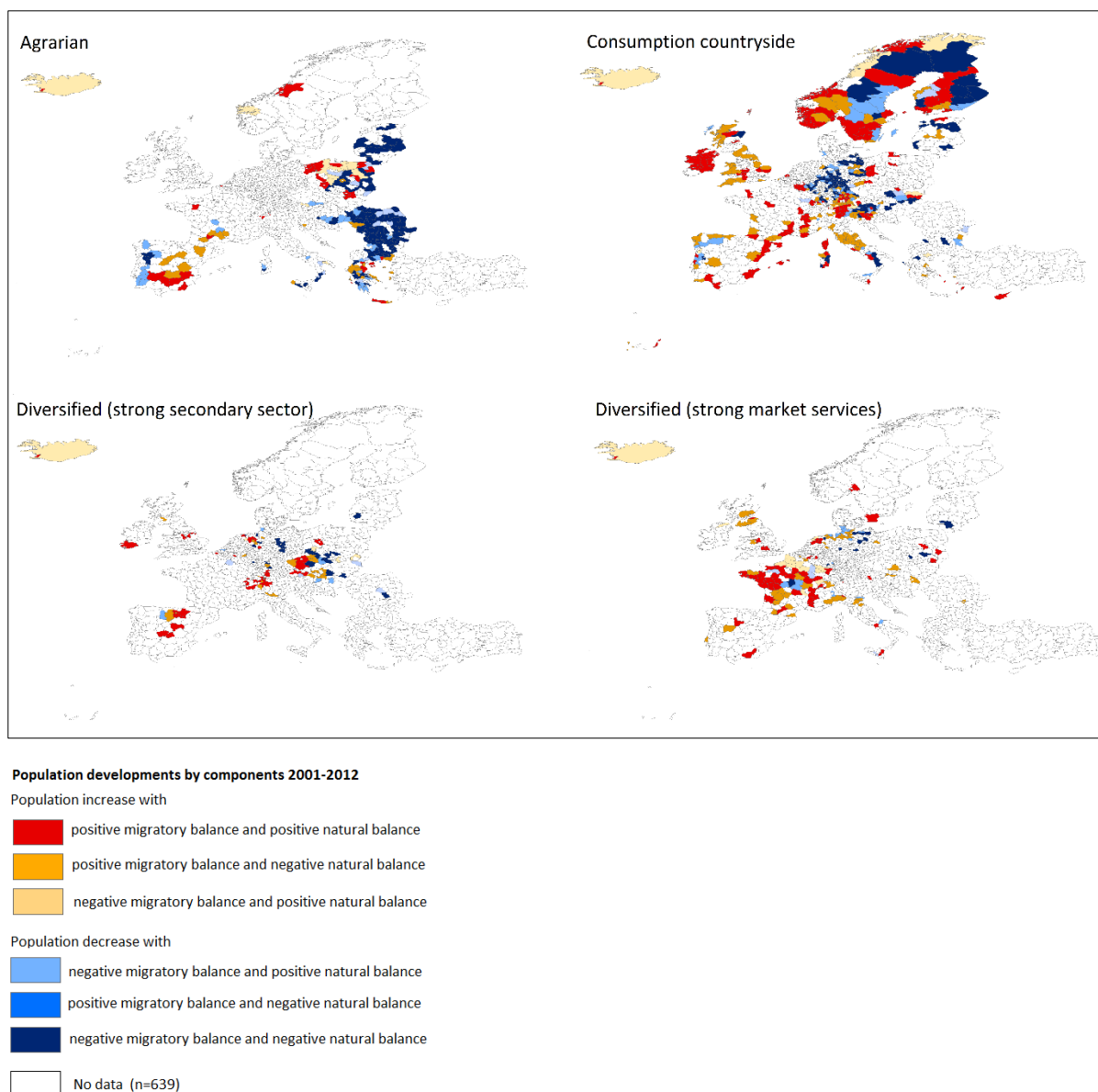
* Based on numbers of regions (NUTS3) and population size (%). Size index (F1), over- or underrepresented with regard to size (index=100, neither nor).

Three Structural types are “overrepresented” in Type 1 – the most favorable type from a sustainable demographic point of view concerning the numbers of regions. These are the “Predominantly Urban” and the two “Diversified rural types”. All three have a higher share of regions in Type 1 compared to the total share of all ESPON regions (see Table 4). When the size aspects are taken on board in the analysis the Structural type 3 “Diversified with strong secondary sector” is dropping off (Table 5).

The relatively good population development in the diversified countryside with a strong secondary sector is perhaps less expected. This type of region accounts for only 7,2 percent of the regions and 6,6 percent of the population within the ESPON Space, and are concentrated in the Czech Republic, Poland and Spain. The diversified countryside with a strong secondary sector has in many cases gone through a deindustrialization process with the result that these regions have experienced a vicious circle with regard to migration and natural population development. More than one third of these regions (34,4 percent) experienced net out-migration during the period 2001-2012 – perhaps a low figure for regions dependent on the declining manufacturing industries.

From Map 4 it can be seen that the development in the diversified countryside with a strong secondary sector seems to show a polarized geographical localization. The expanding areas are to be found in the central or western parts of the ESPON space while the retarding and declining ones are to be found in the old industrial districts in the new eastern member states but this structural type seems to be almost non-existent in these declining areas. This implies that the first category already had been reconstructed and changed the vicious circle to a virtuous one with population increase as one result. This seems, however, to have taken place during the deindustrialization period the decades before the new century. One explanation might be that the most unproductive units were closed down during the deindustrialization process and the most productive and knowledge-based survived even if employment decreased.

