Built to Last: Population Aging and Long Run Development in Metropolitan Europe*

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Abstract

The paper examines the role of demography on the growth perspectives of European Metropolitan Areas. Our findings are in support of the key role played by the demographic structure of the population in determining the economic prospects of European cities. Regions and cities with higher levels of dependency ratios are found to show lower growth rates, in the long run. This evidence supports earlier findings on the relevance of population age on both aggregate productivity changes and the human capital stock of the local labor force.

Keywords: Urban development, population aging, economic prospects

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1. Introduction

Urbanization has to be considered the most relevant phenomenon characterizing the social, economic and geographical landscape in recent years. For the first time in human history, more than 50% of world population now lives in cities. This fact is generally linked with positive economic outcomes since urbanization is often associated to development in the light of the higher productivity of urban centres. At the same time cities as cauldrons of diversity bring new exceptional challenges in terms of social equality and negative externalities of agglomeration. In spite of the broad attention devoted to the analysis of the bright and dark size of urban agglomeration, the empirical evidence in support of either one or the other view is still mixed and inconclusive.

Investigating the urbanization phenomenon in Europe has a particular relevance. Europe has a long history of urbanization and most of its economy is concentrated in cities. Despite that standardised data on European cities are not easily available and only recently the European Commission has released data on metropolitan NUTS-3 regions[1] that allow carrying out empirical analyses on the characteristics and determinants of urban agglomerates in Europe. Table 1 reports some basic data on these geographical units.

[Table 1]

The magnitude of the urbanization phenomenon and the consensus on the relevance of cities within the social and economic landscape has stimulated the need for a much stronger research effort devoted to the analysis of the determinants of their economic performance. It has been increasingly suggested that within the new globalized economy the urban dimension, more than the country dimension, is the most relevant geographical scale of analysis (*McCann and Acs, 2011*). The size of the city and its degree of connectivity, more than the size of the state, is nowadays a key determinant of the economic performance of countries and regions because of their increasing role in attracting investments, talents and firms and their capability to generate a "contextually enabling environment" for innovativeness and growth (*Glaeser et al, 2010*) developing themselves as "agglomeration centres for knowledge flows" (*Miguelez et al, 2010*). This implies further abandoning the traditional perspective of analysis that looked for a long time period at cities as very similar to countries, and based on the idea that human capital accumulation and the location of new firms had to be considered as key and self-sufficient

[1] Sefined as a NUTS-3 region or a combination of NUTS-3 regions with at least 250,000 inhabitants 50% of which should be living in a single NUTS-3 region

determinant of growth and development . Alternative and more heterodox strands of literature have emphasized different and often complementary aspects concurring to determine the performance of cities. Recently, Storper (2008) has argued that institutions and physical geography need to be considered as key factors of urban growth as both forces may provide incentives to firm location and influence the rate of return of both physical and human capital.

Going more in depth in Storper's argument it is important to underline that "Institutions" is a very broad concept which considers both de jure political institutions and de facto institutions which are the "ways that public sector agencies and private sector groups and individuals interact in detailed ways to shape the rules and resources of the economy" (*Storper, 2008; p. 9*). As for de jure institutions, the relevance of history has been convincingly documented and demonstrated. Starting from the evidence provided by Acemoglu et al. (2001) and arguing on the link between the mortality rate of European settlers in former colonies and institutional quality there has been an increasing research effort on the role of institutional aspects focused on the role that the establishment of past institutions and their persistence play in shaping current growth perspectives (*Nunn, 2008; Percoco, 2013a, 2013b*). Similar arguments are also at the heart of the well-known Putnam's (1993) interpretation of regional development patterns in Italy, for which he hypothesizes that past political institutions (i.e. experiences of free cities during the Early Middle Age) influence the present level of social capital and hence development *(Percoco, 2012)*.

As long as the "geography view" is concerned the proponents of this hypothesis, which has been often considered as in competition with the "institutions view", have considered physical and economic geography (i.e., what Krugman (1991) calls first and second natures) as important as institutions in determining economic development (*Bosker and Garretsen, 2009; MacArthur and Sachs, 2001*). However with very few exceptions (*Acemoglu et al, 2005; Bosker et al., 2008; Percoco, 2013b*) and despite the increasing consensus on the relevance of the geographical dimension the existing literature has focused on cross-country development differentials with a limited focus on its role - often proxied simply by distance from the equator- and generally found as irrelevant in determining such differentials. The increasing consensus on the role of geography and the renewed relevance that highly geographically specific conditions play under the recent globalization trend has forced scholars and researchers to go beyond this simplistic approach overcoming a concept of development as insensitive to issues like space and locational factors. The coexistence of globalization and localization trends and the impressive evidence in favour of cities as critical context for growth (*McCann, 2008*) has allowed

for a more conscious understanding of real word phenomena. The study of cross-city variation of development has been progressively linked to different measures of geography which are meant to quantify the natural advantage of cities. In this view urban development is likely to be influenced by both geography and the quality of institutions.

Despite this renewed attention on the complementary and concurring factors shaping the economic performance of cities the understanding of the dynamics at play is still far from being straightforward. To shed more light on the future prospects of urban growth we believe that a more comprehensive perspective on the determinants of economic development is key. Although apparently in competition, both the "institution view" and the "geography view" point at the existence of path dependence of economic development. Through the persistence of de facto and de jure institutions, as well as through economies of agglomeration in economic activity, institutional history and geography concur in shaping paths of economic development (*Martin and Sunley, 2006*). However, in spite of being widely accepted by scholars in the community of economic geography, the concept of path dependence, in particular when applied at detailed geographical scale of analysis, remains vague with some sporadic pieces of evidence corroborating or rejecting this hypothesis, mainly because of the lack of data and of an appropriate framework.

As summarized in Gagliardi and Percoco (2012), current literature in urban economics has extensively analysed the role human capital and its spillovers (*Moretti, 2004*), agglomeration economies (*Duranton et al., 2010*), innovation (*Crescenzi et al., 2013*), entrepreneurship (*Percoco, 2013*), institutions (*Percoco, 2013a; 2013b*). , but no research has been conducted on the relevance of demographic structure.

In this paper, we aim to shed light on the role played by population aging on development of EU metropolitan regions. To this end, we have assembled a novel dataset consisting of 163 EU metropolitan regions with information on GDP growth, education, population aging. We have estimated a growth equation over the period 2002-2010 as a function of dependency ratios and projected the dynamics of GDP per capita to 2050 by using official population projections.

