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# The geography of integration and regional growth in the EU

George Petrakos<sup>a</sup> , Alexandra Sotiriou<sup>a</sup>  and Stavroula Alexiou<sup>a</sup> 

## ABSTRACT

The paper investigates the unevenness in European Union (EU) trade integration patterns and the resulting growth asymmetries at the regional level. With the use of panel econometric models at the NUTS-II level based on a novel trade dataset, the analysis estimates the impact of trade integration on regional growth and the heterogeneous effects of different types of trade partners on peripheral regions. The results suggest that the impact of integration is asymmetric for peripheral regions trading with core EU trade partners, revealing that different development levels are associated with different types of integration and unequal growth returns.

## KEYWORDS

European Union integration; regional growth; convergence; economic geography

JEL C33, F15, R11, R12

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## 1. INTRODUCTION

The acceleration of the integration process does not always allocate costs and benefits evenly among advanced and less advanced regions and countries. A clear and extensively studied geographical pattern of core and peripheral regions is manifest in an economic pattern of 'leading' and 'lagging' regions; when these diverse regions intensify trade between them and deepen their integration, a new landscape emerges which unfolds a plethora of new opportunities but also challenges for the incumbent economies. In a European Union (EU)-wide context more *peripheral* regions in the South or Central East of the EU are expected to face considerable challenges pertaining to geography, scale and competitiveness as a result of strengthened trade relations with relatively more advanced trade partners of the EU *core*.


The central research question of this study is the assessment of how trade integration affects regional growth and more specifically how the geographical breakdown of the trade relations – trading with core versus peripheral partners – plays a decisive role in determining regional trajectories. The underlying research hypothesis is that the exposure to international competition and, in turn, the effects of trade, may depend on the type of trade partners. Trade integration among similar income partners may have more balanced effects on growth, while trade among countries with different levels of development may have unbalanced or destructive effects for less advanced or peripheral regions due to import penetration pressures.

This analysis goes a step further to provide concrete evidence on how geography affects the trade impact depending on who trades with whom, by employing novel trade data at the regional level for the core and the peripheral EU regions. The research question addressed is whether the celebrated benefits from EU integration at the aggregate level persist when we examine trade between peripheral regions and core regions characterised by significant competitiveness gaps.


The key variable is the level of integration, estimated as the share of regional EU trade for three sets of regions: for the entire EU, for peripheral regions and for core regions. In order to assess the heterogeneity of the impact of trade integration on growth across different regions we employ a novel regional dataset on trade (imports and exports) at the NUTS-II level for the period 2010–18, produced by a European Spatial Planning Observation Network (ESPON) (2022) project; by employing subsets of data, we estimate the effect of integration by trade partner for peripheral regions, but also for core regions.

We empirically explore the critical role played by the type of integration in determining growth effects by using a conditional  $\beta$ -convergence growth model enriched with a set of critical growth drivers.

The paper is organised as follows. Section 2 presents a critical discussion of the existing literature. Sections 3 and 4 present the data, modelling and results. Section 5 presents the conclusions and policy implications of the findings.

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## 2. LITERATURE REVIEW

### 2.1. Theoretical framework

Ricardian and Neoclassical theories of trade have dominated the literature of international economic relations for a long period, providing a solid and popular economic ground for policies of openness and integration. Comparative advantage, specialisation in sectors utilising intensively low-cost resources and exchange, emerged for decades as a safe recipe for mutually beneficial trade interactions (Heckscher, 1919/1991; Ohlin, 1933; Tiebout, 1956). The win-win logic of these theories conveyed a powerful message for deeper market integration (Borts, 1960) that affected for decades, policies of international relations and supported the opening of borders globally and the explosion of trade relations in the post-Second World War period, leading to a dramatic increase of consumption and an equally dramatic shift of resources and production patterns. In Europe, these theories provided support to a unique experiment: the creation of the single European market and the free mobility of resources between states. In addition, the Neoclassical trade setting offers a mechanism that leads to the equalisation of relative incomes (wages and returns on capital) among trade partners as resources move away from sectors and products using intensively scarce resources (Grossman & Helpman, 2018; Stiglitz, 1970). This mechanism raised strong theoretical expectation that deeper trade integration in the EU will support a process of convergence among countries and regions, which would bridge the income gaps between the EU core and peripheral countries and regions (Armstrong, 1995; Commission of the European Communities (CEC), 1996; Cuadrado-Roura, 2001; Leonardi, 1995; Neven & Gouymte, 1995).

Yet, these theories, as attractive they may be, do not have much to say about unbalanced trade flows, mounting trade deficits, or sectoral destructive adjustments undermining growth processes.<sup>1</sup> In the EU, the increase of intra-EU trade has gone hand in hand with major disparities in the trade balances and deficits across member states that hide even higher imbalances across regions. The huge disparities in the trade balances range from surpluses of over €170 billion for Germany (the majority of which is with the EU-27) to trade deficits of €2.26 billion in Greece (German Federal Ministry for Economic Affairs, 2022). This unbalanced pattern of trade flows is mainly associated with core-periphery inter-industry trade persistent over time and implies unbalanced growth opportunities across countries and regions.

The *8th EU Cohesion Report* (European Commission, 2022) states that regional economic convergence has stopped in the EU because benefits from globalisation and integration are not evenly transmitted to all regions. EU integration has expanded trade opportunities on the one hand, but has also raised concerns about the equitable distribution of trade advantages within nations and between central and peripheral economies (Monastiriotis et al., 2017; Petrakos et al., 2012; Rodríguez-Pose, 2012).