This indicates also that this was not the fact in the old state-owned factories in the former centrally planned economies in the East. Instead of renewal and reconstruction the development was in many cases characterized by rigidity and “lock-in” mechanisms that prolonged the negative development as one result. The ‘new rurality’ or the New Rural Economy seems neither to have been an alternative to the declining and stagnating economic development. These phenomena might be some of the reasons to the unstable and unsustainable demographic situation in some of these rural areas.



Map 4. The Demographic Typology of the four non-urban EDORA Structural types for the period 2001-2012 (NUTS3).

The diversified countryside with strong market services structural type accounts for 11,5 percent of the regions within the ESPON Space and 13,2 percent of the population. This category shows good population development, as does the Consumption Countryside group which accounts for 33,7 percent of the regions and 23,5 percent of the population. The prime driver behind the good demographic development in these categories is – as usual – in-migration.

These high figures might be an effect of the ‘new rurality’ or the ‘New Rural Economy’ that has changed the performance of the countryside in many European countries and especially then in densely populated rural areas in the surroundings of big urban agglomerations. The densely populated rural regions are in a more favorable position with regard to population change than other more peripheral rural regions. This is not especially surprising as densely populated rural regions have experienced a relatively positive population development during the past decades

(Copus et.al., 2006; Johansson & Kupiszewski 2009, Edora, Activity 2.11, Demography). Even if demographic development with regard to growth and decline is not a 'zero-sum game' the contrary seems anyhow to be the case. Shrinking rural regions were – and still are – often remote and sparsely populated ones already from the beginning and then with bad preconditions for growth and development.

Despite the high in-migration figures in the categories "Consumption Countryside" and "Diversified (strong market services)" the effects of the natural population decrease hamper the positive population change. This seems to be a fact especially in Demographic Type 6 with both out-migration and natural population decrease (see Tables 4 and 6). It is not a qualified guess that many of these small regions might be sparsely populated and localized far away from the metropolitan areas. From Map 2 and 4 it seems obvious that it is the peripheral areas in the northern part of Europe that seems to be in the most troublesome situation but even central parts of Germany and some parts in the new member states are characterized by both natural population decrease and negative migratory balance. The regions in the eastern part of Europe show similarities with the agrarian regions in the same areas. This will result in a future precarious situation for these regions in general and for the rural ones especially.

This can be contrasted to the figures in the 'diversified countryside with strong market services' where only 8,8 percent of the regions with 5,5 percent of the population are in Demographic Type 6 (see Tables 4 and 6). In this category there were 45,3 percent of the regions with 63,4 percent of the population that was hurt by a negative natural population development in 2001-2012. These rural areas are predominantly localized in the western part of Europe – and then especially in France – and it might also be in this kind of rural areas that the NRE has been established. It seems, however, also in this case to be small peripheral and sparsely populated rural regions that is hurt mostly by the demographic development with ageing and depopulation as one result (Johansson 2009, see also Map 3 and Tables 4 and 5). The few blue spots are to be found predominantly in the eastern part of Europe.

The rural category with the most negative demographic development was the Agrarian. Only 35 percent of the regions with a population share of 33 percent showed population increase between the years 2001 and 2012. This negative development can also be illustrated by the fact that only 16 percent of the regions were to be found in Demographic Type 1 and as many as 44 percent of the regions and 49 percent of the agrarian population within the ESPON Space in Type 6. In other words, the Agrarian regions are in a very problematic situation from a sustainable demographic point of view. These regions are mainly found in Eastern Europe and parts of Spain and are associated with transformation problems. These regions are still waiting for the effects of the appearance of NRE and this situation is in many cases also reinforced by the economic transformation in other sectors that hamper the population development as a consequence of natural population decrease as well as net out-migration. In other words, these regions are not only in problematic situation created by the agrarian sector – instead the economy of the whole regions hamper population growth.

An indication of this is that even with regard to agrarian regions most of the rural regions in Eastern Europe are among the "degrading" ones. The overwhelming majority of these regions are in Bulgaria and Romania – countries that are characterized by a very deep and hard population crisis with population decline in both countries. The active component here is once

again migration – internal as well as external – that is the prime driver in this downgrading process. Despite this precarious situation it seems that it is mainly the metropolitan areas that experience positive population development. In Bulgaria three NUTS3-regions had a positive population development and in Romania the corresponding figure was two for the period 2001-2012. The agrarian regions seem here – as in many other countries – thus to be involved in processes dominated by viscous circles and negative development spirals.

Table 4: The distribution of the Demographic types with regard to the five Structural types.

Structural Types	% Demographic Types, N=1294					
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Structural Types Total	31,5	25,1	4,9	3,0	11,5	24,0
0. Predominantly Urban	42,1	26,4	6,0	1,7	10,5	13,2
1. Agrarian	15,7	13,8	5,7	6,7	13,8	44,3
2. Consumption Countryside	27,0	27,3	2,3	2,1	12,9	28,4
3. Diversified (strong secondary sector)	37,6	21,5	4,3	4,3	6,5	25,8
4. Diversified (strong market services)	33,8	35,1	8,8	2,7	10,8	8,8

*Number of regions (%). Period 2001-2012. Combinations highlighted in yellow are those where the share (%) exceeds the average for all Structural types.