The main aim of the paper is to provide consistent evidences on the relevance of demography in determining future economic scenarios in Europe. In doing that we hence developed a structured descriptive analysis of future economic trends taking into account potential evolutions in the demographic structure of European cities. We have found that demography has been the most relevant determinant of growth in Europe during the period 2002-2010 and that the correlation is robust to the

inclusion of traditional regressors such as the level of education and the sectoral composition of European metropolitan areas. Furthermore based on official population projections we found that the role of demography is likely to remain relevant in the next decades and that future growth perspectives of UK metropolitan areas will be reasonably affected by changes in the demographic structure of the population.

The paper is organized as following: the next section contains our main argument, section 3 describes the data used for the analysis while section 4 present the methodology adopted to carry out the econometric analysis and to constructs growth projections for European metropolitan areas. Section 5 discusses the main results and empirical evidences while section 6 concludes.

2. Spatial equilibrium and the economics of population

Population and its features are among the factors that are receiving most of the attention from urban scholars. The reason for such resurgence of academic interest can be found in the revitalization of the concept of spatial equilibrium (*Glaeser and Gottlieb, 2009*). According to this view, economic space is characterized by spatially homogeneous equilibrium utility as individuals maximize their individual utility with respect to location, i.e. the city in which they choose to live. Endogenous variables in this type of models are housing prices and wages across cities. One of the main results of such models is the fact that equilibrium utility is homogeneous across cities once the value of amenities is taken into account. By proxing utility with income, empirical evidence has found strong support for this view for American cities (*Glaeser and Gottlieb, 2009*).

Interestingly, Cheshire and Magrini (2009) could not find a similar pattern for European cities since national borders are found to play still a key role. In other words, in a spatial equilibrium model where migration flows are the mechanism through which economic shocks are absorbed throughout the space, Cheshire and Magrini (2009) argue that Europeans are less mobile than Americans and this in its turn imply limited spatial adjustment in Europe.

Bearing in mind that comprehensive data on migration flows among EU regions is lacking for a reasonably long time period to test explicitly for the spatial equilibrium hypothesis, the evidence in support for differences in the migration behavior between Europe and United States tends to be widely supported by the existing literature. Table 2 reports a comparison between EU NUTS-2 regions and US States in terms of labor mobility. Comparing the share of working age population who moved from other regions or countries in the year before 2006 a clear evidence emerges: Europeans are more sticky

than Americans. However, if we consider an alternative measure of labour mobility, such as the net migration rate, the figure changes slightly.

[Table 2]

Besides considerations on the spatial equilibrium model and the controversial policy implications that can be drawn from this theoretical framework, the main problem with migration flows within the context of urban and regional development is that the theory assumes that those flows are not heterogeneous in terms of quality (e.g. productivity or human capital) of workers. Migration in this context is interpreted as an adjustment mechanism able to equalize the economic differences between cities simply by moving people to the richest places – those more endowed with assets such as physical capital – with the effect of equalizing the capital to labour ratio and hence wages and income per capita.

However this is just part of the story and other theoretical approaches demonstrated that the effect of migration is not so straightforward and that a number of additional factors may generate heterogeneous outcomes. In the new economic geography core-periphery models (since *Krugman 1991*), migration generally has a dual effect on disparities, as it also reinforces agglomeration, with richest regions attracting labour and in this way increasing their home markets, which in turn contributes to the emergence of positive externalities and furthers agglomeration.

Also when endogenous growth mechanisms are included, the convergence effects of migration are not granted. For example in Faini (1996), a model of regional growth is built considering mobile factors, increasing returns to scale and diminishing returns to the reproducible factor. In such a context the paper concludes that convergence only takes place under certain circumstances.

The same holds true when endogenous growth is included in new economic geography models (e.g. *Baldwin, 1999*), as the dual effect of migrations remains.

Some empirical studies cross fertilizing a number of existing theoretical contributions suggested that the individual heterogeneity of migrants has also to be taken into account. Human capital externalities associated to the mobility of skilled individuals (*Moretti, 2004, Gagliardi, 2011, Duranton, 2007*) may operate as further agglomeration force strengthening the economic prospects of those areas that are more able to attract and take advantage from these new available sources of human capital.

Also in models without agglomeration but with labour market distortions, factor mobility can be detrimental to the labour market and income of poorest regions. In Blanchard and Katz (1992), in a model in which states produce different bundles of goods with constant returns to scale, non-idiosyncratic shocks to labour demand lead to fluctuations in wages and unemployment rates as far as there are differences between states in terms of expected income. Those differences are meant to drive migration flows which, in their turn, generate the aforementioned fluctuations

Overall the aforementioned evidence suggests that the equalization effect of migration cannot be taken for granted and that policies based on the spatial equilibrium approach and devoted at targeting specific spatial contexts are likely to underestimate a number of concurring factors as well as the sequential ripple effects at the local level, such as displacement effects and vacancy chains, that may implies an inefficient use of resources due to the failure of accounting for the real structure of local labour markets (*Gordon, 1999*). In particular, according to the spatial equilibrium view, regional disparities in terms of GDP per capita will tend to equilibrate in the long run because of migration flows. However, this view considers the movement of people in space as frictionless and technologically neutral. On this point, in what follows, we will review the literature on selective migration (i.e. migration of human capital) and on population aging, both postulating the relevance of place-based policies.

Drawing from these insights this paper is aimed at contributing to a recent and expanding line of work, which looks at workers heterogeneity as supportive argument for the fact that migration does not necessarily operate as an adjustment mechanism. Those who move out of the poorer areas are often the most skilled ones, so that the poorest regions and countries lose considerable portions of their human capital stock to the richer areas, a phenomenon referred to as brain drain (*Beine et al., 2001; Mountford and Rapoport, 2011*).

Kanbur and Rapoport (2005), in an economic geography model, show that there are reasons for migration to produce convergence as well as divergence. In particular, they focus on selectivity by education and show that the final effect is different for different values of the parameters and for the endogeneity of the education investment decision. Moreover, their model is extended to allow for network effects where past migrants increase the possibility that prospective migrants will move.

Fratesi and Riggi (2007) show that skill-selective migration flows may be due either to different wage-setting mechanisms in the regions or to the existence of different regional endowments of regional-specific assets, so that skill-selective flows take place even if workers receive a wage that equalizes

their marginal productivity and labour is homogenous. As a result, the effect of migration on regional disparities is not determined in advance.

