

European integration and its effects on population in border and peripheral regions

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Abstract

This paper contributes to the literature that explores the effects of European integration, providing new evidence about its impact on population distribution in the EU28 regions (NUTS 3 level) during the period 2000-2018. The main objectives are to explore the effects of the recent three EU enlargements on the growth in population share within the border regions and to compare the behaviour between core and peripheral regions. We use an empirical difference-in-difference approach. The findings show that border regions experienced positive effects on growth in population share since EU integration, but it did not completely reverse their relative population decline. At the same time, the process of European integration seems to have aggravated the demographic decline of EU peripheral regions compared to the EU core regions. Moreover, for the regions that are both border and peripheral, the EU integration effect has been stronger than in border only regions.

Keywords: border, core-periphery, demographic change, regions, European integration

Introduction

The European economic integration process started in the 1950s with six founding members. As a consequence of successive step-by-step enlargements, the European Union (EU) now has 27 members and a total population of about 500 million people, making it one of the largest integrated markets in the world. The enlargement of the EU has increased the diversity of the regions in the EU which,

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combined with globalisation, migration and demographic change, has led to the development of new core-periphery patterns (Ahner, 2015). Cores of economic strength are distinguished from peripheral regions, which are those on the margins, typically rural and often lagging behind economically.

Managing this diversity is thus a central aim of European policy. In particular, the cohesion policy aims to reduce regional and social imbalance, which the Single Market tends to exacerbate (Faludi and Peyrony, 2011). Despite attempts by the cohesion policy to shape its programme to improve territorial integration and encourage cooperation between regions, the dynamics have shown that large regional asymmetries persist, suggesting, in relative terms, that results have not matched expectations (Rodríguez-Pose and Garcilazo, 2015; Butkus *et al.*, 2018; Rodríguez-Pose and Ketterer, 2020). These imbalances constitute new challenges for policy makers, economic agents and society, in particular at the level of the type of investments to be made, the location of economic activities and the quality of services provided, making the design and implementation of territorially based policies very difficult.

In fact, the disparities in economic activity between regions are typically more significant when the distance between regions is larger and where there are artificial obstacles such as border restrictions (Krugman, 1980, 1991; Fujita *et al.*, 1999). This suggests that border regions are of special interest because they experience a larger range of changes in their market access compared to the core regions, particularly at the multiple stage of the EU integration process. A line of thought emphasises the importance of the border effect on trade in general by using the gravity model (e.g. McCallum, 1995; Anderson, 2011). Another line of research, found in the literature on the new economic geography (e.g. Krugman, 1991) focuses on the role of market access in explaining the distribution of economic activities geographically. Whether the border integration effect is positive or negative remains an open empirical question.

The core-periphery dichotomy is another issue of increasing interest for authors that explore the impact of economic integration on regional disparities. A key difficulty relates to the definition of peripherality which can range from “any country or region affected by structural weaknesses” to “areas with very poor accessibility and low population density” (Davies and Michie, 2011). In particular, there is not an objective way of defining the periphery, nor a distinctive identification of the core and peripheral countries of the EU. For example, taking a geographic criterion, the European periphery could be defined as comprising the countries on the edge of the EU. However, some relatively geographically central European countries have been considered peripheral, while others have changed their status from core to peripheral. Thus, while the concepts of core and periphery are found everywhere, their precise definitions remain elusive in the debate surrounding European integration (Campos and Macchiarelli, 2018).

Although the study of border effects has been the focus of considerable academic attention for some years now, relatively little research has been done on the EU integration effect on population for NUTS 3 regions. In addition, the empirical evidence of the impact on behaviour in its peripheral regions is even scarcer. Thus, the main goal of the present paper is to contribute to the literature by exploring the effects of European integration, providing new evidence about its impact on population distribution in the border and peripheral regions, paying special attention to regions that are both border and peripheral. We analyse data for NUTS 3 regions in the EU from 2000 to 2018 and we employ the difference-in-difference estimation approach. The definition of peripheral regions is based on the urban-rural typology developed by the European Commission that classifies NUTS 3 regions as either predominantly rural, intermediate, or predominantly urban.

This paper is organised as follows. After the introduction, Section 1 presents an overview of the European integration process. Section 2 examines different definitions of peripherality. Section 3 contains the empirical analysis, which involves the description of the data and methodology used, as well as a discussion on the econometric results. The final remarks are presented in the conclusion.

1. European integration process

The origins of the process of economic integration in Europe date back to the aftermath of the Second World War. It is in the context of the destruction caused by this war that the first ideas of European integration emerged with the goal of a closer union of the European peoples in order to achieve political and economic integration. In 1957, the European Economic Community (EEC) was established, with the initial aim of increasing economic cooperation between six countries (Belgium, Germany, France, Italy, Luxembourg and the Netherlands).

Since then, the integration process has evolved by becoming both deeper (changing from a customs union to a monetary union) and wider (from 6 to 28 member states). In 1973, the first enlargement of the EEC took place, with the entrance of Denmark, Ireland, and the United Kingdom. Greece joined in 1981, with Portugal and Spain following in 1986. In 1995, Austria, Finland, and Sweden joined the EU. In 2004, the EU registered its biggest enlargement, when ten countries (Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia) became EU members. In 2007, Bulgaria and Romania joined the Union and, in 2013, Croatia became the 28th Member State.¹