Table 5: The distribution of the Demographic types with regard to the five Structural types. Based on population size (%) 2001. Period 2001-2012.

Size: % Structural and Demographic Types, N=1294, NUTS3						
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
StructuralTypes Total	42,6	20,5	9,0	3,4	7,0	17,5
0. Predominantly Urban	52,2	19,4	11,4	2,6	5,4	8,9
1. Agrarian	17,2	7,4	8,5	8,5	9,1	49,3
2. Consumption Countryside	38,7	27,9	3,0	2,3	10,3	17,8
3. Diversified (strong secondary sector)	35,6	18,9	6,0	5,0	5,6	28,9
4. Diversified (strong market services)	47,7	26,4	14,2	1,5	4,7	5,5

*Size of regions (%). Period 2001-2012. Combinations highlighted in yellow are those where the share (%) exceeds the average for all Structural types.

2.4 Large regions – better preconditions

There are studies that have shown no correlations between growth and shrinkage on the one hand and on population density on the other. Instead the history can witness about both growing and shrinking regions on densely populated areas as well the contrary – sparsely populated regions might experience “explosive” growth (European Parliament 2008 pp 34-35). This is, however, not the same as size has no importance for population growth and shrinkage. Already Ravenstein highlighted that - with references – to Newton – that the mass was pull and push factors depending of the size in in- and out-migration areas and, then consequently, also for demographic development (Ravenstein 1885, 1889).

In order to investigate the relation between population size and demographic development the size index (SI) has been used here (Table 6) in order to investigate if the size has importance for the demographic development in the differing Structural types. SI is identical as formula F1. By

combining Tables 4 and 5 and the discussion above it seems obvious that large regions are in better positions concerning sustainable demographic development than small ones. As can be seen from Table 6 large regions are overrepresented in growing regions and underrepresented in shrinking ones. The overrepresentation in the growing Demographic types is valid for almost all Structural types except the diversified countryside with a strong secondary sector – in all other types are large regions overrepresented in the growing Demographic type 1 (Table 6).

It can also be noticed that large regions are overrepresented in Demographic Type 3. It must here be kept in mind that Type 3 is a small category. Among the rural regions the highest share is to be found in the category diversified countryside with strong market services with 9 percent of the regions and 14 percent of the population in this Structural category (see Tables 4 and 5). The total demographic distribution in relative terms is 5 and 9 percent respectively. This means also that small absolute changes may result in large relative effects with regard to the size index and the results ought to be interpreted with some care. One illustration of these shaky results is the large overrepresentation of almost all Structural types for the Demographic type 3. The same reasoning is also applicable with respect to Demographic type 4. This type shows, however, declining regions and this is also a hint that large regions have better demographic development preconditions than small ones. It is only the agrarian regions that are overrepresented in this type. As can be seen, large agrarian regions are overrepresented also in Demographic type 3. These large agrarian regions are thus characterized by a combination of out-migration and natural population increase. This is also an indication of the old truth that agrarian regions have higher fertility than the more urban ones where children is more alike a consumption product than a production factor (Becker 1993). This gap has, however, diminished as a consequence of the economic and social transformation, out-migration and “defamilization” even in peripheral agrarian areas (ESPON 1.1.4 2005, Johansson 2012).

Table 6: Over- and underrepresentation of the various demographic (ESPON) types with regard to population size 2001 in the differing Structural types. Period 2001-2012.

Size/numbers: Edora/Demographic Types, N=1294. NUTS3. Over 100 = large regions overrepresented, under 100 = large regions underrepresented						
Demographic Types	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Structural Types	135,3	81,6	185,1	111,4	60,6	72,9
Total						
0. Predominantly Urban	123,9	73,4	191,2	148,6	51,8	67,5
1. Agrarian	109,4	53,4	149,5	127,7	65,8	111,3
2. Consumption Countryside	143,2	102,2	129,8	110,3	80,0	62,7
3. Diversified (strong secondary sector)	94,6	87,7	139,9	116,1	87,3	112,0
4. Diversified (strong market services)	141,2	75,1	161,5	56,8	43,1	62,7

* Combinations highlighted in yellow are those where large regions are overrepresented.

3. Regional characteristics behind growth and shrinkage

Besides the demographic and economic-structural factors discussed above there are a number of additional regional characteristics that may influence regional population growth, and shrinkage, in regions classified as both urban and rural. It is for example well established that the level of human capital in a region is one significant factor that influence growth in income and

population. In all its essence, people are a significant part of the wealth of regions in terms of what labor contributes to output. The productive capacity of the regional population is known to be larger than other forms of wealth taken together and a primary factor that influence regional growth patterns (Barro 1991; Rauch 1993). Moreover, many of the key factors that drive regional growth can be related to the existence of knowledge spillovers and supply of human capital (Becker, 1964; Asheim 1999). Hence, as people invest in themselves by acquiring education and experience they augment not only their own productivity and income, but also the capacity of the region to grow. In the view that individuals drive regional growth, the overall level of human capital in a region becomes a central factor, in the perspective of population development, since differences across regions can influence regional growth patterns. However, human capital does not only produce externalities in terms of productivity but also in terms of consumption that are of importance in this perspective (Haveman and Wolfe 1984). Such consumption externalities capture a wide range of welfare effects in the social environment that benefit the majority of the regional population. Two such benefits are the democratic involvement and social cohesion, which are both functions of the education level and literacy rate (Blundell, et al. 1999).