More recently a small number of recent empirical studies have tried to tackle the issue of regional convergence and migration. An analysis without labour differentiation is performed by Maza (2006), who concludes that interregional migration flows have had a convergence effect in Spain over the period 1995-2002.

Ostbye and Westerlund (2007) analyzed the case of Norway and Sweden over 1980-2000 considering the heterogeneity across migrants as a key factor affecting the endowment of human capital in recipient areas. They conclude that the composition of migration effect dominates over the quantity effect for Norway, so that migration tends to have a divergence effect, whereas in Sweden the opposite is true and migration appears to contribute to convergence.

Coulombe and Tremblay (2009) focus on the skill intensity of native residents, international migrants and internal migrants in the case of Canadian provinces, finding that inter-provincial migrants tends to be more skilled compared to international migrants (consideration that also applies to the Italian case). Their paper does not analyze the effects of migration on income differentials, but shows that, in Canada, inter-provincial migration increases skill disparities whereas international migration lowers them, with the latter prevailing.

Hierro and Maza (2010) concentrate on the internal migration of foreign-born people across Spanish provinces. Adopting a convergence equation approach they showed that this type of migrations does not significantly affect the convergence/divergence process. Fratesi and Percoco (2012) study Italy, a country where interregional migration flows were a large and very well known phenomenon during the period between the 1950s and 1970s and in recent years, after three decades of very low labor mobility, thousands of Southern graduates have been moving again to Northern regions. On using data covering the period 1980-2001, they find that, although a slight process of convergence occurred between Italian regions, the loss of human capital in the South was detrimental to regional growth.

Finally, in addition to migration trends it has to bear in mind that the demographic structure of each geographical context is likely to be significantly affected by the natural change in population. Population ageing driven by an increase in life expectancy and a decrease in fertility rate represents an important dimension. In Europe, life expectancy rose from 69 years to 74 for men and from 76 to 80 for women in the period 1980-2005. The fertility rate declined from 2.5 to 1.5 in the period mid-60s-

1995, approaching the low-lowest fertility rate generally set at 1.3 (*Billari and Kohler, 2004*). This trend is only indicative of the general population pyramid trend as shown in table 3.

[Table 3]

Demographic change may have important economic outcomes at local level, according to the demographic dividend hypothesis proposed by Bloom et al. (2001), as population age is likely to have a significant impact on both aggregate productivity changes and the human capital stock of the local labor force. This is because older workers may be endowed with lower education and hence be less productive implying that regions and cities with older population may show lower growth rates, in the long run, or different levels of income. Interestingly enough, potential imbalances in the spatial equilibrium can hardly be absorbed through the movement of individuals in case of population ageing as older people are notably less mobile than young workers.

3. Data

This paper relies on the novel classification of EU metropolitan regions recently proposed by Dijkstra (2009). Metropolitan regions have been defined as NUTS-3 regions or a combination of NUTS-3 regions which represent agglomerations of at least 250 000 inhabitants. These agglomerations were identified using the Urban Audit's Larger Urban Zones. Each agglomeration is represented by at least one NUTS-3 region.

In order to account for the effective urban dimension and for potential commuting flows, each metropolitan areas has been constructed including any adjacent NUTS-3 region for which more than 50% of the population also lives within this agglomeration. As the metropolitan regions are based on agglomerations, which by definition include the commuter belt around a city, this approach corrects the distortions created by commuting in virtually all cases.

Dijkstra (2009) has also provided data on GDP between 2002 and 2010. We have extended that dataset by including information on education, population by age, patents, economic structure. When information on NUTS3 regions were available, we have aggregated or averaged them across regions to obtain data at metropolitan region level. In some cases, as for education, we have information only at NUTS2 level and hence have utilized this level of detail.

[Table 4; Figures 1-6]

The final list of variables included in the database is reported in table 4.

Figure 1 and Figure 2 respectively shows a cartographic representation of the level of old and child dependency ratios in 2002, the starting year of our period of analysis. The level of old dependency ratio is particularly relevant in the Eastern part of Europe and in the northern part of Italy and Spain, while the level of child dependency ratio is more accentuated in western and central Europe with peaks in Germany, France and United Kingdom. These trends reflect the structural characteristics of Europe where eastern countries experienced systematic outflows of individuals in the labour force searching better opportunities in western countries. Projections for the two indicators at 2031 are reported in Figure 3 and 4 respectively showing that the geography of the demographic structure of population tends to be fairly consistent over time. Despite this general trend it is possible to underline some distinctive dynamics in Europe. Figure 5 and 6 shows the change in the level of old and child dependency ration between 2002 and 2031 calculated based on official population projections. Interestingly in both cases it is possible to observe that some areas have experienced more pronounced trends than others. It is the case for the Eastern part of Europe that seems to be potentially interested by a further phenomenon of population aging while the opposite trend seems to emerge for some areas of Western Europe such as the northern part of Spain and Italy. More persistent is instead the evolution of the child dependency ratio that maintains higher level in the central and western part of the continent.

The distinctive geography emerging from the cartographic representation of the demographic structure of European cities in addition to the considerations coming from the empirical evidences provided by our estimation results and supporting the key role of demography in determining the growth perspectives of European cities deserve a deeper attention. In order to shed some light of the dynamic evolution of European cities in terms of economic performance with respect to the perspectives demographic trends, the coefficients coming from our estimation have been used to construct some preliminary growth projections for European metropolitan areas.

4. Methodology

The analysis on the impact of population aging on the development of EU cities has been carried out allowing for an integrated approach. As first step we adopted standard econometric techniques to

investigate whether there is any evidence of a significant correlation between the structure of the population in terms of aging and the economic performance of each city. Following that we used our estimation results to project the dynamics of GDP per capita to 2050 by using official population projections. This latter step will allow us to provide some preliminary evidences on the role of population aging as driver of long run economic development.

Unfortunately the unavailability of some data for the whole period of analysis prevents from the possibility to carry out our investigation using panel data techniques. Despite that and in order to provide some evidences on the dynamic effect of demography on growth an alternative strategy has been adopted.

The estimation equation takes the following form:

$$growth_{ic}^{2002-2010} = -\beta gdp_{ic}^{2002} + demography_{ic}^{2002} + controls + countryFE + \varepsilon_{ic} \quad (1)$$

where the dependent variable represent the growth rate of GDP between 2002 and 2010 in metropolitan area *i* and country *c* and the regressor of interest is defined by the demographic structure of the population in each metropolitan area in the beginning of the period of analysis, controlling for the initial level of GDP and a vector of additional controls. Robust Clustered standard errors by country are included to account for cross sectional dependence.