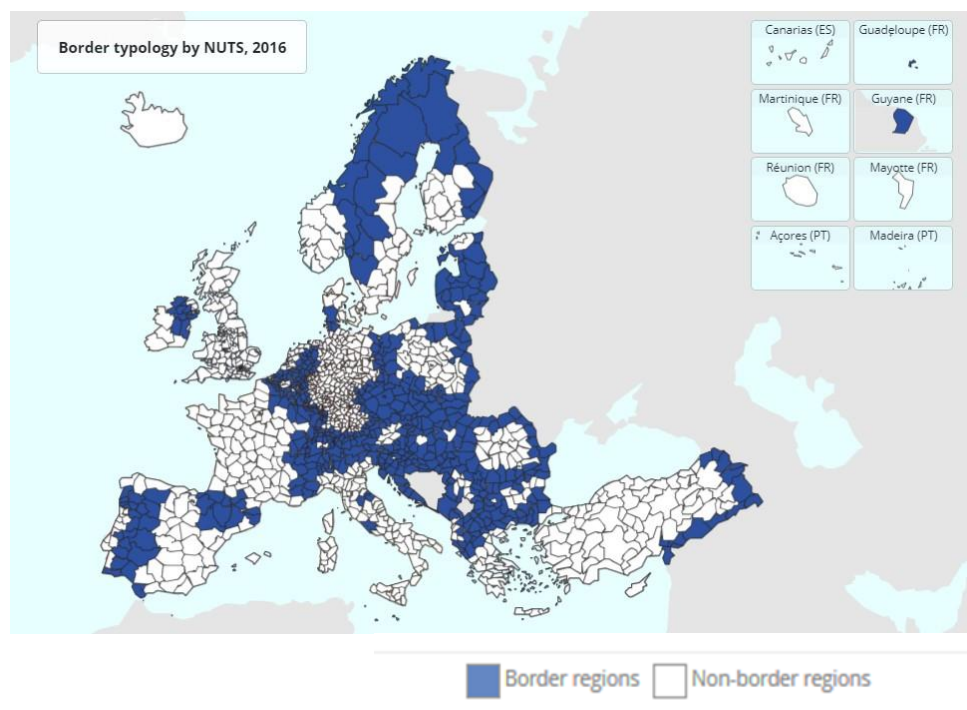
On 31 January 2020, for the first time, one member - the United Kingdom - left the EU.

The completion of the single market in 1993 is one of Europe's biggest achievements. Legislation to uphold and carry forward the principles of the EEC,

¹ Hence, we cover the last three enlargements of EU.

enshrined in the Treaty of Rome in 1957 was enacted with the Single European Act of 1986 which has facilitated a closer, more effective economic union, which in turn has bestowed better and cheaper goods and services across the EU over more than 25 years. The abolition of border barriers, inherent to the EU integration process, influenced transportation and trade costs and the factor mobility, and has presumably changed the market access of both firms and consumers (Figure 1). In this context, the accession of new members greatly increased the diversity of the regions in the EU, the total population of EU and the potential market access for the EU members. At the same time, the removal of a border results in an immediate reduction in transaction costs across borders, in turn affecting the spatial allocation of people in the EU and the distribution of economic activities geographically.

Figure 1. Border and non-border regions: NUTS 3 in EU-28 and in 9 non-member European countries



Source: Eurostat²

From a theoretical perspective, borders are a hindrance to trade since they cut between regions which would otherwise be in economic collaboration, thus

² Retrieved from <https://ec.europa.eu/eurostat/cache/RCI/#?vis=border.typology&lang=en>.

reducing their potential. Also border region barriers result in ‘contiguity diseconomies’ that reduce development potential and efficiency. When a border is abolished, two types of positive effects are expected: the first results from taking advantage of factor cost differentials and the second relates to the exploitation of complementarities and economies of scope (Sohn and Licheron, 2018). However, border regions experience a significant adjustment pressure due to increased competition in product and labour markets (Niebuhr, 2006). In the New Economic Geography models, this is called the price-competition effect, and could tend to decrease rather than increase market access.

As a consequence, the net effect from economic integration is an open question and has to be estimated empirically. Some studies (Hanson, 2001; Redding and Sturm, 2008; Brakman *et al.*, 2012) point out that the border regions are expected to benefit more from increased market access. In particular, using a difference-in-differences estimation approach, Brakman *et al.* (2012) analyse the effects of EU integration on population distribution of the cities and regions of EU member states across the national borders, between 1990 and 2008. Their results show that negative border effects are compensated by higher population growth following EU integration. Specifically, Brakman *et al.* (2012) find a positive empirical effect of EU enlargement, as measured by the growth of population share along integrated borders. However, the overall effect of borders on neighbouring regions remains negative.

In conclusion, although spatial effects of economic integration have been a central topic of regional science for a long time, the spatial effects on border regions of the process of EU integration remains unclear. In fact, regions that are close to the border are of special interest in the stepwise enlargement of the EU, because they experience more drastic changes in terms of market access than regions further away from the border. Additionally, this diversity of regions and their dynamic over time has led to the development of a core-periphery pattern in Europe.

2. Defining the periphery

The prolonged economic crisis in Europe after 2009 stimulated interest in finding a deeper understanding of the dynamics of core and periphery in the EU, particularly in EMU (De Grauwe, 2018). Contributors to the literature agree that macroeconomic imbalances were one of the most important causes of the European crisis (Correia and Martins, 2019), and that peripheral countries have become the most vulnerable to the vicissitudes of the crisis (Correia, 2016). In particular, some authors argue that the EMU crisis can be understood as the outcome of a structural imbalance between “core” and “periphery” countries (e.g. Lapavitsas *et al.*, 2010), with the core countries running large external surpluses, high growth and low unemployment rates while the peripheral countries have current account deficits, causing a build-up of debt, low growth and high unemployment rates. Due to the