As stated by the endogenous growth theory, a higher initial level of human capital can bring a one-time increase in the income level or increase the income growth rate (Romer, 1990). This implies that enhancements in human capital have both a level and/or a growth effect. What follows from this is that a region with a larger share of highly educated individuals will successively grow to be wealthier compared to regions that have lower shares (Becker 1964; Blundell et al. 1999; Funke and Strulik 2000). Besides level effects, regions that have a high overall level of human capital are also shown to experience a cumulative process of higher growth in the human capital level (Moretti 2004). However, the influence of human capital on growth does not only depend on individual characteristics but also on the presence of both demand and supply effects. These effects mainly appear in the form of educational infrastructure and the presence of knowledge intensive firms that influence the regional ability to produce human capital, to replace any that it might lose through migration and to prevent human capital from exiting the region (Rauch 1993). Hence, there are reasons to believe that the influence of human capital on growth varies depending on regional characteristics with regards to industry structure and degree of urbanity.

The contrary to growth is shrinkage and what is said above is then also relevant for shrinking regions but in the opposite way. Shortage of human capital is often seen as a central factor behind shrinkage and stagnation. This kind of reasoning has much in common with the product-life cycle theory and development can be seen as a consequence of the spatial product-life cycles that transform the economic landscape and where the shrinking regions often are in the matured phases (Friedrich 1993). One effect is the increased polarization between growing and shrinking regions and 'brain-drain' to the expanding knowledge-based areas. This 'cumulative causation' process is often a central ingredient in differing kinds of transformation and polarization processes where the 'backwash effects' are larger than the 'spread effects' (Myrdal 1957, see also McCann 2001, pp 197-200). History can also stand witness to this kind of processes with e. g. industrialization and de-industrialization as obvious and illustrative cases where differences and changes in human capital are both causes to and effects of growth and decline.

The size of human capital is also a function of the demographic structure in a region as human capital in many ways is a cohort phenomenon. Regions with young population differ from regions with an ageing population with regard to human capital. For our purpose it is then interesting to check if the age structure is of importance for regional growth and shrinkage. The problem here is – as in many other estimations – to isolate causes and effects. A changed age structure is often an effect of in- or out-migration but it has also impact on the preconditions for growth and the risk for shrinkage. It is also a well-known fact that various cohorts have differing migration patterns and this might also have impact on the level of human capital and the production factor of labor (ESPON 1.1.4, 2005). It shall also be kept in mind that different age groups have differing consumption patterns and demands with regards to different kinds of products seen from a local and regional point of view and then different impact on growth and decline. This means that the age structure has differing impact on population growth and decline on population changes and this is an argument for taking the age structure on board in the analysis.

The Total Fertility Rate (TFR) is of importance through its impact on natural population change and then also on total population change. It must, however, be kept in mind that migratory movements also have impact on natural development as it is predominantly the most active and fertile age groups that are on the move (ESPON 1.1.4 2005, DEMIFER 2010). During the past decades most of the countries in Europe have seen a decrease in TFR but with some time-lags between the dropping TFRs in the east and the higher and more stabilized in the west. Today there is an east-west divide with regard to TFR-levels and this accentuates the divergent population development between the ‘old’ and ‘new’ EU-members (Johansson 2014). This means also that the age structures in east and west will be more similar in the sense that the reproduction potentials in Eastern Europe will be eroded – a process that started some decades earlier in the southern and western parts of Europe. This is the primary argument for integrate TFR in the estimations about factors behind regional population growth and shrinkage.

The Gross Regional Product (GRP) is another factor that usually is suggested to be of importance both for migration and natural population changes. According to many migration models income differences are suggested to be of great importance as pull and push factors. The effects on natural population development might be more problematic to specify from a theoretical point of view as it is necessary to distinguish between levels and changes and incomes and prices. With regard to the two latter factors it can be problematic to separate the income effects from the price or substitution effects. It is also important to separate children’s function as production factor – as in the agricultural society – from children as consumption factor as in the post-industrial society (see e.g. Becker 1993 about this discussion). As a consequence of data problems GRP is not integrated in the multivariate regressions but only in the bivariate ones (see the correlation matrices in Appendix A).

It is also of significance to separate the levels from changes in the GRPs. It has been shown that since the middle of the 90s and up to the middle of the 00s the income levels between the European countries have converged but diverged within the countries (Button and Pentecost 1999, Halmai and Vásáry 2010). This is, at least partially, a catching-up effect as the start in

especially the countries in Eastern Europe started from a low level – a ‘starting from scratch phenomenon’ that resulted in a fast income growth.

As the development in Europe has been of quite different character dummies for the ‘old’ EU-member states and the ‘new’ ones have been integrated in the regressions. The effect of this can be seen as with regard to the other factors in the tables below (Tables 10-11).