GDP –Data on GDP are at metropolitan regions are provided by Eurostat. The dependent variable is constructed as growth rate in GDP per capita over the period 2002-2010. The specification of the dependent variable in terms of growth rate is an attempt to overcome the lack of consistent panel data and provide some evidence on the dynamic effect of demography on growth after controlling for the effect of initial conditions.

Initial level of GDP - The initial level of GDP in each metropolitan area is used as a proxy for the existing local conditions potentially affecting subsequent growth trends.

Demography - Coherently with the existing literature the demographic structure of each metropolitan area is proxied by customary indicators such as old and child dependency ratios. The old dependency ratio is calculated based on the share of population above 65 year old while the child dependency ration is based on those below 14 years old. The two categories represents that portion of population that is not in the labour force interpreted as “productive” segment.

Controls - Our specification also includes a number of additional controls for population density at the metropolitan area level, education in term of share of people with tertiary education and sector structure measured by the share of employment by aggregated sectors. The sectoral composition is controlled for by using data on employment for three sectors: agriculture, industry and services and is interpreted as a measure of specialization.

The estimation results regarding the role of the demographic structure of the population and the magnitude of its impact on GDP are also used to project the dynamics of GDP per capita to 2050 based on official population projections. This implies that the estimated coefficients of our regressors of interest have been used to account for the impact of population aging on GDP and to project the evolution of GDP over time.

5. Results

Results for our main estimation equation are reported in table 5. In column 1 our key regressors of interest are included, namely the old and child dependency ratio after controlling for the initial level of GDP. As expected both regressors are negatively correlated to growth and highly significant at 5% and 1% respectively. This preliminary evidence confirms that the structure of population may play a role in determining the economic perspectives of European cities. Those cities with the highest share of "unproductive" individuals are those experiencing the lowest growth rate during the period under analysis. Column 2 includes controls for education and population density. Despite showing the expected sign none of them is a significant determinant of long run growth. Finally column 3 controls for the sectoral structure of each metropolitan area without showing any consistent evidence of a significant effect. Interestingly enough our regressor of interest remains significant and negatively correlated to growth in all specifications confirming the existence of a robust correlation between the demographic structure of the population and the growth perspectives of EU metropolitan areas.

[Table 5]

The relevance of our demographic variables suggests some interesting considerations on the role that this dimension may play in the future development scenarios. The relevant debate on the progressive aging of the European population for example may become even more relevant in the light of these results. In order to provide evidence on the relevance of demography within the economic landscape

European cities results coming from our estimation equation have been used to project the evolution of GDP over time suing official population projections.

Figure 7 shows the cartographic representation of GDP per capita in 2002, the starting year of our period of analysis. The map emphasizes the emergence of areas characterized by higher level of GDP per capita mainly concentrated in the central and western part of Europe with distinctive peaks for metropolitan areas such as London, Paris, the northern part of Italy and other traditional high income spots in Germany, Denmark and Netherlands. Figure 8 shows the baseline projections of GDP per capita at 2031 based on our estimated rate. Interestingly enough the map emphasizes a distinctive change in the growth perspectives of European cities with the Eastern part of Europe that seems to be interested by a more pronounced positive evolution of GDP over time. This future trend confirms the current tendency towards a significant increasing in the level of wealth for Eastern European countries that after the enlargement in 2004 and 2007 outperformed the rest of Europe in terms of economic performance.

Projections reported in Figure 8 provide evidence of the potential future European scenarios assuming a certain level of stability in terms of level of education, sectoral composition and demographic structure of the population. This latter assumption is particularly relevant considering that demographic variables seem to be the most significant determinant of European growth during the period 2002-2010. This reasonably implies that changes in the demographic structure of the population are likely to affect significantly the future growth prospects of Europe and this feature is even more relevant if we take into consideration that those areas that are likely to experience higher level of growth in the next decades (based on our estimation results) are also those characterized by higher level of dependency ratios particularly with respect to the elder segment of the population.

In order to account for the concurrent evidences our GDP projections have been replicated considering the potential evolution in the demographic structure of the population based on official population projections provided by Eurostat. Despite demonstrating a certain level of consistency in the growth perspectives of European metropolitan areas with Eastern European regions that are likely to be interested by more pronounced future growth rates (Figure 9) a more accurate analysis of our data support the relevance of demography as determinant of perspective income levels. Figure 10 shows the change in GDP per capita projections comparing our baseline model reported in Figure 8 and that in Figure 9 where changes in the dependency ratios are taken into account. Interestingly enough the evolution in the demographic structure of European cities seems to play a significant role in particular

with respect to the level of old dependency ratios. Higher levels of dependency ratios will consistently affect the future growth perspectives of European cities slowing down the potential increase in the level of wealth. This trend is particularly accentuated for Eastern Europe but it will affect significantly also areas in the central part of the continent with peaks in Spain, UK, France and Germany.

The econometric analysis support the existence of a robust correlation between customary measures of demographic structure and the growth rate of EU regions over the period 2002-2010. The evolution of demographic trends will reasonably affect future growth perspectives of European cities slowing down the economic potential of those areas that will reasonably experience higher levels of dependency ratios, namely those cities characterized by a further raise in the ratio between unproductive and productive segments of the resident population.

6. Concluding remarks

The role of demography as key determinant of the economic performance of cities, regions and countries has been deeply analysed within the existing literature. Population ageing driven by an increase in life expectancy and a decrease in fertility rate is likely to play a key role within the European context (*Billari and Kohler, 2004*). As supported by Bloom et al. (2001) population age is likely to have a significant impact on both aggregate productivity changes and the human capital stock of the local labor force because older workers may be endowed with lower education and hence be less productive (*Gagliardi and Percoco, 2012*). This further implies that regions and cities with older population may show lower growth rates, in the long run, or different levels of income.

This empirical evidence has strong policy implications. Potential imbalances in the spatial equilibrium can hardly be absorbed through the movement of individuals in case of population ageing as older people are notably less mobile than young workers.

The estimation results support the evidence in favour of a robust correlation between demographic measures and growth. Our cartographic representations show that demography is likely to play a key role in determining future prospects of European metropolitan areas. In the interpretation of our finding it has to be bear in mind that the analysis of causality is beyond the scope of this paper and that any causal prediction has to be taken with caution. Future research will improve along with the quality of data.