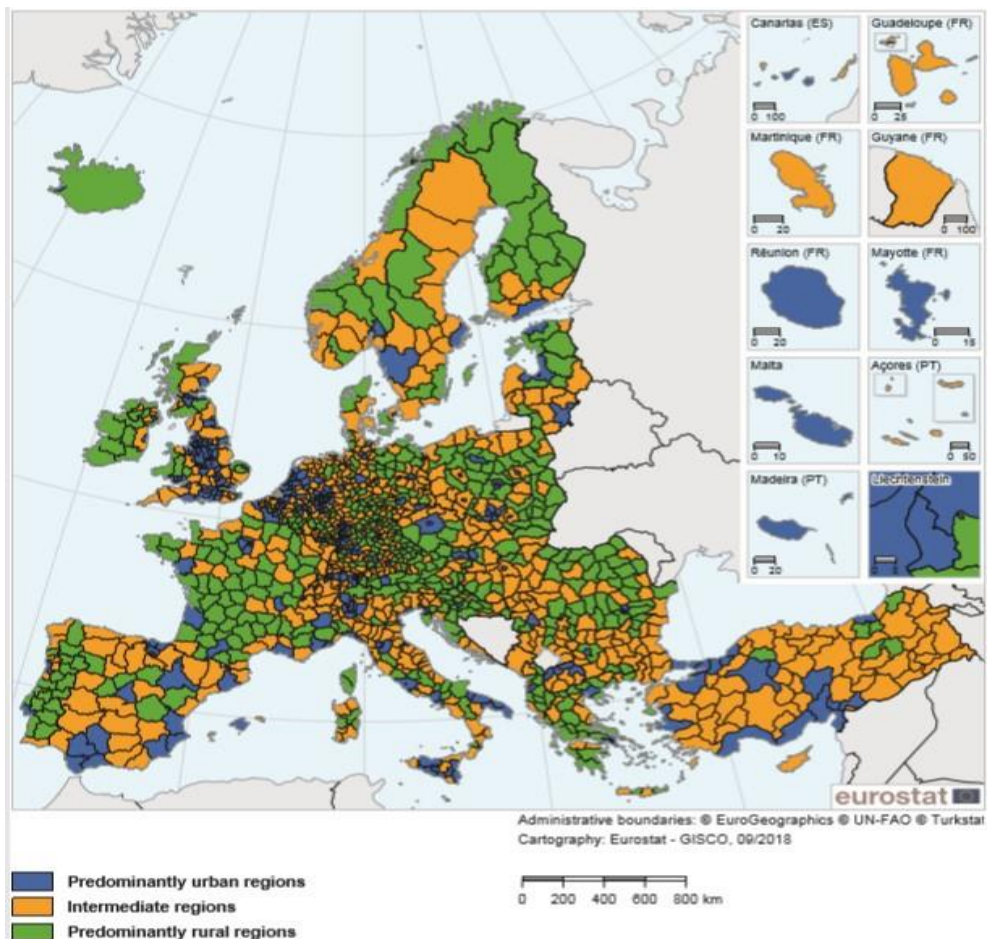
sovereign debt crisis, the economic heterogeneity in the EMU has received closer attention and some authors have advocated helping the periphery by a redistribution of aggregate demand from core to periphery, so as to reduce the external surpluses of the former and foster GDP growth in the latter (Bonatti and Fracasso, 2017).

Historically, the paper by Bayoumi and Eichengreen (1993) is one of the first papers to identify a core-periphery pattern in the run-up to the inception of EMU. Based on optimal currency area (OCA) theory and using a modified Blanchard and Quah (1989) decomposition for pre-EMU data, they find that there is a core where shocks are highly correlated (Germany, France, Belgium, Netherlands and Denmark) and a periphery where this correlation is significantly lower (Greece, Ireland, Italy, Portugal, Spain and UK). They warn that if persistent, this core/periphery division would be detrimental to the EMU project. After Bayoumi and Eichengreen, many studies are based on static binary classifications, but a different approach was proposed by Campos and Macchiarelli (2018), placing countries along a core to periphery continuum, that flags up the probability of a country being classified as peripheral. The results from the application of this new measure show that the core and periphery pattern has changed considerably since the creation of euro. They identify a newer and increasingly integrated group of core countries (Austria, Belgium, Germany, France, Italy and Netherlands), an entrenched periphery (Finland, Ireland, Norway, Portugal, and Switzerland), and a third set of countries marked by in-and-out movements (Denmark, Sweden, Greece, Spain and the UK). It is noteworthy that different countries join the core in different years, which confirms endogenous OCA predictions that euro membership and more flexible product market regulations (or trade openness) increase the probability of being in the core, while other members remain consistently and obstinately on the periphery as predicted by Bayoumi and Eichengreen's.

Taking a wider perspective of the EU, Bartlett and Prica (2017) consider the economic growth interdependency between core and periphery and identify three distinct peripheries: (i) an inner periphery, that includes those EMU countries that have suffered a deep recession as a result of the 2009 crisis (Cyprus, Greece, Ireland, Italy, Portugal and Spain); (ii) an outer periphery, including those countries that are within the EU and have not adopted the euro, but has also suffered from the spillover effects of that crisis (Bulgaria, Hungary and Romania); and (iii) a super periphery that consists of countries that are outside both the EMU and the EU, namely the western Balkans and of the eastern European neighbourhood, but with currencies tied to the euro (Albania, Croatia, FYR Macedonia and Serbia). For its part, the core appears to be divided into two groups: (i) an inner core, corresponding to the core countries within the EMU and the EU (Austria, Belgium, Finland, France, Germany, Netherlands) and (ii) an outer core, relating to the core countries outside the EMU but within the EU (Czech Republic, Denmark, Estonia, Latvia, Lithuania, Poland, Slovakia, Sweden, UK).

Similarly, at the regional level the concept of periphery is neither unified nor static. Indeed, arriving at a definition of a peripheral area or region may involve different approaches (anthropological, geographical and sociological) and incorporates a dynamic dimension (Pezzi and Urso, 2016). The literature presents several definitions which qualify zones as peripheral, ranging from the premise that peripherality is the opposite of accessibility (geographical distance from a centre), to a perspective that looks at both accessibility and population density (Davies and Michie, 2011).

Figure 2. EU urban-rural typology of NUTS 3 regions



Source: Eurostat, JRC and European Commission, Directorate-General Regional and Urban Policy and Directorate-General Agriculture and Regional Development

A common characteristic of many studies is the use of socio-economic indicators, like GDP and unemployment rates, to classify the peripheral position (Werner *et al.*, 2017). Although having different emphases, the studies point out the same types of problems of peripheral areas (Davies and Michie, 2011): poor accessibility to large markets and service centres, low population density and/or falling or ageing populations, low availability and quality of local public services (e.g. health care, education) and infrastructure.