These limitations have led to the rise of more critical approaches to trade integration, claiming that markets generate positive, but also adverse effects that need to be counterbalanced by stronger policies and that winners and losers may coexist at the regional or national level. These approaches are typically in favour of deeper market integration that is complemented and supported by a strong policy agenda and have influenced to a certain extent the development of the EU Cohesion Policy. The basic argument of these theories is that the process of integration is characterised by heterogeneous products, imperfect markets and competition among unequal partners, whether that be firms, regions or countries. Especially for EU regions that differ widely in their productive structure, innovative capacity, science base, infrastructure, human capital, resources and institutions, these differences may lead to destructive adjustments for the weaker ones, where a significant part of the industrial base will not be able to stand competition (Camagni, 1992). Defensive structural change towards non-tradable sectors (local services, public sector) will eventually increase structural differences and divides in Europe, where the advanced regions specialise more in capital-, knowledge- and information and communication technology (ICT)-intensive industries, while the less advanced in labour- and resource-intensive industries (Brühlhart & Traeger, 2005; Midelfart-Knarvik & Overman, 2002; Petrakos et al., 2005; Petrakos et al., 2011).

These critical approaches to trade integration have received support from the New Trade Theories (NTTs) of strategic trade (Krugman, 1979) and the New Economic Geography (NEG) (Krugman, 1991, 1995). In the NTT setting, trade patterns are not driven by comparative advantage but by increasing returns that may alter the pattern of comparative advantage. In the NEG setting, the reduction of the costs of trade between an advanced centre and a weaker periphery lead to benefits that may not be equally distributed. If labour is highly mobile between core and periphery, so that wages in the core areas do not increase with economic expansion, scale and agglomeration effects, home market effects and the barrier of critical threshold may result to an unequal allocation of the costs and benefits of integration and to unbalanced growth. As a result, initial conditions matter, as regions that have not managed to reach a critical scale are unable to benefit from cumulative adjustments triggered by the process of integration.

This new terrain of theoretical approaches challenging the symmetry of the Classical and Neoclassical paradigms implies that *unbalanced trade integration* may have an adverse effect on weaker regions with limited 'territorial capital' that may affect their growth prospects (Camagni, 2009). Core-periphery trade among partners with serious gaps in their development levels tends to take an inter-industry type, putting pressure on the more exposed tradable sectors of the domestic industrial bases in peripheral countries and regions (Petrakos & Psycharis, 2016).

The concept of unbalanced trade integration is better aligned with the trends observed at the subnational level,

as increasing returns to scale, home market effects, factor mobility and distance related costs explain the intensification of core–periphery patterns across space (Iammarino et al., 2019). NEG-related approaches explain how trade and factor mobility will lead to the clustering of economic activity in space, alter existing (regional) comparative advantages (Rodríguez-Pose & Gill, 2006) and lead to regional divergence (Krugman, 1991).

This debate between theories of trade leading to convergence or divergence at different spatial scales lasts for over three decades. The evidence tends to suggest that both processes of trade-driven convergence and divergence coexist at all spatial levels, but in different proportions and different strengths, leading to multiple growth regimes. Their balance, however, over time and space changes with development levels and the broader geographical, institutional or political coordinates (Petrakos, 2008). Although evidence can go both ways, the persistence in regional inequalities over long periods of time in significant parts of the European economic space may suggest that market-based divergence mechanisms may prevail over other, counteracting, policy-driven ones.

## 2.2. Empirical evidence

Empirical findings tend to suggest that for peripheral regions the strengthened trade relations with relatively more advanced economic partners of the EU core can pose serious competitiveness threats, while import competition has also been criticised for deindustrialisation processes in the EU South (Fratesi, 2012; Petrakos et al., 2012). In addition, the opening of a closed economy triggers internal polarisation as labour mobility favours agglomeration dynamics (Paluzie, 2001), competition tends to concentrate activities in the strongest areas (McCann, 2008; World Bank, 2009), leading to uneven growth patterns at the subnational level and intensifying spatial inequalities (Autor et al., 2013; Rodríguez-Pose, 2012). Therefore, increased trade openness creates winners and losers at the spatial level, increases inequalities (Ezcurra & Rodríguez-Pose, 2014; Petrakos et al., 2005) and social discontent (Sotiriou et al., 2025).

Evidence from the pre-accession phase in EU new member state (NMS) regions indicate that the areas initially more exposed to trade competition experienced the greatest losses in industrial employment, triggering a process of de-industrialisation (Kallioras & Petrakos, 2010). Similar evidence is found in the European Neighborhood countries (ENP), where trade with advanced EU countries increased regional inequalities, while trade with the less advanced EU countries reduced inequalities (Petrakos et al., 2016). This pattern is also evident in Greece, where periphery–core and periphery–rest of the world types of trade appear with a different impact on regional growth (Rodríguez-Pose & Sotiriou, 2021).

An analytical classification of European regions based on their integration into global markets by Fratesi (2012) explains the conditions under which regions may benefit from trade; it presents a taxonomy of regions at the NUTS-II EU level using two key dimensions:

structural connectivity and economic specialisation. Regions are categorised as global players, regional players, or local players, with a focus on their involvement in globalisation processes. The regions specialising in ‘open growing sectors’, that is, industries that perform well in international trade or attract significant foreign direct investment (FDI), are better positioned to benefit from globalisation, while others struggle with the loss of traditional industries due to outsourcing and competition from emerging markets.

The loss of industrial base in the EU and especially the periphery, has led to the emergence of arguments in support of a new industrial strategy in Europe (European Commission, 2018), where policies of re-industrialisation need to blend with the 4th Industrial Revolution and place-based policies in order to build a critical mass of industrial knowledge at the local level that will be more likely to stand competition (Capello & Cerisola, 2022). The experience of reindustrialising regions shows a positive link with manufacturing employment growth in areas increasing their specialisation in high-level manufacturing (Capello & Cerisola, 2024). The critical role of regional countervailing policies turns out to be a key condition for trade benefits to prevail.