4. Data and empirical model

For the purpose of explaining the influence of key underlying demographic factors on population growth across Europe the paper applies a cross-regional regression model. The research unit is NUTS 3 regions and the dependent variable is the total change in population measured over the periods 2001-2012, 2001-2007 and 2007-2012. The degree to which demographic factors along with relevant control variables are observable at finer aggregation levels is limited and the variables that we use are attained from Eurostat at either NUTS 2 or NUTS 3 level. Variables are measured at the finest available aggregation level in Eurostat implying that all variables are measured at the NUTS 3 level except human capital and total fertility rate which are only attainable at the NUTS 2 level. There are several problems associated with the use of these data in empirical analysis of growth, particularly with regards to the high aggregation level. One such problem is that some NUTS regions correspond very closely to functionally defined regions whereas others are extensive and economically very heterogeneous. Some even contain one or more different types of metropolitan regions within them. In cases when regions correspond closely to their functional definition it is possible to obtain consistent estimates of factors that may influence regional population growth. However, in cases where regions are very heterogeneous it is difficult to define variables that consistently measure growth. Having this in mind, considerable care has been undertaken to define variables and model the underlying demographic processes.

Variables used in the empirical analysis are obtained from Eurostat and defined in Table 7 and summary statistics are presented in Table 8.

Table 7. Variables and definitions

Dependent variables	Definition
PC 01-12	Population change measured as total annual change in population (exponential) by NUTS 3, 2001-2012.
PC change 01-07	Population change measured as total annual change in population (exponential) by NUTS 3, 2001-2007.
PC 07-12	Population change measured as total annual change in population (exponential) by NUTS 3, 2007-2012.
Independent variables	
Netmig 01-12	Total annual net migration by NUTS 3, 2001-2012.
Netmig 01-07	Total annual net migration by NUTS 3, 2001-2007.
Netmig 07-12	Total annual net migration by NUTS 3, 2007-2012.
Age +65	
Age -15	

TFR	
HC	Human capital measured as share of population aged 25-64 with tertiary education by NUTS 2, 2001.
GRP	Per capita income measured by GRP/population by NUTS 3, 2001 (in € 2011).
Density	Population density measured as inhabitants per square kilometer by NUTS 3, 2001.
Industry	Share of employment by NUTS 3 (NACE Rev. 2), 2001.
New MS	Dummy indicating countries Not included among the EU 15 member states.

Source: EUROSTAT. Independent variables are retrieved for the base year 2001 alt. closest available year when values are missing.

Table 8. Summary statistics

Variables	Mean	Std.Dev.	Min	Max
PC 01-12	0.1033	0.730	-3.117	4.601
PC 01-07	0.195	0.770	-3.523	6.730
PC 07-12	-0.002	1.052	-7.189	3.680
Netmig 01-12	0.163	0.570	-2.952	3.744
Netmig 01-07	0.254	0.625	-3.460	5.827
Netmig 07-12	0.082	0.865	-6.886	3.629
Age +65	18.663	3.596	7.376	30.360
Age -15	14.971	2.610	0	26.075
TFR	1.553	0.263	1.07	2.27
HC	20.001	7.853	3.70	48.9
GRP	19250.31	11396.52	800	145700
Density	448.85	1037.135	1.1	20317.4
New MS	0.201	0.401	0	1
EDORA typology				
Predominantly urban	0.313	0.464	0	1
Agrarian	0.161	0.368	0	1
Consumption countryside	0.337	0.472	0	1
Diversified strong secondary sector	0.072	0.259	0	1
Diversified strong market services	0.115	0.319	0	1
Demographic typology				
Growing regions	0.612	0.487	0	1
Shrinking regions	0.379	0.485	0	1

4.1 Empirical model and estimations

The empirical approach in this paper is to estimate an equation to analyze the influence of key demographic factors along with control variables on population change across rural European regions. The main purpose of the analysis is to compare estimates across regions defined as shrinking or growing with regards to their population sizes. The results from running preliminary auxiliary regressions and using a White test indicate that we are able to reject the null hypothesis of homoscedasticity of the model and we therefore apply the generalized least squares (GLS) method to estimate the growth equation. In order to build an implementable version of GLS we apply the standard two stage procedure to obtain a Feasible Generalized Least Squares (FGLS) estimator (Kmenta, 1986). This implies using the residuals estimated by OLS to build a consistent estimator of the errors covariance matrix which is then used in the estimation. Hence, a growth model of the following form is estimated:

$$PC_{t,i} - PC_{t,2001} = \alpha_i + X' \beta + Y' \delta + Z' \gamma + \varepsilon_i \quad (1)$$

where PC denote the total annual change in population, t is either 2007 or 2012 and i denote the NUTS 3 regional level. Moreover, X denote the variables included to explain demographic factors (net migration, age structure and TFR), Y denote regional characteristics in terms of the initial levels of human capital, density and per capita income and Z denote variables that control for economic-structural factors using the EDORA typology.

Regression results are reported in Tables 10-11. In a first step, we estimate the model using the total sample of NUTS 3 regions and in two different specifications. The first specification includes the variables explaining demographic factors and the second specification adds the variables controlling for regional characteristics. In a second step, we estimate the model across the demographic typology to examine the relative importance of explanatory variables between regions that are either defined as growing or shrinking.