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Table 1: Basic data on metropolitan regions

	Country	Number of metropolitan regions	% Population in 2006	Change in population share 2000-2006	% GDP	Change in GDP share	GDP per capita in PPS, EU=100 Metropolitan	Non-metropolitan	National
1	BE	5	42.2	0.2	53.8	0.4	151	95	118
2	BG	3	31.2	2	47.4	9.4	56	28	37
3	CZ	4	51.5	0.2	60.2	2	91	63	77
4	DK	4	67.7	0	70.9	0.4	129	111	123
5	DE	55	62.2	0.6	67.6	0.1	126	99	116
6	EE	1	38.8	0.5	61.1	4.2	103	42	65
7	IE	2	53.8	-0.4	66.5	1.1	182	107	147
8	GR	2	46.2	0.7	58.5	4.4	119	73	94
9	ES	22	74.2	0.3	76.3	0.1	107	96	104
10	FR	30	65.1	0	72.3	0	122	87	109
11	IT	26	53.1	0.3	57.1	1	111	95	103
12	CY	1	100	0	100	0	90		90
13	LV	1	47.9	0.7	68.3	2.6	75	32	53
14	LT	2	45	0.5	57.6	5.1	71	43	56
15	LU	1	100	0	100	0	267		267
16	HU	3	41	0.4	55.8	4.4	86	48	64
17	MT	1	92.4	0.1	94.1	0.2	78	59	77
18	NL	14	64.6	0.2	69.8	0.7	142	111	131
19	AT	5	46	1.2	56.5	-0.2	153	100	124
20	PL	22	58.9	0	68.7	n/a	61	40	52
21	PT	2	38.4	0.3	48.6	-1.1	97	64	76
22	RO	8	32.6	0.1	46.1	2	54	31	38
23	SI	2	40.9	0.3	49.5	2	106	75	88
24	SK	2	25.6	-0.1	38.3	0.8	95	53	64
25	FI	3	43.6	1.2	52.4	0.4	138	97	115
26	SE	3	50.8	0.9	57	0.5	136	106	121
27	UK	34	72.8	-0.1	77	0	127	102	120
	EU27	258	58.7	0.5	66.9	0.0	114	80	100

Source: Dijkstra (2009)

Table 2: Labour mobility in US and Europe (2006)

	US	EU-27	EU-15	EU-12
Share of working age residents who moved from a different region/state	1.98%	0.96%	1.12%	0.34%
Share of working age residents who moved from abroad	0.76%	0.30%	0.34%	0.16%
Net migration	0.40%	0.32%	0.40%	-0.03%

Source: Gakova and Dijkstra (2008)

Table 3: Population ageing in Europe 2005-2050

Eurostat base scenario, EU-25	2005-2050 (in %)
Total population	-2.1
Children (0-14)	-19.4
Young people (15-24)	-25.0
Adults (25-39)	-25.8
Adults (40-54)	-19.5
Adults (55-64)	+8.8
Adults (65-79)	+44.1
Adults (80+)	180.5

Source: Eurostat, EUROPOP2008

Table 4: Variables List

Variable	Description	Source
GDP Growth 2002-2010	Growth rate in GDP per capita between 2002 and 2010	EUROSTAT
GDP 2002	GDP per capita in 2002	EUROSTAT
Aged Dependency Ratio	Population above 65 year old over working age population	EUROSTAT
Child Dependency Ratio	Population below 14 year old over working age population	EUROSTAT
Higher Education	Share of population with a university degree	EUROSTAT
Population Density	Total population over surface	EUROSTAT
Employment in A-B NACE Sectors	Share of Employment in sectors A-B	EUROSTAT
Employment in C-F NACE Sectors	Share of Employment in Sectors C-F	EUROSTAT
Employment in G-P NACE Sectors	Share of Employment in Sectors G-P	EUROSTAT

Table 5: (Cumulative) Growth Regression

VARIABLES	(1) GDP growth 2002-2010	(2) GDP growth 2002-2010	(3) GDP growth 2002-2010
GDP 2002	-0.367	-0.557***	-0.557**
	(0.214)	(0.161)	(0.216)
Aged dependency ratio	**-0.931****	**-0.818****	**-0.542****
	(0.382)	**(0.320)**	**(0.209)**
Child dependency ratio	**-1.634*****	**-1.535*****	**-1.170*****
	(0.351)	(0.444)	(0.235)
Higher education		0.144	0.0898
		(0.269)	(0.224)
Population density		0.0564	-0.0757
		(0.0986)	(0.154)
Employment in A, B NACE sectors			-0.0423
			(0.124)
Employment in C-F NACE sectors			-0.157
			(0.0992)
Employment in G-P NACE sectors			0.243
			(0.139)
Constant	11.28**	11.11***	9.646**
	(4.042)	(3.820)	(3.846)
Coutry FE	yes	yes	yes
Observations	163	149	137
R-squared	0.842	0.839	0.840

Note: *** p<0.01, ** p<0.05, * p<0.1 - Clustered - robust standard errors in parentheses