Our analysis aims to bridge a gap in the relevant empirical literature by providing fresh concrete regional-level evidence on how the asymmetry in the development level of trade partners determines and ‘turns’ the signs of the trade impact depending on *who trades with whom* by employing novel trade data at a fine EU geographical level for two critical blocks of regions in the EU, the core and the periphery. To the best of our knowledge the core–periphery unbalanced trade effects on regional growth have not been empirically explored. We thus expect to fill in this gap with fruitful evidence-based policy implications.

## 3. DATA AND METHODOLOGY

The analysis is based on regional statistics from ARDECO-EC (2023), Eurostat (2023a, 2023b, 2023c, 2024) and a novel database on regional trade for the period 2000–18 (ESPON, 2022). The ESPON database includes export and import data at the EU NUTS-II level, allowing for the first time the study of the effects of trade integration at the regional level.<sup>2</sup>

The empirical analysis for the assessment of the impact of EU trade integration on growth is based on a conditional  $\beta$ -convergence panel econometric model, employing data at the regional (NUTS-II) level. The estimated equation takes the form:

$$g_{r,t} = \beta_0 + \beta_1 Y_{r,t-1} + \beta_2 INT_{r,t-1} + \sum_{i=1}^k \gamma_i Z_{i,r,t-1} + \delta_r + e_{r,t} \quad (1)$$

The dependent variable  $g$  is the gross domestic product (GDP) per capita growth in region  $r$  and year  $t$ ; and  $Y$  is

the initial GDP per capita level in thousands of euros (both at constant 2015 prices). The parameter  $\beta_1$  detects conditional regional convergence ( $\beta_1 < 0$ ) or divergence ( $\beta_1 > 0$ ) processes according to the estimated sign.

The key variable of interest is the EU trade integration index (*INT*). The index represents the ratio of imports and exports from/to the EU in region  $r$  and year  $t$  over the total imports and exports of region  $r$  in year  $t$  and reflects EU trade intensity. The index is estimated according to the following formula:<sup>3</sup>

$$INT_{r,t} = [X_{r,t}^{EU} + M_{r,t}^{EU}] / [X_{r,t}^{World} + M_{r,t}^{World}] \quad (2)$$

The key regressor also takes the form of two different types of trade integration: (a) with trade partners belonging to the more developed EU countries ( $INT_{MD}$ ) and (b) with those belonging to the less developed EU countries ( $INT_{LD}$ ) as a share of total EU trade.

The criterion for the geographical breakdown of the trade relations is the trade partners' level of development, which is proxied by GDP per capita (in constant 2015 prices). Countries with development levels higher than the EU national average are categorised in the *More developed trade partners group*, whereas those with development levels lower than the EU national average are categorised in the *Less developed trade partners group*. Subsequently, the *More developed* group mainly consists of the advanced countries of the Northwest and includes Austria, Belgium, Denmark, Germany, Ireland, Finland, France, Italy, Luxembourg, the Netherlands, Sweden, the UK, Norway, Iceland, Lichtenstein and Switzerland. On the other hand, the *Less developed* group includes Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovenia, Slovakia and Spain and coincides with the less advanced NMS and the EU South.

The model is estimated for all NUTS-II regions, but also for a subset of 73 regions with development level lower than 75% of the EU average (based on 2010), which constitute our 'peripheral regions' dataset. In this way, we can compare the experience of peripheral regions with more and less developed trade partners to the experience of the whole sample of EU regions. Moreover, we expand our analysis on a 'core regions' dataset, which includes the most advanced 63 NUTS-II regions in terms of GDP per capita in 2010 (core regions are defined as the regions with a development level higher than 120% of the EU average).

The model examines the impact of trade integration in both products ( $T-INT$ ) and services ( $S-INT$ ), as the latter accounts for an increasing share of trade and is becoming a key element in growth strategies by creating higher value-added jobs and acting as a source of innovation (World Trade Organization (WTO), 2023).

Following the discussion and the evidence in the critical approach literature above, we expect commodity trade integration ( $T-INT$ ) to have a heterogeneous impact on regional growth, which depends on the typology of trade partners. On the other hand, our expectation is

that trade in services ( $S-INT$ ) will have a positive effect on growth, as it allows net exporting regions to expand their market and net importing regions to benefit from the embedded technological progress and increase productivity.

The model is augmented with a set of control variables  $Z$ , identified in previous research as growth determinants. The control variables are:

- Level of openness (*OPEN*) of the regions' economy, proxied by the world trade as a share of GDP (Brühlhart, 2011; Frankel & Romer, 1999; Mankiw et al., 1992).
- Share of high-skilled human capital (*SKILL*) (Acemoglu & Autor, 2011).
- Share of the gross fixed capital formation of the public sector (*PUB*) (Rodríguez-Pose et al., 2015).
- Geo-economic position of a region, proxied by gravity index (*GRAV*)<sup>4</sup> which accounts for market size and accessibility (Petrakos, 2000; Sotiriou & Tsiapa, 2015).
- Inward FDI as a share of GDP (Becker et al., 2013; Iammarino, 2018; Iammarino & McCann, 2013).

Based on both theory and evidence we expect these variables to matter for regional growth.

The analysis is performed by means of region fixed effects ( $\delta_i$ ) regressions, using Driscoll and Kraay (1998) standard errors, in order to account for cross-sectional dependence. All variables enter the model with year lags, to account for potential delays of their impact on regional growth, and to address issues of endogeneity/reverse causality. A list of all variables used in the analysis, their measurements and data sources are presented in detail in Table A1 in Appendix A in the supplemental data online.

