

## EXPLORING DYNAMICS BETWEEN THE SOCIOECONOMIC SECTORS FROM NORTH OF PORTUGAL AND GALICIA

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### **Abstract**

Cultural and institutional differences could difficult to strengthen the relationships between regions from diverse countries. This situation is a little true for the cooperation among the North of Portugal and Galicia, but present and recent past show that there is promising news for the future. In this scenario, the main objective of this work is to identify the dynamics between the economic sectors of these two regions, stressing the advantages from a closer cooperation. To achieve these objectives, data from the Eurostat for the Portuguese and Spanish NUTS 3 were considered. These data were explored through panel data models from the Keynesian and Neoclassical models, allowing for spatial effects. The main findings stress that there are interesting catching-up effects between the North of Portugal and Galicia that could be explored deeper, namely between the manufacturing industry.

**Keywords:** Verdoorn law, Convergence Theory, Panel data.

**JEL classification:** C23, E12, E13, O47, R11

**Acknowledgments:** This work is funded by National Funds through the FCT - Foundation for Science and Technology, I.P., within the scope of the project Ref<sup>a</sup> UIDB/00681/2020. Furthermore we would like to thank the CERNAS Research Centre and the Polytechnic Institute of Viseu for their support. This work is supported by national funds, through the FCT – Portuguese Foundation for Science and Technology under the project UIDB/04011/2020.

We would, also, like to thank the IACOBUS – Research Stays program (7th edition, 2019/2020, <https://iacobus.gnpaect.eu/>), as well as, its managing entity AECT – Galicia-Norte de Portugal (<https://www.gnpaect.eu/portal-transfronterizo/>). This IACOBUS program is co-financed by FEDER funds, through POCTEP INTERREG VA.

### **1. Introduction**

The North of Portugal and Galicia benefit from a closer relationship in the several dimensions and domains of the Portuguese and Spanish dynamics and there are, fortunately, several examples where the interlinkages were, are, and will be profitable for both regions (Bouza, Llanes, and Lopez 2019). The two regions have several similarities and differences, that may be potentiated as strengths through adjusted approaches (Fernández and Grela 2003), in a context of territorial cooperation (Outeda 2010), where the companies may share synergies (Ferraz, Galbán, and Villar 2007). These analogies and diversities are visible in various fields, including in the natural conditions and occurrences (Fernandez-Nogueira and Corbelle-Rico 2020). Some macroeconomics problems are identical in Portugal and Spain (Antosiewicz and Lewandowski 2017) and these two countries take advantages from working together, where the universities (Blanco, Bares, and Hrynevych 2019) and the scientific research (Calvo, Fernandez-Lopez, and Rodeiro-Pazos 2019) may have an interesting contribution. Human capital is crucial for any regional development strategy, and here, the universities and the scientific community bring relevant outcomes.

In a regional development perspective, closer relationships between neighbours' regions are crucial for a balanced growth that allows for a more reduced level of asymmetries, with benefits for the local populations and the several stakeholders (Lange 2017). Of course, in these relations, it was vital the Portuguese and Spanish adhesion to the European Economic

Community, because removed the constraints in the borders (Santamaría and González 2011), increased the availability of public financial supports and changed, for instance, the evolution of the transport infrastructures. However, here the strategies adopted by the two countries were different with impacts in relations between the Portuguese and Spanish (Cornado 2018). The transport costs play a determinant role in regional development, namely, because of their implications in the accessibility conditions of the border regions to the great urban concentrations (Condeco-Melhorado and Christidis 2018). For a balanced regional development, it is essential to reduce the transport costs and in these contexts, maybe the benefits from the railroad should be highlighted.

It seems that there are, indeed, several opportunities for relationships between the North of Portugal and Galicia. However, the realities are, in certain aspects, different and need a deeper analysis that brings more insights for the diverse stakeholders to create conditions for a more balanced development between the both regions (Anuario Galicia-Norte de Portugal 2018).