Before turning to the results, significant correlations among the regressors mainly arise between variables included in the demographic equation measuring the natural change in population (death minus births), net migration, age structure and fertility as indicated in the correlation matrix below:

Table 9. Correlations of key variables

Variables	<i>PC 01-12</i>	<i>Netmig01-12</i>	<i>Natch 01-12</i>	<i>Age +65</i>	<i>Age -15</i>	<i>TFR</i>
<i>PC 01-12</i>	1					
<i>Netmig 01-12</i>	0.9101	1				
<i>Natch 01-12</i>	0.6704	0.303	1			
<i>Age +65</i>	-0.297	0.028	-0.7356	1		
<i>Age -15</i>	0.376	0.122	0.6453	-0.567	1	
<i>TFR</i>	0.419	0.221	0.569	-0.307	0.618	1

Since the natural change in population (*Nach 01-12*) is a function of both age structure (*Age 65+ and -15*) and fertility (*TFR*) these parameters have to be estimated separately implying that natural change in population is excluded from the final model. Similarly, since per capita income is a function of both the size of regions in terms of their populations and the marginal productivity of labor, there is also significant correlations between the initial levels of per capita income, human capital and population density (correlation matrices are presented in Appendix A). It should be mentioned that per capital income is statistically significant at the one percent level when the model is estimated with all three regional characteristics and initial levels of human capital and density become insignificant. Hence, only human capital and density are considered in the estimated model.² To strengthen the interpretation of our results and examine robustness we estimate the model in two different specifications and for three different time periods (2001-2012, 2001-2007 and 2007-2012) and report the estimated condition number based on the spread

² Similarly, controlling for industry using share of employment in NUTS 3 regions within sectors defined according to the NACE rev. 2 classification add very little to the final model and is therefore excluded. Since the EDORA typology was formulated to reflect the most important differences in economic structure across European regions, controlling for the typology also implies that we indirectly control for industry structure.

in eigenvalues to indicate multicollinearity.³ Estimating the model across these time periods allows us to examine if macroeconomic conditions have any influence on the results since these time periods include high growth periods (2001-2007) and periods in which most of the European countries have faced downturns in economic growth, predominantly due to the financial crisis of 2008.

4.2 Regression results

Table 10 presents the results from running the regression model in equation 1 including the independent variables defined in Table 8. In a first step, the model is estimated using the full sample of NUTS 3 regions, thereafter controlling for regional heterogeneity by adding regional characteristics and the EDORA structural typology (Table 10). In a second step we examine the influence of the parameters using the demographic typology that divides NUTS 3 regions into shrinking and growing regions according to the discussion above, these results are presented in Table 11.⁴

From Table 10 it can be seen that adding parameters to the model improves the explanatory power and the fit of the model, the Akaike criterion reduces from 7001 to 5623, comparing the first two specifications. Moreover, judging from the contextual variation, the adjusted R square for the two specifications across the three time periods range from 0.948 – 0.967, indicating that the parameters in our model are able to explain a significant part of the total variance in population change. The parameters of the demographic equation are shown to be significant and robust across the estimations, though the magnitude of the coefficient values is reduced when regional characteristics are controlled for.

In line with expectations, the estimated parameter of net migration (*netmig*) is associated with a positive and significant value, such that increases in net migration are positively related with population change. The relative magnitude of the estimate also indicates that net migration is an important source of growth over the studied time periods. These results are in line with the theoretical discussion where migration is seen as a key factor influencing population growth discussed above. The parameters reflecting age structure (+65 and -15) have the anticipated signs reflecting reproduction potential such that regional population growth is negatively related with a high initial share of senior individuals in the regional population base and positively related to a high share of young individuals. The parameter reflecting fertility rate also has the anticipated positive and significant effect on population growth and is shown to be robust across the estimations.

Turning to the variables indicating human capital and population density. Like many previous studies, we also find that human capital (measured by share of regional population that has tertiary education) is an important determinant of growth (*Funke and Strulik 2000; Badinger and Tondl 2003; Cohen and Soto 2007*). The parameter reflecting human capital indicates a consistent

³ If the condition number is less than 100, there is no serious problem with multicollinearity, while condition numbers between 100 and 1000 reflects moderate to strong multicollinearity (Montgomery et al., 2001).

⁴ The multicollinearity indicated by bivariate correlations is low and the estimates are robust with regards to their signs and magnitude across the estimations.

positive and significant estimate across the two specifications and across the time periods. Although the parameter is shown to be significant in statistical terms its significance from an economic viewpoint is indicated to be relatively low. This suggests that the regional level of human capital does not have broader direct impacts on population change. Beeson et al. (2001) and Backman (2013) show that the measured effect of human capital is greatly reduced when measures of educational infrastructure (e.g. presence of universities) are added to the regression, suggesting that it is not just the stock of human capital that matters, but also the regions ability to produce more human capital and to replace any that it might lose through migration. Furthermore, as we proxy education or the level effect of knowledge by share of population that have tertiary education in our empirical research this may lead to biased interpretations of impacts when general intellectual achievement of school graduates changes over time and perhaps in nonlinear ways (Beeson et al. 2001). As a result of the high level of aggregation used in this empirical study we are not able to control for all these demand and supply effects since they occur at a much more disaggregated level (Bjerke, 2012; Backman, 2013).