Our sample consists of the NUTS-II regions of the EU-27 member states, following the NUTS 2016 classification. In order to account for the fact that some regions may have low levels of openness, which may distort our integration measurement, we exclude from the analysis the regions that have an average level of openness (measured as world trade over GDP) lower than 20%, which in fact eliminates regions with little overall trade. This leaves us with a maximum of 210 regions.

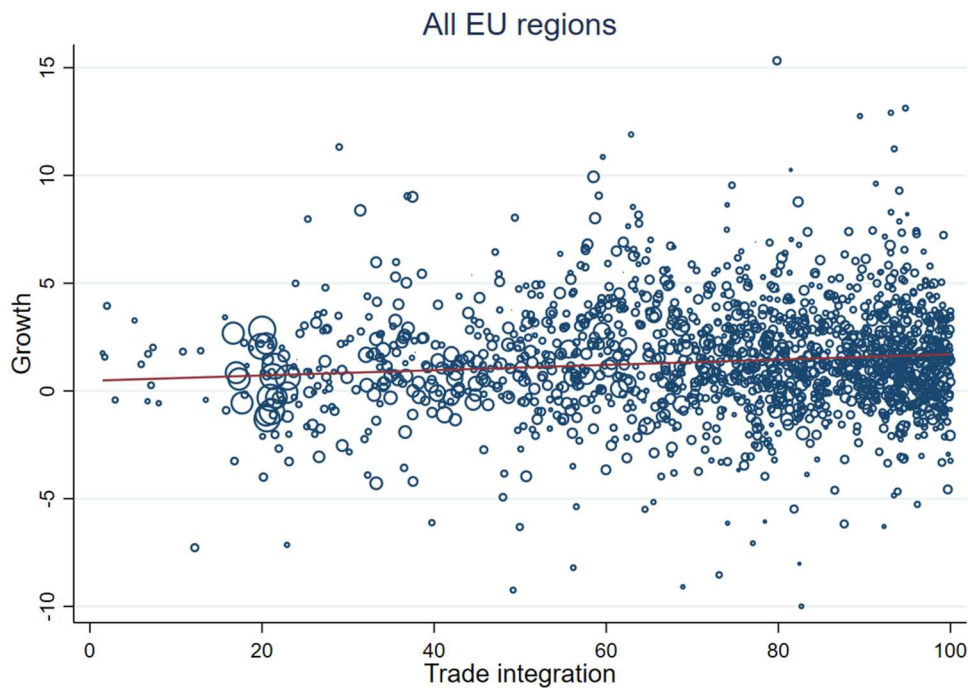
The period of analysis is confined in the period 2010–18, which is determined by the availability of regional trade data at the NUTS-II level (ESPON, 2022).

The empirical analysis takes into account both the geography and the typology of regions by estimating the effects of different types of trade integration at different levels of aggregation. The model in equation (1) is first estimated for all the EU regions and then for the peripheral regions separately, testing for heterogeneous effects from different types of trade integration.

## 4. EMPIRICAL ANALYSIS

### 4.1. Descriptive evidence

The evolution of EU integration for core and peripheral regions and the association with regional growth provides important insights for our key research hypotheses.



**Figure 1.** Growth and trade integration in European Union NUTS-II regions weighted by trade per capita, 2010–18.

Sources: Authors' own elaboration using data from the European Spatial Planning Observation Network's (ESPON) (2022) trade database and ARDECO-EC (2023).

Figure 1 depicts the correlation between growth and integration for all EU regions, measured by the share of trade of each region with the EU in its total trade.

The fitted line is slightly positive, with variation increasing in higher levels of integration. This indicates that in an EU wide context where all regions are considered, the level of integration may have on average a positive association with growth, although this association varies widely, especially in high levels of integration.<sup>5</sup> Figure 1 suggests that the integration experience of the EU regions may include both net winners, experiencing a positive association with growth, and net losers, experiencing a negative association.

Figure 2 presents the same correlation for peripheral regions trading with more developed trade partners. This time the slope is negative, with again significant variation taking place in relatively high levels of integration. Figure 2 shows that peripheral regions have a variety of experiences in trading with more advanced counterparts. However, on average, integrating into more competitive markets is typically associated with significant pressures on their productive base that may have a destructive character and hamper their growth.<sup>6</sup>

The correlation between trade integration and growth seems to be positive (Figure 3) when peripheral regions trade with less developed EU countries. This indicates that trade among partners with similar development levels and sectoral structures may be mutually beneficial and less destructive for the productive base of trading partners.

Besides the role of integration based on merchandise trade, we also examine the role that trade in services may play in shaping regional performances. Trade in services may include traditional sectors such as hospitality and