Despite differences of opinion about what constitutes peripherality, various types of regional classifications are based on an urban-rural typology. The European Commission's classification, for example, building on work already done by the Organization for Economic Cooperation and Development (OECD), classifies the NUTS 3 regions as: predominantly urban, intermediate or predominantly rural (Eurostat, 2019). According to this typology, for the current NUTS 2016 classification of 1348 NUTS 2016 level, 3 regions in the EU-28, 367 were classified as predominantly urban regions, 553 as intermediate regions and 428 as predominantly rural (Figure 2).

3. Empirical analysis

This section includes the description of the data, the methodology applied, the interpretation and discussion of results.

3.1. Data and methodology

We used data for the population of European regions (NUTS 3 level) from Eurostat, for the period 2000-2018. The information included concerns the 28 EU countries and nine non-member European countries, giving a total number of 1,517 regions (Table A.1 in the appendix presents the list of countries and the number of regions of each country).

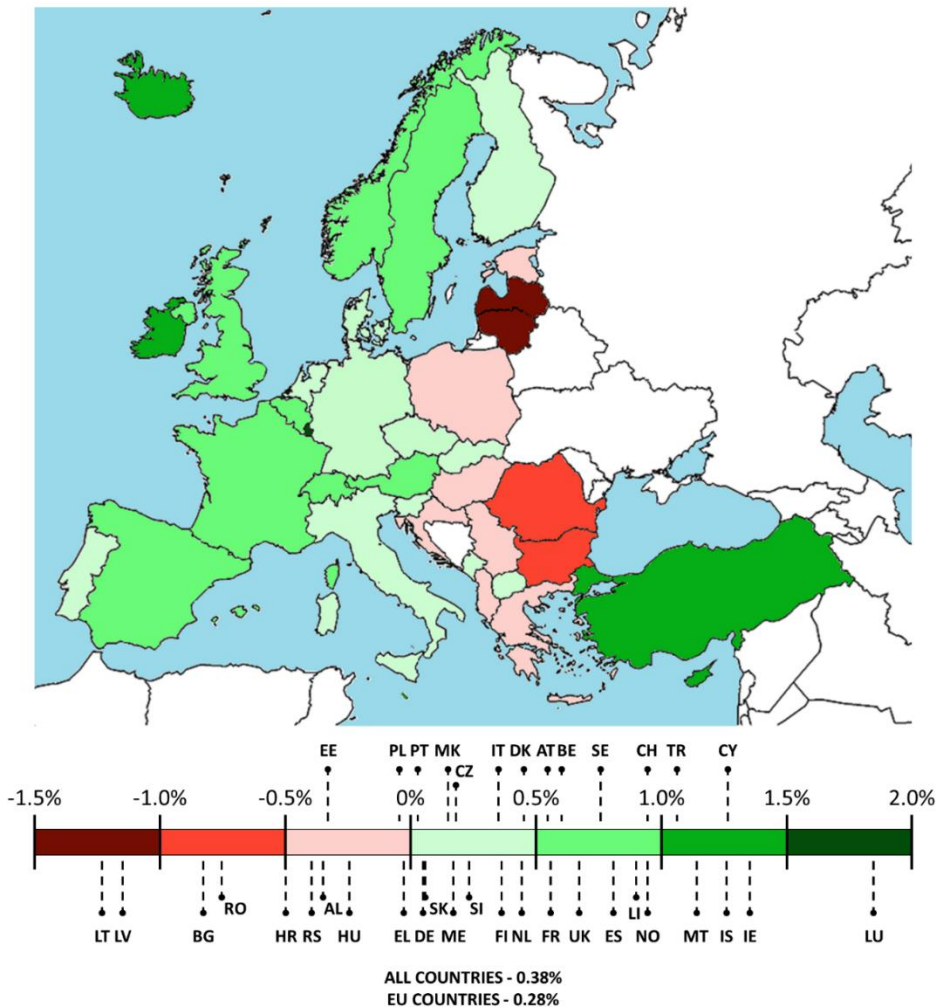
During the period of analysis, the EU population grew from 487,259,080 in 2000 to 512,372,000 in 2018, corresponding to an average annual growth rate of 0.28% (Figure 3).

The growth was higher in the group of non-EU countries (0.87%), giving an annual growth rate of 0.38% for all the countries in the sample. In the EU, nine countries registered a negative annual growth rate, eight of them being countries involved in the enlargements (Bulgaria, Estonia, Croatia, Hungary, Lithuania, Latvia, Romania and Poland); only four countries grew more than 1% (Ireland, Cyprus, Luxembourg and Malta). Outside the EU, the annual growth rate was negative in Albania and Serbia and above 1% in Iceland and Turkey.

Of the 1,517 regions analysed, 553 corresponded to border regions and 458 to peripheral regions (37% and 30% of the regions, respectively). In the definition of border regions, we adopted the classification of Eurostat that is based on the

existence of a land border within 25 km. To make the distinction between peripheral regions and core regions, we adopted the EU rural-urban typology, taking as peripheral regions the predominantly rural ones. The border regions and peripheral regions are marked in blue and green in the previously presented Figures 1 and 2, respectively.

Figure 3. Average annual growth rate of population, by country, 2000-2018



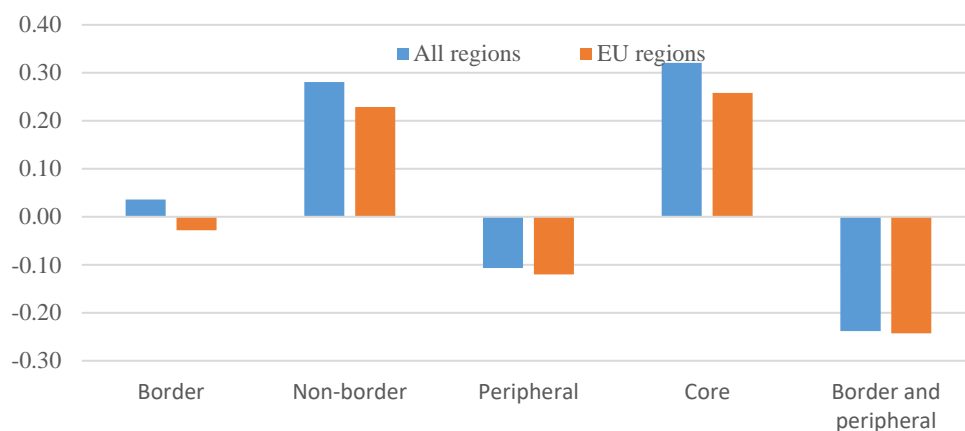
Source: authors' representation based on data from Eurostat

Note: The acronyms for countries are explained in Table A.1 in the appendix.