Turning to population density, which is included to control for the size of the initial population base reflecting urbanity and to some extent also agglomeration effects. The parameter is positive and significant indicating that the initial level of the type of externalities and advantages that arise as a result of urbanization (i.e. shared infrastructures, institutions and other benefits being associated with larger cities and densely populated urban regions) are positively associated with population growth (Essletzbichler 2013). However, the economic significance is indicate to be very low, similarly to what was found for human capital (0.00002 to 0.00004). In line with the previous discussion, the type of externalities that are associated with larger cities and densely populated urban regions may vary widely in their geographical reach (Van Oort 2007; Rosenthal and Strange 2008; Andersson, Klaesson and Larsson 2012). Hence, it is not realistic to believe that we are able to capture the actual influence of density with the type of data that we have access to with regards to aggregation level.

Table 10. Regression results, FGLS estimation

Parameters	Spec: 1 estimated growth equation			Spec 2: estimated growth equation with control variables		
	2001-2012	2001-2007	2007-2012	2001-2012	2001-2007	2007-2012
	Coeff. (Std.Err.)	Coeff. (Std.Err.)	(Coeff. Std.Err.)	Coeff. (Std.Err.)	Coeff. (Std.Err.)	Coeff. (Std.Err.)
<i>Netmig</i>	1.121*** (0.007)	1.068*** (0.007)	1.108*** (0.007)	1.081*** (0.007)	1.032*** (0.006)	1.079*** (0.006)
<i>Age +65</i>	-0.051*** (0.001)	-0.046*** (0.001)	-0.081*** (0.002)	-0.064*** (0.001)	-0.064*** (0.002)	-0.097*** (0.002)
<i>Age -15</i>	0.016** (0.002)	0.033*** (0.003)	0.002 (0.004)	0.013*** (0.002)	0.027*** (0.002)	-0.006* (0.003)
<i>TFR</i>	0.255*** (0.054)	0.170*** (0.026)	0.540*** (0.075)	0.176*** (0.020)	0.070** (0.023)	0.442*** (0.028)
<i>HC</i>				0.001** (0.0005)	0.001** (0.0006)	0.0008 (0.0007)
<i>Density</i>				1.1e-04** (4.85e-06)	1.34e-04*** (5.15e-06)	0.00002** (6.32e-06)
<i>New MS</i>				-0.230*** (0.012)	-0.287*** (0.014)	-0.288*** (0.017)
EDORA typology^a						
<i>Agrarian</i>				-0.043*** (0.013)	-0.059*** (0.015)	-0.068 *** (0.018)
<i>Consumption countryside</i>				-0.019** (0.009)	-0.034*** (0.010)	-0.047** (0.013)
<i>Diversified strong secondary sector</i>				0.011 (0.017)	0.007 (0.017)	-0.006 (0.021)
<i>Diversified strong market services</i>				-0.006 (0.012)	-0.021 (0.015)	-0.040** (0.018)
Constant	0.247** (0.054)	0.037 (0.064)	0.654*** (0.074)	0.706*** (0.054)	0.656*** (0.063)	1.208*** (0.018)
N	1276	1276	1276	1274	1274	1274
Adj. R square	0.953	0.948	0.952	0.967	0.965	0.964
Akaike Criterion	6895	7001	7026	4532	5623	6546
F value	6577.32	5823.83	6362.87	3449.18	3177.96	3151.34
Condition number	25.66	23.98	39.12	18.21	56.23	22.47

***Significant at 1% level, ** significant at 5% level, * significant at the 10% level. Dependent variable PC (total annual population change). ^a Predominantly urban is the omitted category.

4.3 Comparison between shrinking and growing regions

The discussion so far has been focused on the influence of key demographic factors on population growth in Europe. The central question addressed in this paper is whether the relative importance of key determinants of population change varies across regions defined as either shrinking or growing. In order to answer this question we divide our sample of European NUTS 3 regions into those defined as shrinking regions and those defined as growing with regards to the different underlying components that explain population development. These results are presented below.

Table 11. FGLS regression results across demographic typology. Dependent variable total population change 2001-2012.

Typology	Growing regions (type 1,2 3)	Shrinking regions (type 4, 5, 6)
Parameters	Coeff. (Std.Err.)	Coeff. (Std.Err.)
<i>Netmig</i>	1.016*** (0.013)	1.00*** (0.014)
<i>Age +65</i>	-0.059*** (0.002)	-0.078*** (0.003)
<i>Age -15</i>	0.016*** (0.006)	-0.002 (0.003)
<i>TFR</i>	0.160*** (0.036)	0.171*** (0.031)
<i>HC</i>	0.001** (0.0006)	-0.0002 (0.0007)
<i>Density</i>	0.00002*** (5.72e-06)	0.00006 (0.0002)
<i>New MS</i>	-0.143*** (0.016)	-0.446*** (0.022)
Constant	0.591*** (0.102)	1.224*** (0.098)
N	795	493
R square	0.920	0.960
F value	1189.16	1232.43
Condition number	32.21	45.16

***Significant at 1% level, ** significant at 5% level, * significant at the 10% level.

Starting with regions classified as growing, the results are shown to be in line with the estimates presented above. All of the parameters included in the estimated growth equation are statistically significant and have their anticipated signs. This is also the case for parameters reflecting initial levels of human capital and density. However, the results for shrinking regions show some differences. The results indicate that none of the variables *Age -15*, *HC* and *density* are significant in explaining population growth in regions classified as shrinking. One possible explanation to the insignificance of *Age -15* is that many shrinking regions tend to have a large share of children in their population base since the ones that migrate tend to be in the age group 20-30/35. By contrast the *TFR* tend to be low, although it has not reached its full effect yet.