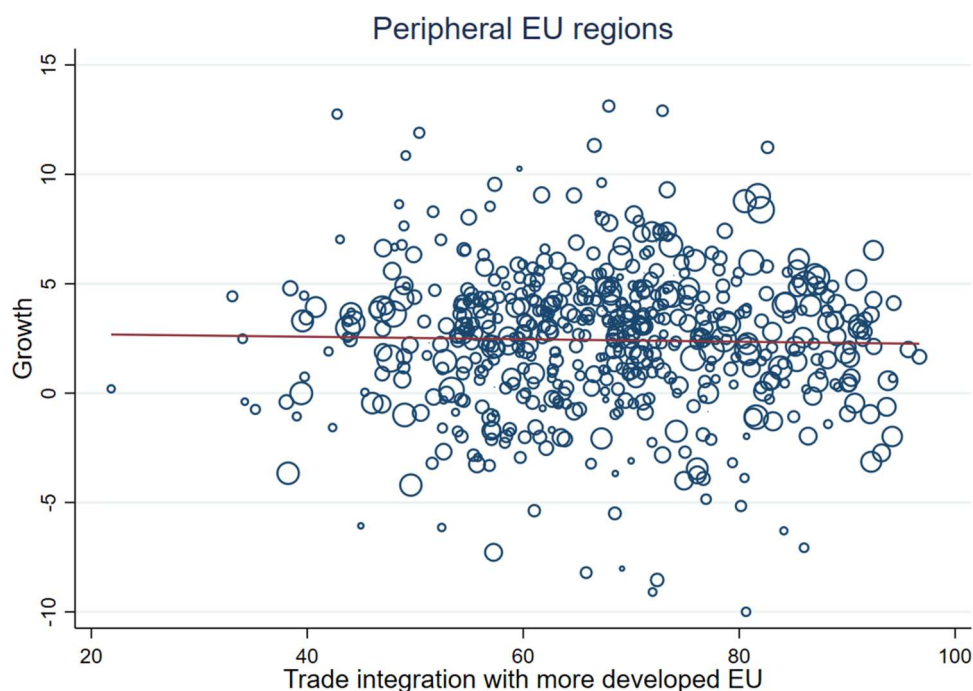
tourism, but also trade in the new tertiary sector, that includes the knowledge intensive and high-tech sectors that are based on artificial intelligence. In that perspective, they play an important role in both maintaining and changing the productive bases of regions in all sectors of the economy through a process of improvement on the one hand and creative destruction on the other that may have a geographical footprint.

On average, we expect that this new wave of regional integration would have a positive impact on regional growth, by expanding markets, creating higher value-added jobs and acting as a source of innovation. It remains an open question, however, if this impact will be equally beneficial for growth in both core and peripheral regions.<sup>7</sup>

#### 4.2. Empirical results

Given the uneven geography of development in the EU, especially at the regional level, we examine whether trade among partners with similar or different levels of development has a differentiated impact on growth. In order to capture the geographical heterogeneity of the EU trade impact, we estimate our model for the following sets of trade relations: (1) *all* EU regions trading with all EU trade partners, (2) *peripheral* regions trading with *more developed* EU trade partners and (3) *peripheral* regions trading with *less developed* EU trade partners. Table 1 presents the results of the baseline and extended models. Regressions (1–3) display the results for all 210 EU regions, whereas regressions (4–6) and (7–9) present the results for 73 peripheral regions when trading with more versus less developed trade partners, respectively.<sup>8</sup>

First, we observe that the *b*-coefficient is insignificant in the *all regions* models in columns (1–3) but appears

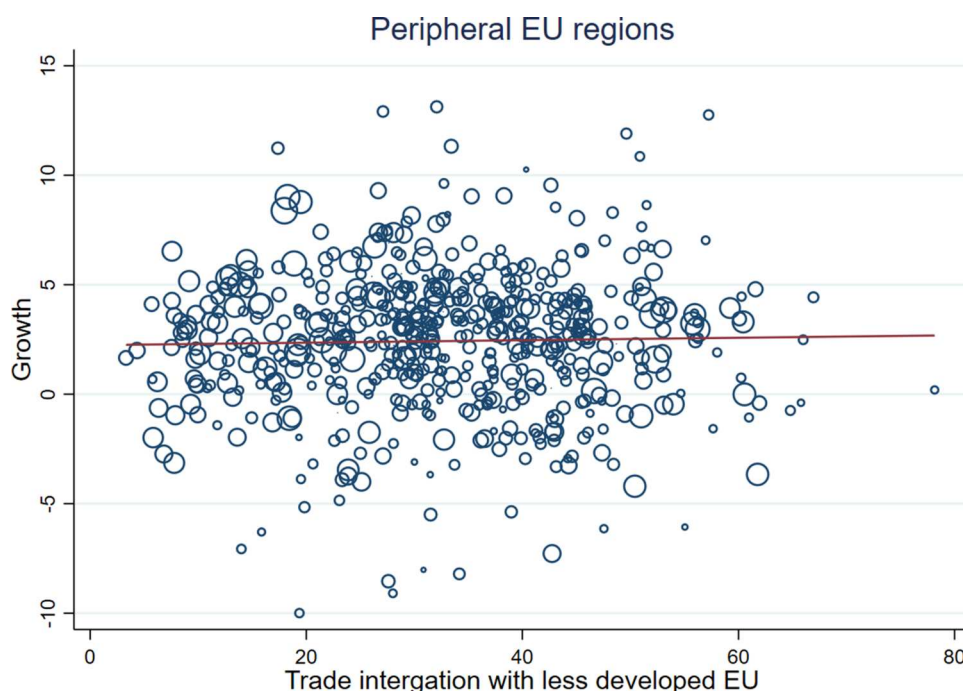


**Figure 2.** Growth and trade integration of peripheral European Union (EU) NUTS-II regions trading with more developed EU partners weighted by trade per capita, 2010–18.

Sources: Authors' own elaboration using data from the European Spatial Planning Observation Network's (ESPON) (2022) trade database and ARDECO-EC (2023).

significant in columns (6) and (9) of the *peripheral regions* models. This finding suggests that there is no evidence for convergence trends among EU regions in the period under examination. Of course, this was not a typical period, as the EU economy was affected by the financial and the debt

crisis, which had a heterogeneous footprint at the spatial level (Organisation for Economic Co-operation and Development (OECD), 2009, 2011; Petrakos & Psycharis, 2016; Psycharis et al., 2014). In any case, this finding is in line with a number of reports and studies (European Commission, 2022;



**Figure 3.** Growth and trade integration of peripheral European Union (EU) NUTS-II regions trading with less developed EU partners weighted by trade per capita, 2010–18.