Figure 1: Old Dependency Ratio 2002

Figure 2: Child Dependency Ratio 2002

Figure 3: Old Dependency Ratio 2031

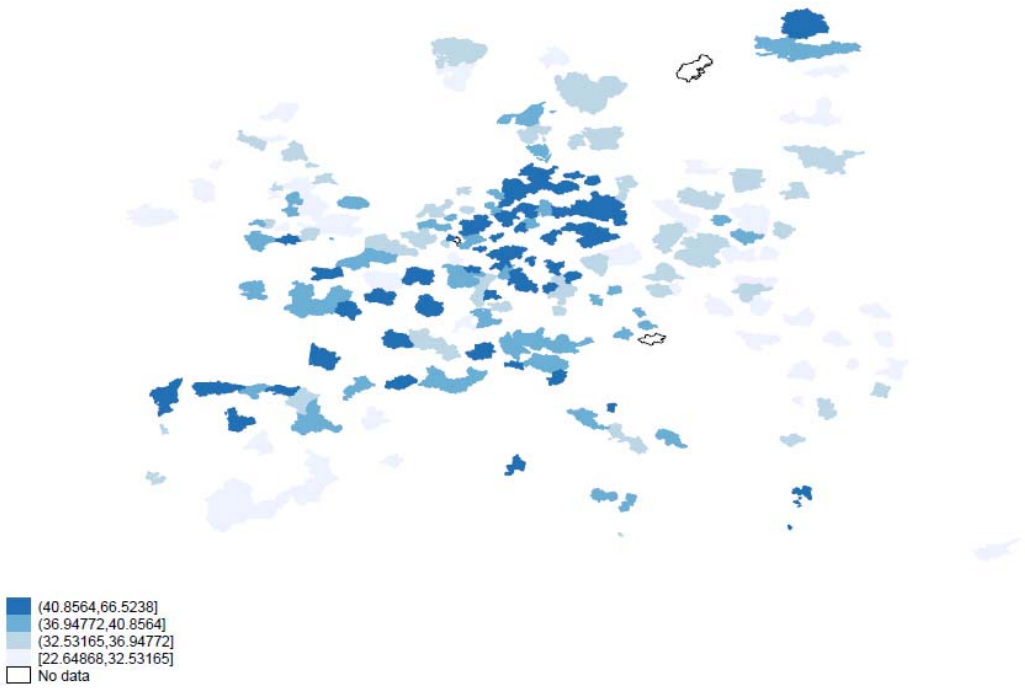


Figure 4: Child Dependency Ratio 2031

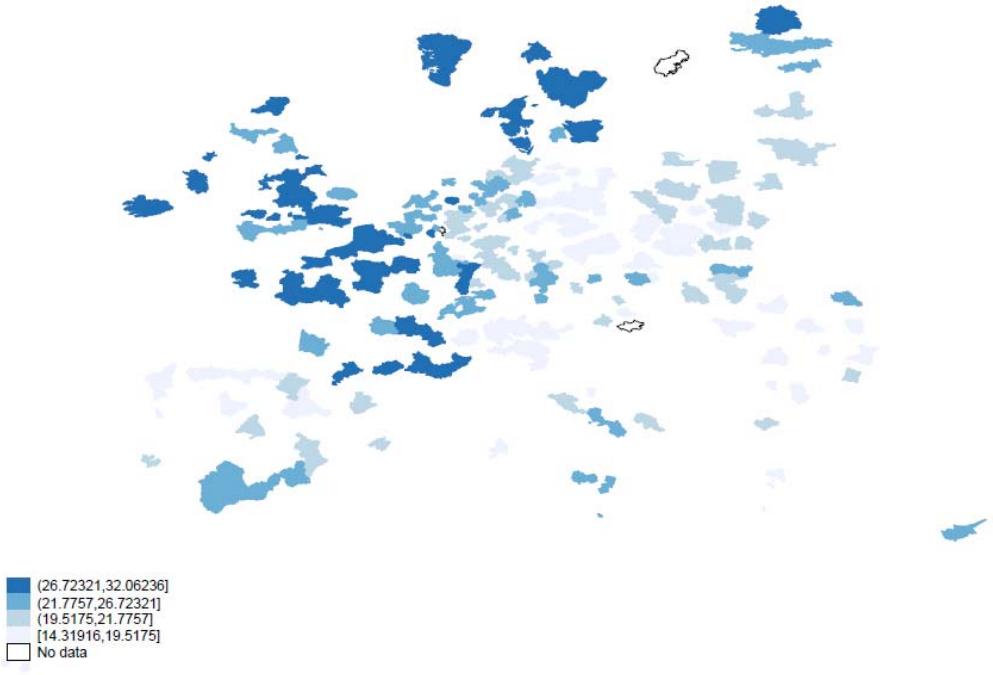


Figure 5: Change in the Old Dependency Ratio