As the analysis shows, there was a heterogeneous population growth across categories of regions (Figure 4). There was a negative evolution of population in both the peripheral and EU border regions, which is more accentuated when the regions were simultaneously both border and peripheral. Conversely, the population living in the core regions and in the non-border regions grew in the 2000-2018 period.

Given the different performance of population growth between all the regions (from the 28 EU countries and nine non-member European countries) and just the EU regions, as revealed in our study, we decided to consider these two samples to check the respective results.

Figure 4. Average annual growth rate of population, by type of region, 2000-2018



Source: author's calculations based on data from Eurostat

Concerning the methodology, we used the difference-in-differences (DID) approach. This methodology has become an increasingly popular way to estimate causal relationships. The DID estimation is simple and integrates the advances of the fixed effect estimators with causal inference analysis when unobserved events or characteristics confound the interpretations (Angrist and Pischke, 2008).

The basic premise of the DID approach is to study the impact of some 'treatment' - we compare the performance of the treatment group pre- and post-treatment relative to the performance of a control group pre- and post-treatment. To account for time trends unrelated to the 'treatment', the change experienced by the treatment group is adjusted by the change experienced by the control group.

The DID estimator approach is often used for estimating the effect of policy interventions (Athey and Imbens, 2006). For example, Slaughter (2001) investigated the impact of the trade liberalization on the per capita income convergence, and Gibbons and Machin (2008) studied how housing prices are affected by three policy relevant urban issues: transport accessibility, school quality and crime. This last

paper of Gibbons and Machin (2008) has a completely different field of research to the present paper, but it presents an important conclusion: the DID approach is an efficient spatio-temporal framework within which to evaluate the impact of changing features over time while accounting adequately for spatial features that remain fixed over time. This conclusion, and the research carried out by Brakman *et al.* (2012) concerning the effects of EU integration on the populations of border regions, encouraged us to adopt this methodology to investigate the impact of EU integration on population distribution in border and peripheral regions over time.

We defined two different models to obtain a more accurate picture of how the European integration process affected demographic evolution in border and peripheral regions, respectively. In model A, the treatment group comprised border regions, with the control group being the non-border regions. In a similar way, in model B, the treatment group and the control group were the periphery and core regions, respectively. In both models the ‘treatment’ was the European integration process (Table 1).

Table 1. Model A and model B: main variables of DID approach

	Model A		Model B	
	Treatment variable		Treatment variable	
Treatment group	Border (region with a land border within 25 km)	Variable <i>integrationA</i> is equal to one at time <i>t</i> when an EU integration border within its reach was abolished	Peripheral (region predominantly rural)	Variable <i>integrationB</i> is equal to one at time <i>t</i> when the respective country is a member state of the EU
Control group	Non-border	Variable <i>integrationA</i> is equal to one at time <i>t</i> when the respective country is a member state of the EU	Core	Variable <i>integrationB</i> is equal to one at time <i>t</i> when the respective country is a member state of the EU

Source: authors’ representation

We estimate the following two equations:

$$\text{Model A: } \text{Popsharegrowth}_{it} = v_i + z_t + \beta \text{border}_r + \gamma (\text{border}_r * \text{integrationA}_{it}) + \varepsilon_{it}$$

$$\text{Model B: } \text{Popsharegrowth}_{it} = v_i + z_t + \alpha \text{periphery}_r + \lambda (\text{periphery}_r * \text{integrationB}_{it}) + \mu_{it}$$

Both models A and B include country (v_i) and time (z_t) as fixed effects. The explained variable ($\text{Pop share growth}_{it}$) is the annual rate of growth of the population share (expressed as a percentage), where the population share is the weight of the population of each region within the total population of the respective country.

In model A, border_r is a dummy equal to one when the region r is a border region. Regarding model B, periphery_r is a dummy equal to one when the region r is a peripheral region. In both models, the ‘treatment’ variable concerns the European

integration process, but the dummy variables $\text{integratio}nA_{rt}$ and $\text{integratio}nB_{rt}$ are defined differently (Table 1). For non-border regions (model A) and for peripheral and core regions (model B), the ‘treatment’ variable is equal to one at time t when the respective country is a member state of the EU. In the case of border regions, we took into account that the European integration process only affects some of these border regions. Therefore, the variable $\text{integratio}nA_{rt}$ is equal to one at time t when an EU integration border within its reach was abolished, which is the definition used by Brakman *et al.* (2012). This means that the border regions of 14 country pairs were affected in 2004, while in 2007 and 2013 the border regions of 3 and 2 country pairs were affected, respectively.

The coefficient β (α) captures any systematic difference in population growth rate between border and non-border regions (peripheral and core regions). The main coefficients, the difference-in-differences coefficients, are γ and λ on the interaction between border/periphery regions and EU integration, and this explains the relative changes in population growth between the treatment and control group. Concerning border regions, and taking into account the empirical conclusions of other studies (e.g., Brakman *et al.*, 2012), we expect that regions that are close to an abolished border resulting from the EU integration process will experience a relative population increase. Thus, the coefficient γ should be positive. In the case of peripheral regions, we are not able to make comparisons because, as far as we know, there are no other empirical studies that have analysed this issue for NUTS 3 regions in the EU. So, the estimated signal of coefficient λ could be positive or negative.