Sources: Authors' own elaboration using data from the European Spatial Planning Observation Network's (ESPON) (2022) trade database and ARDECO-EC (2023).

**Table 1.** Results of basic and extended models for three sets of trade relations.

Dependant variable: <i>g</i>	All regions to all EU			Peripheral regions to more developed EU			Peripheral regions to less developed EU		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Y</i>	-0.168 (0.336)	-0.245 (0.329)	-0.516 (0.382)	0.332 (0.224)	0.051 (0.243)	-1.055*** (0.235)	0.332 (0.224)	0.299 (0.203)	-1.105*** (0.237)
<i>T-INT</i>	0.029** (0.014)	0.024* (0.014)	0.016* (0.009)	-0.054* (0.029)	-0.055** (0.027)	-0.052** (0.025)	0.054* (0.029)	0.052* (0.028)	0.051** (0.026)
<i>OPEN</i>	0.021* (0.012)	0.018* (0.009)	0.021*** (0.006)	0.030*** (0.009)	0.018*** (0.006)	0.021*** (0.004)	0.030*** (0.009)	0.029*** (0.009)	0.026*** (0.005)
<i>S-INT</i>		0.184*** (0.021)	0.083*** (0.016)		0.351*** (0.073)	0.157*** (0.057)		0.165 (0.099)	0.047 (0.055)
<i>SKILL</i>			0.325*** (0.058)			0.444*** (0.061)			0.471*** (0.075)
<i>PUB</i>			0.007 (0.014)			0.057* (0.032)			0.056* (0.032)
<i>GRAV</i>			0.633 (0.528)			0.920*** (0.306)			1.103*** (0.256)
<i>FDI</i>			0.022*** (0.005)			0.023 (0.018)			0.024 (0.020)
Constant	2.125 (10.564)	1.429 (10.102)	-71.316 (45.861)	-0.277 (1.500)	0.118 (1.795)	-95.532*** (28.604)	-5.719* (3.366)	-5.761* (3.242)	-118.677*** (23.858)
Observations	1470	1470	1464	511	511	508	511	511	508
<i>R</i> <sup>2</sup>	0.018	0.067	0.164	0.043	0.095	0.223	0.043	0.048	0.215
Regions	210	210	210	73	73	73	73	73	73
<i>F</i>	6.13	87.97	378.20	16.83	12.65	1471.34	16.83	18.30	175.66
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors are shown in parentheses.

\*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1.

Pina & Sicari, 2021) that have also documented the exhaustion of regional convergence trends in the EU.

When, however, we look at the results of the subsample with the 73 peripheral regions, there is some evidence that the less advanced regions of the EU are characterised by convergence trends, in the sense that the relatively less advanced in the group make steps towards the relatively more advanced within the group. This limited evidence may be in line with reports suggesting that the process of regional convergence or divergence in the EU has taken a 'U'-shaped form, where the less developed regions converge to an average level threshold that they cannot exceed, while the more advanced regions tend to diverge from this trend (Petrakos et al., 2011).

Turning to our main hypothesis, we observe in models (1–3) that the EU trade integration index (*T-INT*) returns a positive and significant sign, which remains robust across all specifications. This finding indicates that at the level of the entire EU market, trade contributes to regional growth, acting as a neoclassical catalyst of specialisation, efficiency and expanding markets that supports growth.

Having established the evidence for this baseline hypothesis, it is now important to examine whether the expansion of trade of peripheral regions with the more developed trade partners also leaves a positive footprint in their economy as in the entire EU market. In this context, we estimate again our model only for the subgroup of peripheral regions. In models (4–6) the competing to the neoclassical hypothesis is that the distribution of the benefits and costs of *periphery-to-more developed* integration are geographically uneven and exert significant pressures on the growth prospects of the weaker regions. In models (7–9) the underlying hypothesis is that *periphery-to-less developed* economic integration, that is, trade between regions with similar levels of development, may be characterised by 'milder' competition effects than integration between very unequal regional partners.

The results for the subset of peripheral regions support the hypothesis that for less advanced regions the intensity and composition of trade by type of trade partner is critical for growth. When peripheral regions trade with more developed EU partners (models 4–6), the integration effect is negative, statistically significant and robust, due to unbalanced trade and the prevailing effect of import penetration on their productive base. However, when peripheral regions trade with each other (models 7–9), the results show a positive and significant effect of integration on growth. This result is in line with the hypothesis that integration can be mutually beneficial and growth-inducing, when regions with similar income and development levels trade with each other. Although this may appear as a growth-conducive and more balanced type of integration, it cannot be recommended as a single long-term trade strategy for weaker regions. The down side of the *periphery-to-less developed* type of integration is, of course, that it is not based on capital and knowledge intensive sectors and cannot support the required structural transformations of the productive

base for the real convergence of weaker regions with their more advanced counterparts.

Trade in services (*S-INT*) appears with a positive and significant coefficient at the *all regions* level (models 2–3), supporting our hypothesis that imports and exports in services may expand markets and operate as a catalyst for innovation.

Moreover, trade in services with *more developed* trade partners (models 5–6) has a clear positive and significant effect on growth performance in peripheral regions, indicating the importance of this type of trade as a transmission mechanism for high-tech knowledge and innovation in their productive base. *Periphery-to-more developed* trade in services is more compatible with the production bases of the peripheral regions and is less of a threat for existing service and product sectors in weaker regions. The typical pattern of trade may include exports of peripheral regions mainly based on tourism related services and imports related to high-tech service sectors, such as software development, artificial intelligence services, or perhaps advisory in the financial, legal, real estate or other sectors. These services are typically absent in the production base of the peripheral regions and as a result, trade does not have an immediate substitution effect. Moreover, these advanced services tend to support the modernisation, restructuring and upgrade of the other sectors of the economy, including manufacturing, in the peripheral regions. On the other hand, trade in services with *less developed* trade partners (models 8–9) appears to have a statistically insignificant growth impact, which may be due to the low level of interaction (on average less than 4% as a share of GDP).