An insignificant estimate for human capital is also reasonable considering that shrinking regions tend to have a lower education level in general. The ones that migrate from these regions are

likely to search for higher wages and improved matching in terms of job opportunities and would naturally be drawn to regions that are growing. Furthermore, since educated individuals are more mobile than educational infrastructure (e.g. institutions for higher education), regions with permanent educational infrastructure that are capable of replacing erosion also have more significant growth advantages with regards to human capital. With some exceptions, educational infrastructure especially those for higher education tend to be found in urban regions. This would suggest that shrinking (rural) regions do not have the necessary infrastructure to create neither level effects nor cumulative growth effects in human capital.

5. Conclusions

From the analysis above following conclusions can be drawn:

- Migration is the prime driver both behind population growth and shrinkage.
- Migration will change the age structure and the reproduction potentials as it is the most active and fertile age-groups that dominate the migration flows.
- Large regions are in a better position with regard to population growth and experience less risk for shrinkage. This is valid for almost all economic-structural types (EDORA-types).
- This seems also to be valid for 'density' that show significant positive signs concerning its impact on growth and shrinkage.
- There is clear east-west divide concerning growth and shrinkage. This is primarily an effect of huge net out-migration from the east to the west but also population redistributions with the 'new' EU-member states in a monocentric direction.
- The 'new' EU-member states have also negative impact on the population changes.
- Growing regions are 'young' regions in the sense that the share of children and TFR are correlated in a positive way to population changes.
- Ageing regions are 'old' regions in the sense that the share of elderly people (65+) has negative influence on population changes.
- The east-west divide is also a consequence of, among other things, differing industrial structures different income levels where the declining agrarian regions still are more frequent in the Eastern part of Europe. This is also valid for the de-industrialization regions (Diversified regions with a strong secondary sector). The latter has no significant impact on population growth but this might be an effect of the divide between growing regions in the west and shrinking in the east within this EDORA-type.
- From bivariate correlations it can be shown that the variable GRP shows positive correlations with population growth and migration but also – not surprising – with human capital.
- The large and geographically widespread Consumption Countryside regions have significant impact on the population growth. These regions have a high share of wage-earners and employment in the public sectors an employment category that might have been hurt by the cut-drawns in the public sector during the first decade of the new century.

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Appendix A. Correlation matrices

Table A1: 2001-2012

Variables	<i>PC 01-12</i>	<i>Netmig01-12</i>	<i>Age +65</i>	<i>Age -15</i>	<i>TFR</i>	<i>HC</i>	<i>GRP</i>	<i>Density</i>	<i>New MS</i>
<i>PC 01-12</i>	1								
<i>Netmig 01-12</i>	0.9101	1							
<i>Age +65</i>	-0.297	0.028	1						
<i>Age -15</i>	0.376	0.122	-0.567	1					
<i>TFR</i>	0.419	0.221	-0.307	0.618	1				
<i>HC</i>	0.153	0.094	0.030	0.116	0.354	1			
<i>GRP</i>	0.446	0.387	0.070	0.081	0.243	0.428	1		
<i>Density</i>	0.138	0.041	-0.154	-0.018	0.117	0.223	0.394	1	
<i>New MS</i>	-0.304	-0.349	-0.465	0.048	-0.165	-0.229	-0.391	-0.085	1

Correlations are significant at the five percent level at the maximum.

Table A2: 2001-2007

Variables	<i>PC 01-07</i>	<i>Netmig01-07</i>	<i>Age +65</i>	<i>Age -15</i>	<i>TFR</i>	<i>HC</i>	<i>GRP</i>	<i>Density</i>	<i>New MS</i>
<i>PC 01-07</i>	1								
<i>Netmig 01-07</i>	0.8997	1							
<i>Age +65</i>	-0.316	0.0009	1						
<i>Age -15</i>	0.380	0.109	-0.567	1					
<i>TFR</i>	0.347	0.139	-0.307	0.618	1				
<i>HC</i>	0.056	-0.020	0.030	0.116	0.353	1			
<i>GRP</i>	0.346	0.247	0.070	0.081	0.243	0.428	1		
<i>Density</i>	0.060	-0.044	-0.154	-0.018	0.117	0.223	0.394	1	
<i>New MS</i>	-0.263	-0.268	-0.465	0.048	-0.165	-0.228	-0.391	-0.085	1

Table A3: 2007-2012

Variables	<i>PC 07-12</i>	<i>Netmig07-12</i>	<i>Age +65</i>	<i>Age -15</i>	<i>TFR</i>	<i>HC</i>	<i>GRP</i>	<i>Density</i>	<i>New MS</i>
<i>PC 07-12</i>	1								
<i>Netmig 07-12</i>	0.9172	1							
<i>Age +65</i>	-0.223	0.099	1						
<i>Age -15</i>	0.295	0.051	-0.567	1					
<i>TFR</i>	0.399	0.188	-0.309	0.621	1				
<i>HC</i>	0.216	0.161	0.022	0.127	0.358	1			
<i>GRP</i>	0.450	0.383	0.063	0.088	0.248	0.435	1		
<i>Density</i>	0.188	0.091	-0.157	-0.018	0.115	0.225	0.396	1	
<i>New MS</i>	-0.278	-0.320	-0.461	0.043	-0.169	-0.232	-0.392	-0.086	1