Table 2. Average annual growth rate of population share, for total and EU regions, 2000-2018

	All regions			EU regions		
	Regions	Observations	Mean (%)	Regions	Observations	Mean (%)
Border	553	8970	-0.16	475	8002	-0.15
Non-border	964	16303	-0.08	867	14872	-0.05
Peripheral	458	7531	-0.29	427	7208	-0.27
Core	1059	17742	-0.04	915	15666	0.00
Border and peripheral	191	3113	-0.34	176	2975	-0.32
Total	1517	25273	-0.11	1342	22874	-0.09

Source: authors' calculations based on data from Eurostat

Table 2 presents some information about the population share for the whole sample and for EU regions, by categories of regions, for the 2000-2018 period. All types of regions showed a decrease of their population share with the exception of

core EU regions whose population is stabilized. This contraction is greater in the peripheral regions than in the border regions, but the decrease of population share is even more evident in regions that are both border and peripheral.

3.2. Econometric results

The estimates of Model A and B for the whole sample (all regions), and for the EU regions alone, are presented in Table 3. The value of differences-in-differences approach depends on the quality of the control group and, as stressed by Slaughter (2001), it is not obvious how best to select these groups. Thus, we chose to consider two samples, all regions (from the 28 EU countries and nine non-member European countries) and EU regions alone, to check the respective results.

Table 3. Estimations of Model A and B: all regions and EU regions

	Model A		Model B	
	(1)	(2)	(3)	(4)
Border	-0.1315*** (-2.6734)	-0.2891*** (-4.1053)		
Border*integrationA	0.1074** (2.0725)	0.2662*** (3.6441)		
Periphery			-0.3300*** (-4.167)	-0.1283 (-1.618)
Periphery*integrationB			0.0078 (0.0974)	-0.1928** (-2.4253)
Sample	All Regions	EU Regions	All Regions	EU Regions
Observations	25273	22874	25273	22874
R²	0.034	0.030	0.058	0.057

Notes: Robust standard errors in parentheses; *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: authors' calculations based on data from Eurostat

In model A, estimations (1) and (2), the border effect (β) is negative and significant in both estimates for all regions and for EU regions, being higher in absolute terms in the EU border regions. Thus, the results prove that border regions are poor performers relative to the non-border regions, mainly in the EU. The border integration effect (γ) is positive and, as expected, has a greater impact in EU regions. As a result of the integration process, the population share growth rate for border regions rises by about 0.11 and 0.27 percentage points per year in all regions and EU regions, respectively.³

³ It is interesting to note that the name of the methodology derives from its form of calculation. The coefficient 'difference in differences' is equal to the change in mean outcomes for the treatment group (in model A, border regions) minus the change in mean

Regarding model B, and estimations (3) and (4), when we consider the regions of the 37 European countries, we find that the periphery effect (α) is negative: more negative than the border effect of estimation (1), although the periphery integration effect (λ) has no statistical significance. Thus, it seems that the change in population share growth rate after EU integration in peripheral regions is not significantly different relative to the same change in core regions. Unlike in the EU regions, the periphery effect has no statistical significance, but the effect of peripheral integration has a negative and significant coefficient.

Since the decrease of population share is even more evident in regions that are both on the border and peripheral, we estimate model A to be appropriate for the subsample of peripheral regions and model B for border regions only. The results are reported in Table 4.

Table 4. Estimations of Model A and B: subsamples

	Model A		Model B	
	(1)	(2)	(3)	(4)
Border	-0.3899*** (-5.3374)	-0.5082*** (-6.0016)		
Border*integrationA	0.4213*** (5.2889)	0.5400*** (5.8709)		
Periphery			-0.3884*** (-5.4176)	-0.1892* (-1.8796)
Periphery*integrationB			0.0983 (1.3393)	-0.0995 (-0.9817)
Sample	All Peripheral Regions	EU Peripheral Regions	All Border Regions	EU Border Regions
Observations	7531	7208	8970	8002
R²	0.090	0.095	0.090	0.101

Notes: Robust standard errors in parentheses; *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: authors' calculations based on data from Eurostat

When we consider the subsample of the peripheral regions, the sign and the statistical significance of the coefficients are similar to the results of model A presented in Table 3, but the coefficients are higher in absolute terms for both estimates concerning all peripheral regions and EU peripheral regions (estimations (1) and (2) of Table 4). Thus, the border and peripheral regions present a larger decrease of population share relative to the non-border peripheral regions, but the

outcomes for the control group (in model A, non-border regions). Slaughter (2001) highlights that what matters for a control group is its outcome change relative to the treatment group's outcome change, not its overall outcome relative to that of the treatment group.

integration process had also a greater positive effect in these regions. More importantly, in both estimations, the border EU integration effect in peripheral regions seems to compensate for the relative decline of the population in border and peripheral regions.

Regarding model B, we find that the periphery effect is negative and has statistical significance in both estimations relative to all border regions and EU border regions, but its absolute value is greater when we consider the regions of the 37 European countries than when we consider the 28 EU countries. Thus, also in the case of border regions, the findings indicate that the demographic contraction of peripheral regions was more pronounced in European countries that are not member states of EU. In the subsample of the border regions, the periphery integration effect has no statistical significance. The integration process did not contribute to a differentiated demographic evolution between the peripheral border regions and the core border regions, as in estimation (4) of Table 3, because the integration effect was positive in the border regions.

3.3. Discussion of results

The findings of our first model show a positive effect of the EU integration process within the border regions that could be perceived as a success of the integration process. However, this positive effect is smaller than the negative effect of being a border region of EU, suggesting that the EU integration did not completely reverse the relative demographic decline in border regions. These results are in line with those of Brakman *et al.* (2012).

The findings of the core-periphery dichotomy indicate that EU integration has contributed to the decline of population in peripheral regions of the EU countries when compared to changes in population in their core regions. Although there is no study to enable direct comparison, these results are in line with the literature on migration that, in general, associates emigration with the status of “periphery” and immigration with a more prosperous “core” and better wages. Additionally, the study of Bourdin (2019), based on 147 NUTS 3 regions (belonging to 8 member states of Central and Eastern Europe) over the period 2000-2016, shows a positive effect of the cohesion policy on regional growth, which is higher for the core regions than for the peripheral regions. The author highlights that regional differences have increased since structural funds have more influence on the core regions than on the peripheral ones, creating a virtuous circle for core regions and a vicious circle for peripheral regions.