Overall, the control variables have the expected signs and are in line with previous findings. Openness (*OPEN*) and skilled resources (*SKILL*) appear to contribute to higher regional growth in all datasets and models. Interestingly, higher shares of the public sector seem to be conducive to growth only in the peripheral regions sample, while *FDI* returns a positive sign in the full regional sample that includes also the core regions.

Although our interest is primarily focused on the impact of EU trade on peripheral regions, in Table 2 we also estimate the impact of EU trade on core regions. The first three columns present variants of the models for *core-to-more developed* trade and the second three columns present variants of the models estimated for *core-to-less developed* trade.

The evidence suggests that the impact of *core-to-more developed* trade integration is negative, while the impact of *core-to-less developed* trade is positive. This implies that core regions have growth-related gains when they are engaged in inter-industry type of trade with peripheral regions, but experience growth related losses when they trade with each other. Therefore, *core-periphery* trade appears to be zero-sum, as core regions are found to have positive and peripheral regions negative growth effects. As discussed above, the key drivers for this pattern are unbalanced trade flows and import penetration pressures on the productive base of peripheral regions.

**Table 2.** Results for the 'core regions' dataset.

Dependant variable: <i>g</i>	Core regions to more developed EU			Core regions to less developed EU		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Y</i>	−0.278 (0.370)	−0.296 (0.366)	−0.362 (0.363)	−0.278 (0.370)	−0.279 (0.371)	−0.322 (0.361)
<i>T-INT</i>	−0.082*** (0.022)	−0.070** (0.029)	−0.003 (0.029)	0.082*** (0.022)	0.082*** (0.022)	0.093*** (0.026)
<i>S-INT</i>		0.174*** (0.050)	0.072** (0.029)		−0.446 (9.400)	−6.699 (6.859)
<i>OPEN</i>	−0.015 (0.009)		0.001 (0.005)	−0.015 (0.009)	−0.015 (0.010)	
<i>SKILL</i>			0.399*** (0.070)			
<i>PUB</i>						−0.312*** (0.051)
<i>FDI</i>			0.017*** (0.005)			0.025*** (0.007)
Constant	20.505 (17.551)	16.216 (16.940)	−3.296 (14.577)	12.269 (16.338)	12.284 (16.582)	16.706 (15.895)
Observations	441	441	441	441	441	441
<i>R</i> <sup>2</sup>	0.038	0.057	0.111	0.038	0.038	0.066
Regions	63	63	63	63	63	63
<i>F</i>	7.78	12.49	61.38	7.78	11.31	99.12
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors are shown in parentheses.

\*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1.

The *core-to-more developed* finding is unexpected. Typically, trade between advanced regions is mainly intra-industry trade in capital- and ICT-intensive sectors. This type of trade involves heterogeneous products and monopolistic competition markets, and is considered to have milder impact on partners, as restructuring takes place within (and not between) sectors (Grimwade, 2020). Intra-industry trade is the main type of trade between advanced countries and regions and is considered to increase primarily welfare, by providing consumers access to a larger variety of products.

Another explanation is that the balance of creative and destructive forces associated with the process of competition among the advanced EU regions may favour the later in the period under examination, where aggregate demand in the EU is suppressed by fiscal consolidation policies. Given that the model does not provide any evidence for a growth impact of openness either, the results may detect a situation where the celebrated strategies of international competitiveness and export-led growth need to be reconsidered. Perhaps the message of Table 2 is that the dominant model of growth in advanced regions, which is based on exports and competition in foreign markets, has reached (or exceeded) its limits, given the existing level of competition and the macroeconomic priorities that restrict aggregate demand. Of course, this strategy may still work well in *core-*

*periphery* trade, but this represents a smaller share compared with *core-to-core* trade. A new strategy may have to examine more carefully the role of domestic demand, which is suppressed by austerity policies, as an important driver of growth in core regions and countries. An increase in domestic demand in advanced regions by, let's say fiscal transfers, minimum wage policies or tax reductions for the weaker income groups, may generate the required demand at the own regional and the international level (to the extent that all advanced countries follow this policy) to support both domestic and export-led growth.

This option may have the advantage that by increasing consumption in the core regions, it also supports exports in the peripheral regions, reducing their trade gaps and contributing to a more balanced type of integration.

In Table 2, we also observe that *core-to-more developed* trade in services has a positive and significant impact on regional growth in core regions, implying that in the highly heterogeneous sectors of services the benefits from specialisation and exchange are (in contrast to commodity trade) spread to all partners. This may be due to the fact that some services (such as tourism) are place specific and an indication that the level of competition in tradable services in the EU core is not yet as severe as in tradable commodities. We also observe that *core-to-less developed* trade in services has no impact on growth,

but this may be well due to the low share of core trade in services that goes to the periphery.

To further assess the relative impact of the independent variables on regional growth, we re-estimate equation (1) across all sets of trade relations, using standardised variables. As shown in Tables D1 and D2 in Appendix D in the supplemental data online, the results maintain the same signs and levels of statistical significance as the original estimates. However, standardisation allows for a direct comparison of coefficient magnitudes. Among the key determinants, integration in services (*S-INT*) stands out as the strongest driver of regional growth, followed by economic openness (*OPEN*). The EU trade integration index (*T-INT*) exerts a more moderate, yet still meaningful, effect across all trade settings. Notably, geographic proximity and human capital also emerge as crucial factors in promoting regional growth.