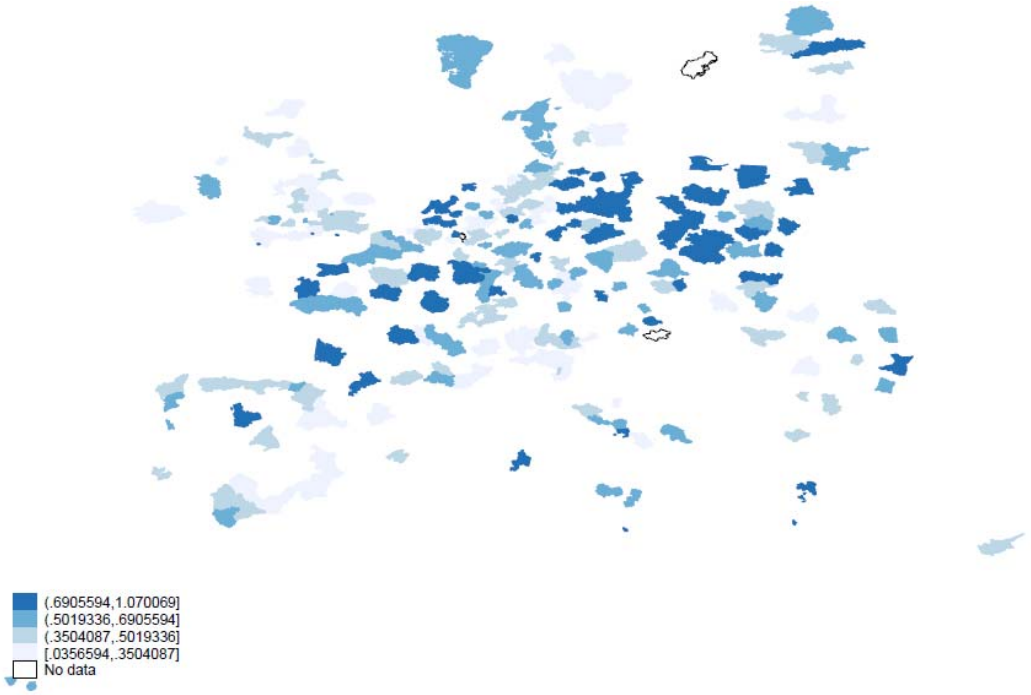


Figure 6: Change in the Child Dependency Ratio

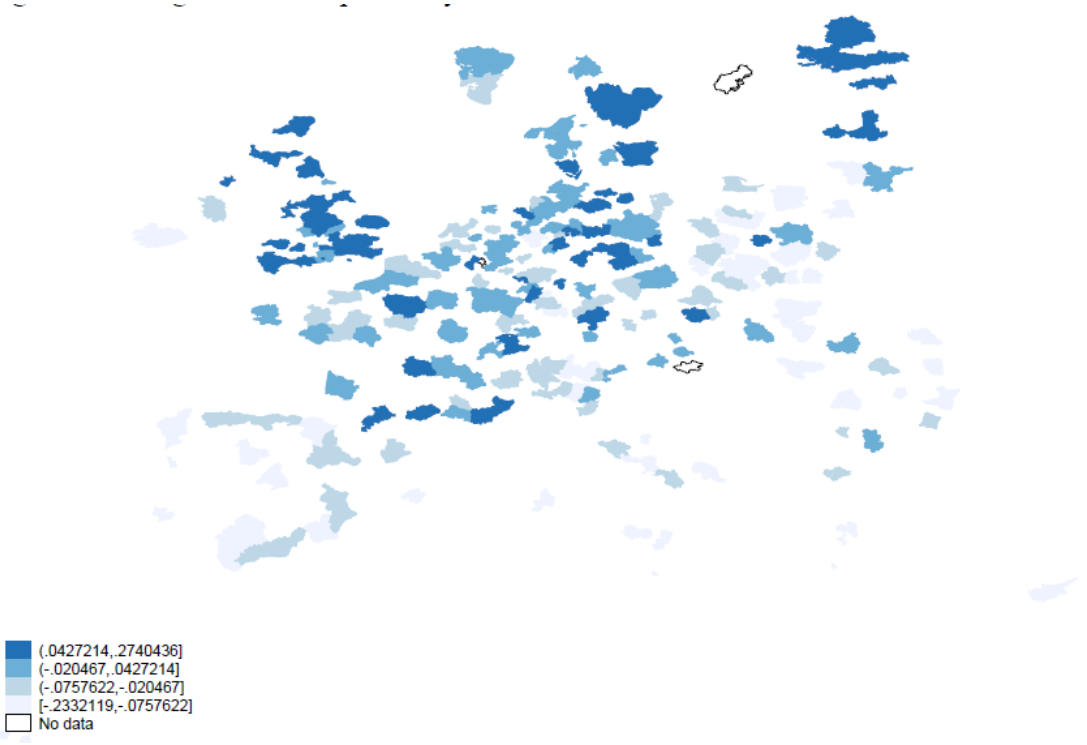


Figure 7: GDP per capita in 2002

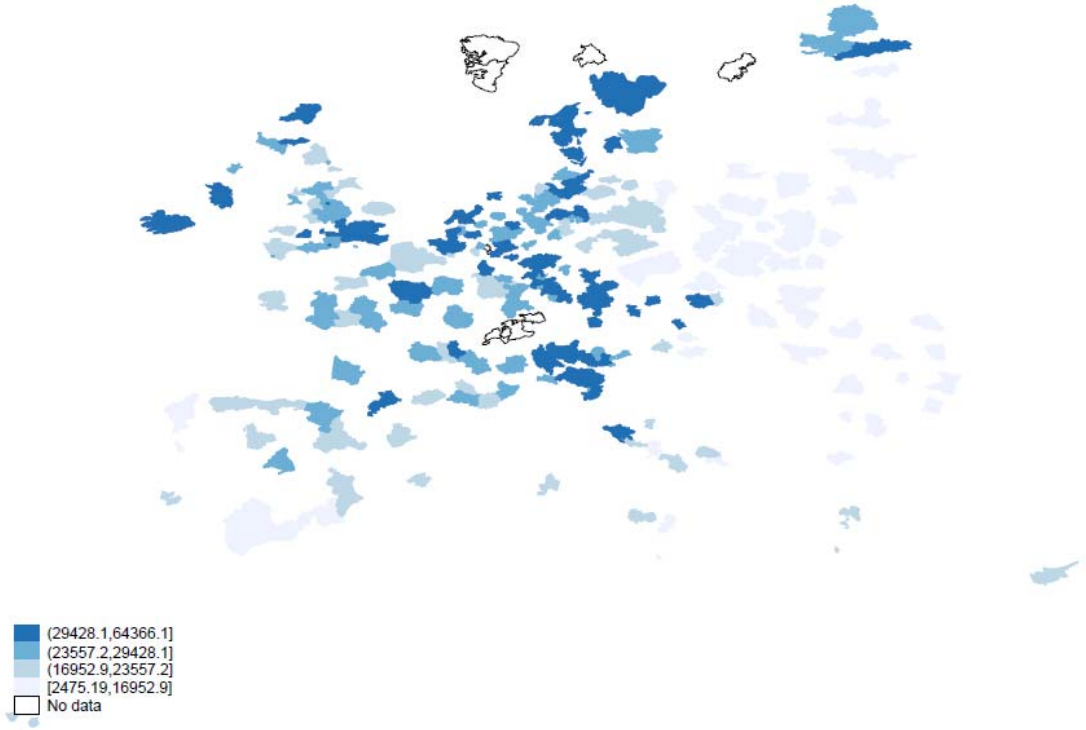


Figure 8: Baseline GDP per capita projections in 2031

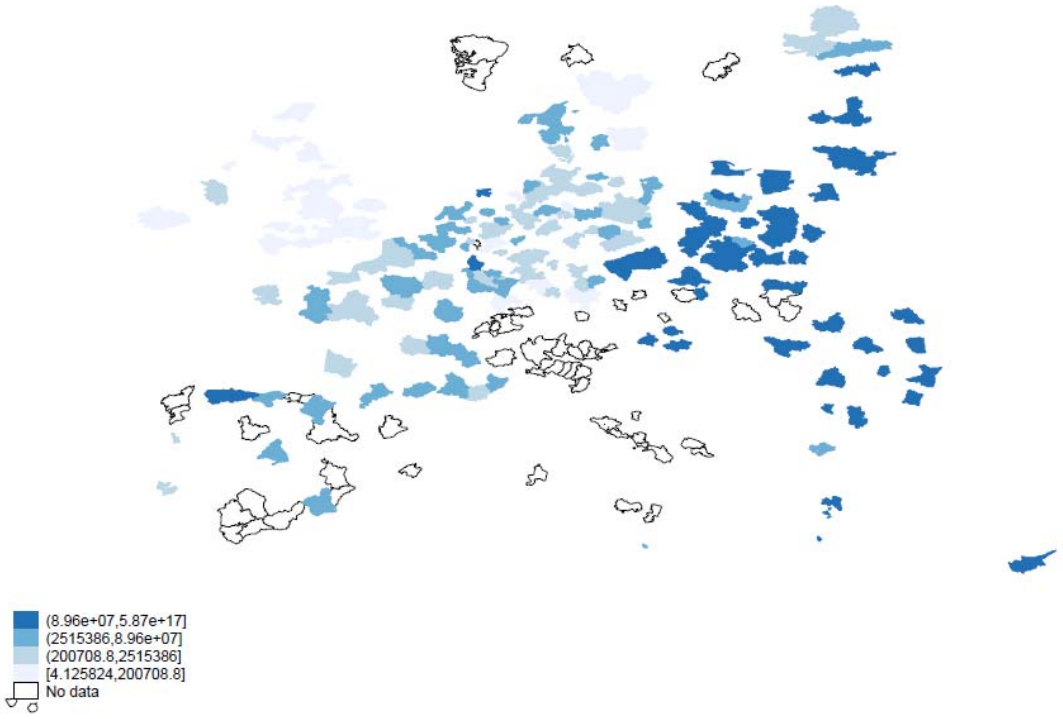