With regard to both border and peripheral regions, the results suggest that the effect of border integration in the EU is positive and stronger in these regions compared to the border only regions. These findings are in line with those of Camagni *et al.* (2020), who used NUTS 2 regions of 19 countries of the EU for the period 1980-2015 and investigated the relationship between the deepening and

widening processes of EU integration and the historical evolution of regional disparities. They concluded that the conditions of countries and regions in economic unions are very different and that the latest enlargements “triggered (and exacerbated) intranational disparities, since strong urban areas were the fastest to take advantage of the integration process, widening the gap with weaker regions”. According to the authors, these could happen because the central regions are the main beneficiaries of new investments and are in a better position to compete on the international markets while “weaker regions might lack some preconditions for modern development”. Also, Butkus *et al.* (2018), by using 1,242 NUTS 3, NUTS 2 and NUTS 1 distributed among 28 EU countries, concluded that the disparities become sharper and converge less clearly as they analysed smaller territorial units.

Overall, our findings suggest that EU regional policy should be designed to take into account the peripheral/rural regions where population decline has not yet been averted. Policy makers should focus on this problem in such a way that European integration can help these regions to reverse the situation. Local stakeholders and regional institutions also should bear this in mind in order to claim suitable measures to their territories. Moreover, it is important that the scientific community explores this issue in a deeper way, such as by using more detailed data and including more variables, given that NUTS 3 has not yet received the same attention as NUTS 2.

Conclusions

Several forms of barriers to the movement of workers, goods and services have been removed over the past few decades in Europe with important repercussions in terms of territorial dynamics. This paper examines the impact of the economic integration process on the spatial distribution of populations in border and peripheral regions (NUTS 3 level) in Europe. To achieve this, we applied a difference-in-difference estimation approach to the three enlargements that took place from 2000 to 2018, and adopted the definition of peripheral regions based on the EU urban-rural typology.

Our results reveal that the effect of the European economic integration process on border and peripheral regions is mixed. On the one hand, we find a positive effect of EU integration on growth in population share in border regions, suggesting that integration compensates to some extent for the negative border location. On the other hand, when we consider the peripheral regions, we conclude that there is an outflow of population and that the process of European integration seems to have aggravated the demographic decline of EU peripheral regions compared to the EU core regions, suggesting a vicious cycle of geographical, social and economic marginality. Moreover, for the regions that are both border and peripheral, we conclude that the border EU integration effect is positive and stronger in these than in border regions, but the EU integration process does not contribute to a differentiated demographic evolution between the peripheral border regions and the core border regions.

This new empirical evidence on the consequences of economic integration on border and peripheral regions provides additional elements for policy makers to improve the “tools” that may provide some assistance to these territories in the context of EU cohesion policy. For example, the individual characteristics of border and disadvantaged regions, and the specificity of the places within them, calls for a rethinking of the territory on a more microeconomic and localized scale and going beyond “one-size-fits-all” political solutions. In another words, the current NUTS 2 level used to define and assess cohesion policy, does not take into consideration the geographical specificities that are frequently prevalent at the NUTS 3 level. Consequently, if the debate is restricted to this scale only, a lot of information is lost and the results will not reflect reality, since there is a great heterogeneity of sub-regions within NUTS 3.

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References

- Ahner, D. (2015), Foreword, in: Copus, A. K. and Lima, P. (eds.), *Territorial cohesion in rural Europe*, NY: Routledge, pp. xix-xxiii.
- Anderson, J. E. (2011), The gravity model, *Annual Review of Economics*, 3, pp. 133-160.
- Angrist, J. D. and Pischke, J.-S. (2008), *Mostly Harmless Econometrics: An Empiricist's Companion*, New Jersey: Princeton University Press.
- Athey, S. and Imbens, G. (2006), Identification and inference in nonlinear difference-in-difference models, *Econometrica*, 74(1), pp. 431-497.
- Bartlett, W. and Prica, I. (2017), Interdependence between Core and Peripheries of the European Economy: Secular Stagnation and Growth in the Western Balkans, *European Journal of Comparative Economics*, 14(1), pp. 123-139.
- Bayoumi, T. and Eichengreen, B. (1993), Shocking Aspects of European Monetary Integration, in: Giavazzi, F and Torres, F. (eds.), *Adjustment and Growth in the European Monetary Union*, Cambridge: Cambridge University Press, pp. 193-235.
- Blanchard, O. and Quah, D. (1989), The Dynamic Effects of Aggregate Demand and Aggregate Supply Disturbances, *American Economic Review*, 79(5), pp. 655-673.
- Bonatti, L. and Fracasso, A. (2017), *Addressing the core-periphery imbalances in Europe: resource misallocation and expansionary fiscal policies*, EconPol Working Paper, No. 6, ifo Institute, Munich (retrieved from https://www.ifo.de/DocDL/EconPol_Working_Paper_06_2017_core-periphery_imbalances.pdf).
- Bourdin, S. (2019), Does the Cohesion Policy have the same Influence on Growth Everywhere? A Geographically Weighted Regression Approach in Central and Eastern Europe, *Economic Geography*, 95(3), pp. 256-287.