## 5. CONCLUSIONS

The results of the analysis suggest that the European landscape is characterised by patterns of regional integration that are not always growth-conducive for the peripheral regions and as a result, do not support the goal of cohesion and inclusive growth.

Trade integration at the EU level appears to have a positive impact on growth, as a variety of regions trade with each other in an overall balanced way and with a mix of inter- and intra-industry trade that is clearly in favour of the latter. However, trade integration has a negative impact on growth in weaker regions, as it is dominated by unbalanced trade relations that are responsible for imported structural pressures in the capital-intensive tradable sectors. On the other hand, trade integration among peripheral regions has a positive impact, as trade relations among 'equal' partners may be dominated by low- to medium-technology sectors.

These findings reveal the diverse footprint of different types of integration and the importance of the mix of trade partners. On the one hand, inter-industry trade, which dominates North–South and West–East trade relations, contributes to the formation of fixed capital and is the main avenue for technology transfer, but at the same time, it is associated with competitive pressures and contraction in the capital-intensive sectors of the weaker regions, that are necessary for long-term development. On the other hand, intra-industry trade, which dominates relations of countries and regions with similar levels of development, provides opportunities for expansion without affecting significantly their structural characteristics. The challenge arising for the lagging regions is that they are engaged in a dominant type of integration that is at the same time both necessary, as it contributes to 'technological learning' and capital formation, and destructive, as it puts pressure on the more exposed and less competitive capital-intensive sectors.

The evidence provided by the core trade models seems to indicate that export-led strategies of growth, even for the advanced regions, are conditioned on the level of

aggregate demand in the EU, but also globally and may not be successful in periods of crisis and debt-related macroeconomic priorities.

It is interesting that trade in services has consistently a positive impact on growth, implying that the rapid development and internationalisation of the service industries (digital platforms, finance, tourism, producer and consumer services) does not pose yet any competitive pressures on the production base of either advanced or lagging regions, perhaps because potential benefits are stronger than potential losses. The footloose character of many of these services may provide an opportunity for the peripheral regions and a promising avenue for the design of future regional policies that may focus on the attraction of digital nomads or highly skilled labour.

The paper confirms earlier findings in the literature that the existing European architecture implies that regions having diverse structures and endowments will also have diverse responses to the prevailing mix of integration dynamics. The results show that the single market, a basic pillar of the European model, does not lead to an inclusive economy, driven by a clearly visible process of convergence. On the contrary, unbalanced patterns of integration, as well as divergence from the advanced core and chronic gaps in human, physical and financial capital shape a geography of opportunities and challenges that seems to be unfavourable for peripheral regions.

The policy implication of our findings is that unbalanced growth appears to be an inherent characteristic of trade integration between advanced and less advanced EU regions in a spatial setting where convergence trends are absent. Evidently, Cohesion Policy needs to recognise this undesired element of the EU integration process and take a more systemic and permanent character. Given that Cohesion Policy cannot claim any significant progress in the reduction of intra-national inequalities, but also the reduction of regional discontent, one would expect to also see a more effective utilisation and an increase of resources devoted to reducing development gaps (Petrakos et al., 2024) and supporting inclusive growth and the left behind people and places in Europe.

Interestingly, the standardised coefficients of the models indicate that the negative impact of trade integration on peripheral growth is not as strong as the positive impact of human capital and geographic proximity. This provides a ground for a policy direction where the quality of human resources and the connectivity of peripheral places remain top priorities. This of course needs to be blended skilfully with a more spatially balanced 'industrial strategy' for the re-industrialisation of Europe that will allow for the participation of the lagging regions in the new European networks of industrial knowledge, production and value capture.

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## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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## NOTES

1. In the neoclassical setting of two countries and two products, all specialisations are equally good for growth and development. Whether a country ends up producing computers or wheat is irrelevant, as with either one it reaches higher levels of consumption from specialisation and trade.
2. Apart from the ESPON database, trade data at the regional level is also available by the EUREGIO (PBL EUREGIO, n.d.) and its recent update for 2017 by Almazán-Gómez et al., (2023) and the more recent dataset by Huang and Koutroumpis (2023) in Nature Scientific Data. We would like to clarify that the empirical work for this paper was initiated before the public release of Huang and Koutroumpis's (2023) dataset. As such, our analysis was based on the most comprehensive and accessible regional trade data available at that time – specifically, the ESPON Trade database (2010–18), which uniquely provides intra-EU regional trade flows including services at the NUTS-II level. Moreover, EUREGIO from PBL offers an earlier coverage (2000–10), which is beyond the scope of the present analysis, and is also limited to the EU-25 (not including data for Cyprus, Romania and Bulgaria).
3. The specific index is established in the literature as a measure of relative (not absolute) trade movement. It works equally well in all possible scenarios because it measures the relative attractiveness of the single European market as a trade partner to firms located in different EU regions.
4. The index is estimated by the formula:

$$GRAV_i = \sum_j \left( \frac{P_i P_j}{d_{ij}} \right)$$

where  $P_i$  and  $P_j$  represent the population of regions  $i$  and  $j$ , respectively; and  $d_{ij}$  indicates the Euclidian distance between them.

5. Regions with integration index close or equal to 1 are those with no trade relations outside the EU.

6. To examine this association further, we also plotted regional growth of peripheral regions with imports from developed countries as a share of total imports from the EU (see Figure B1 in Appendix B in the supplemental data online), which provides evidence of a negative correlation between import penetration from more developed countries and regional growth in EU periphery.

7. Correlations between growth and integration in services by typology of trade partners are presented in Figures C1–C3 in Appendix C in the supplemental data online.

8. The results are estimated with two-year lags in all explanatory variables. We also used one-year lags, but resorted to the two-year lags due to the better fit of the model.

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