Figure 9: Projected GDP per capita in 2031with changes in the dependency ratio

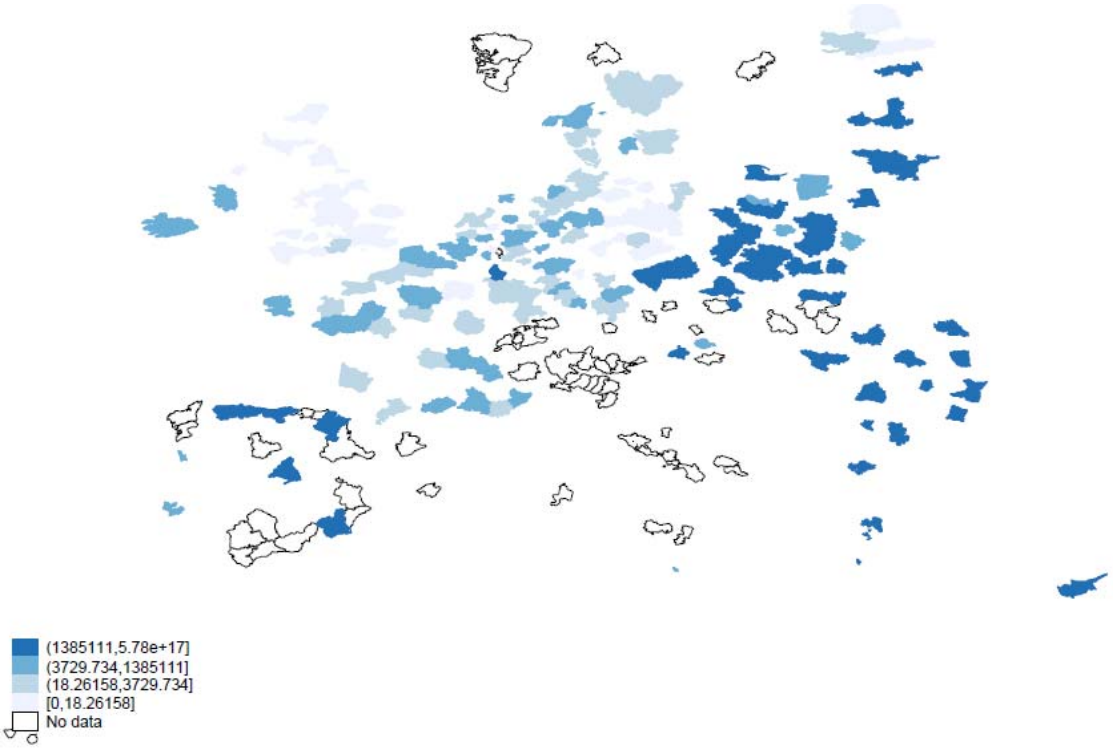
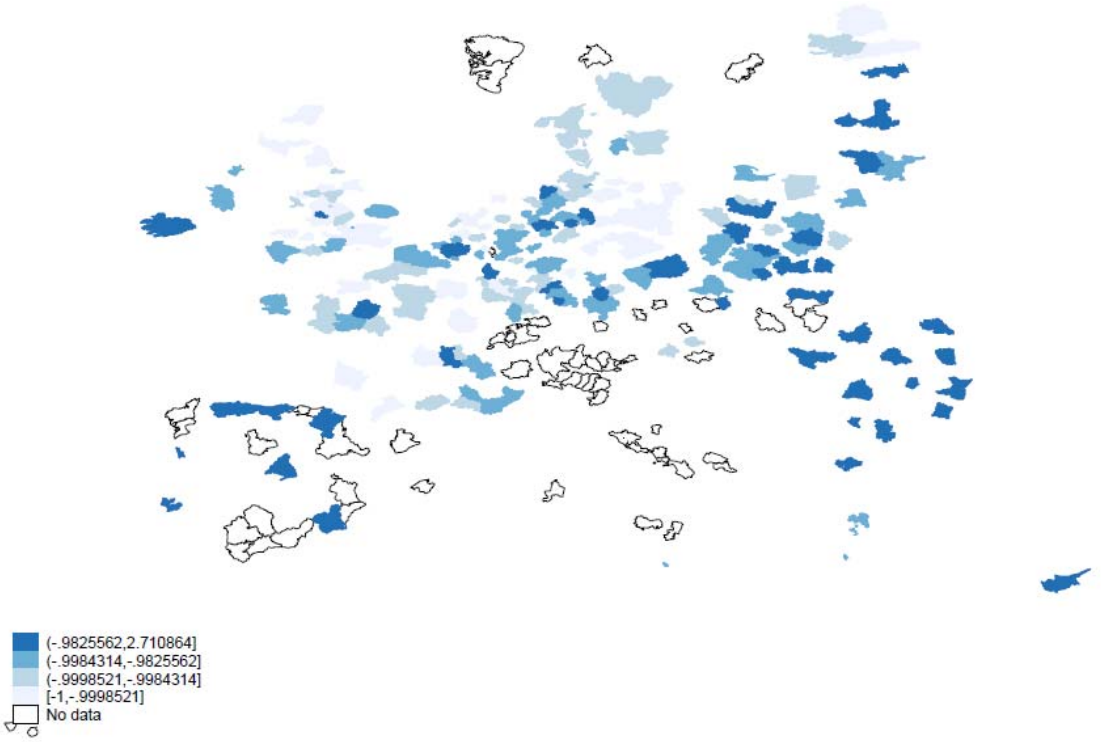


Figure 10: Change in the GDP per capita projections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