- Brakman, S., Garretsen, H., van Marrewijk, C. and Oumer, A. (2012), The border population effects of EU integration, *Journal of Regional Science*, 52(1), pp. 40-59.
- Butkus, M., Cibulskiene, D., Maciulyte-Sniukiene, A. and Matuzeviciute, K. (2018), What is the evolution of convergence in the EU? Decomposing EU disparities up to NUTS 3 level, *Sustainability*, 10(5), pp. 15-52.
- Camagni, R., Capello, R., Cerisola, S. and Fratesi, U. (2020), Fighting Gravity: Institutional Changes and Regional Disparities in the EU, *Economic Geography*, 96(2), pp. 108-136.
- Campos, N. and Macchiarelli, C. (2018), *Symmetry and Convergence in Monetary Unions*, LEQS Discussion Paper, No. 13, London School of Economics and Political Science (retrieved from <https://www.lse.ac.uk/european-institute/Assets/Documents/LEQS-Discussion-Papers/LEQSPaper131.pdf>).
- Correia, L. (2016), The European Crisis: Repercussions on the Portuguese Economy, *Athens Journal of Mediterranean Studies*, 2(2), pp. 129-144.
- Correia, L. and Martins, P. (2019), The European crisis: Analysis of the macroeconomic imbalances in the rescued euro area countries, *Journal of International Studies*, 12(2), pp. 22-45. doi:10.14254/2071-8330.2019/12-2/2.
- Davies, S. and Michie, R. (2011), *Peripheral Regions: A Marginal Concern?*, European Policies Research Centre Paper, No. 6 (retrieved from <https://www.eprc-strath.ac.uk/public/dam/jcr:2d3d3259-8f99-4769-9576-196531a32ff2/EoRPA%20paper%202011-6.pdf>).
- De Grauwe, P. (2018), *The Economics of Monetary Unions*, Oxford: Oxford University Press, 12th edition.
- Eurostat (2019), *Methodological manual on territorial typologies: 2018 edition*, Luxembourg: Publications Office of the European Union.
- Faludi, A. and Peyrony, J. (2011), Cohesion Policy Contributing to Territorial Cohesion - Future Scenarios, *European Journal of Spatial Development*. Refereed article No. 43 (retrieved from https://relocal.eu/wp-content/uploads/sites/8/2017/01/refereed_43.pdf).
- Fujita, M., Krugman, P. and Venables, A. J. (1999), *The Spatial Economy Cities, Regions, and International Trade*, Cambridge: The MIT Press.
- Gibbons, S. and Machin, S. (2008), Valuing school quality, better transport, and lower crime: evidence from house prices, *Oxford Review of Economic Policy*, 24(1), pp. 99-119.
- Hanson, G.H. (2001), U.S. - Mexico integration and regional economies: evidence from border-city pairs, *Journal of Urban Economic*, 50(2), pp. 259-287.
- Krugman, P. (1980), Scale Economies, Product Differentiation, and the Pattern of Trade, *The American Economic Review*, 70(5), pp. 950-959.
- Krugman, P. (1991), *Geography and Trade*, Cambridge: The MIT Press.
- Lapavistas, C., Kaltenbrunner, A., Lindo, D., Michell, J., Paineira, J., Pires, E., Powell, J., Stenfors, A. and Teles, N. (2010), Eurozone crisis: beggar thyself and thy neighbour, *Journal of Balkan and Near Eastern Studies*, 12(4), pp. 321-373.

- McCallum, J. (1995), National borders matter: Canada-U.S. regional trade patterns, *American Economic Review*, 85(3), pp. 615-623.
- Niebuhr, A. (2006), Spatial effects of European integration: Do border regions benefit above average? *The Review of Regional Studies*, 36(3), pp. 254-278.
- Pezzi, M.G. and Urso, G. (2016), Peripheral areas: conceptualizations and policies. Introduction and editorial note, *Italian Journal of Planning Practice*, 6(1), pp. 1-19.
- Redding, S. and Sturm, D. (2008), The Cost of Remoteness: Evidence from German Division and Reunification, *The American Economic Review*, 98(5), pp. 1766-1797.
- Rodríguez-Pose, A. and Garcilazo, E. (2015), Quality of Government and the Returns of Investment: Examining the Impact of Cohesion Expenditure in European Regions, *Regional Studies*, 49(8), pp. 1274-1290.
- Rodríguez-Pose, A. and Ketterer, T. (2020), Institutional change and the development of lagging regions in Europe, *Regional Studies*, 54(7), pp. 974-986.
- Slaughter, M. (2001), Trade liberalization and per capita income convergence: a difference-in-differences analysis, *Journal of International Economics*, 55(1), pp. 203-228.
- Sohn, C. and Licheron, J. (2018), The multiple effects of borders on metropolitan functions in Europe, *Regional Studies*, 52(11), pp. 1512-1524.
- Werner, J., Herrmann, S. and Lovett, A. (2017), Clusters of Rural European Regions: An Approach to Show the Multi-Dimensional Character of Core-Peripheral Patterns, in: Pascariu, G. and Duarte, M. (eds.) *Core-Periphery Patterns across the European Union: Case Studies and Lessons from Eastern and Southern Europe*, UK: Emerald Publishing Limited, pp. 177-197.

Appendix

Table A.1. Regions for each country

Country		Number of regions	Number of border regions	Number of peripheral regions	Number of border and peripheral regions
AT	Austria	35	28	24	18
BE	Belgium	44	39	12	11
BG	Bulgaria	28	19	7	6
CY	Cyprus	1	0	0	0
CZ	Czech Republic	14	13	4	4
DE	Germany	402	107	110	29
DK	Denmark	11	5	4	0
EE	Estonia	5	3	3	2
EL	Greece	52	13	29	9
ES	Spain	59	16	10	2
FI	Finland	19	7	12	5
FR	France	101	28	55	12
HR	Croatia	21	21	13	13
HU	Hungary	20	17	6	6
IE	Ireland	8	4	6	3
IT	Italy	110	23	20	3
LT	Lithuania	10	9	2	2
LU	Luxembourg	1	1	0	0
LV	Latvia	6	5	2	2
MT	Malta	2	0	0	0
NL	Netherlands	40	23	1	1
PL	Poland	72	29	31	1
PT	Portugal	25	12	16	9
RO	Romania	42	21	28	14
SE	Sweden	21	7	5	2
SI	Slovenia	12	11	9	8
SK	Slovakia	8	8	13	3
UK	United Kingdom	173	6	15	1
	Total EU28	1342	475	437	166
AL	Albania	12	7	8	5
CH	Switzerland	26	21	2	2
IS	Iceland	2	0	1	0
LI	Liechtenstein	1	1	0	0
ME	Montenegro	1	1	0	0
MK	North Macedonia	8	8	0	0
NO	Norway	19	6	9	4
RS	Serbia	25	18	5	3
TR	Turkey	81	16	6	1
	Total nonEU9	175	78	31	15
	Total of Regions	1517	553	468	181

Source: authors' calculations based on data from Eurostat