For example, in the Galician (for the year 2017) textile, clothing, fashion, and construction are relevant sectors with remarkable contributions for the total gross value added. On the other hand, tourism was one of the sectors with higher growth rates relative to 2016. The tourism is, indeed, an important sector for the Portuguese and Spanish contexts (Dimitric, Zikovic, and Blecich 2019). The Galician labour productivity growth, in 2017, had, also, interesting growth rates (Consortio de la Zona Franca de Vigo 2019). In any case, other socioeconomic sectors have, also, its importance in Portugal and Spain, as the agricultural sector, where, the productivity problems continue to be real (Escribano et al. 2016). The labour productivity performance is crucial for the economics dynamics (Santos and de Waal 2019). However it is a variable that depends on several factors (Ferreira et al. 2019), as, for example, the foreign direct investment (Galanos and Poufinas 2018), or the regional institutions quality (Ganau and Rodriguez-Pose 2019), or the monetary policies and the capital allocation (Gopinath et al. 2017), or companies size (Marques 2019), or labour market characteristics (Murtin and Robin 2018), or technological innovation (Toshevaska-Trpchevska et al. 2019).

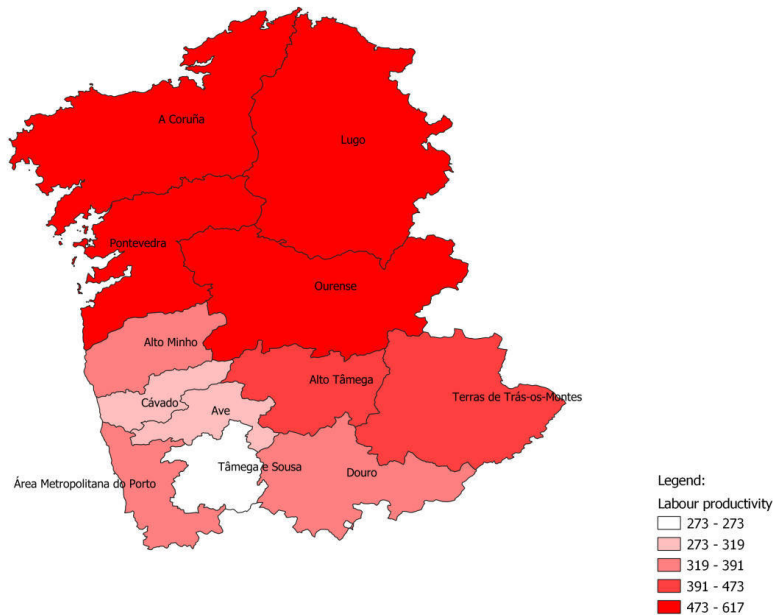
In this context, it is intended in this study to highlight the main socioeconomic dynamics between these two regions, showing opportunities for several actors from Portugal and Spain. For that, it was, first, we explored the data through descriptive analysis, considering the outputs from the QGIS (2020) software, and after through spatial autocorrelation research with the GeoDa (2020) software. Finally, several regressions were performed, considering panel data and spatial approaches, through the Stata (2020) software. The several statistical information and the shapefiles (for the spatial analysis) were obtained from Eurostat (2020) for the NUTS 3. The regressions were performed considering as base the models from the Keynesian theory for the Verdoorn law, and the Neoclassical theory for the convergence approaches.

In the Verdoorn law model, the productivity growth is endogenous and depends on the output growth. This model captures increasing returns to scale (more significant when the coefficient of regression is higher a close to one a lower when the coefficient is inferior and close to zero) and effects of learning-by-doing (Wells and Thirlwall 2003). High increasing returns to scale are evidences of regional divergence through self-reinforced circular and cumulative processes. In the convergence approaches, it was considered the models from (Islam 1995) for panel data, where productivity growth is dependent on the productivity logarithm of the previous year. A negative coefficient of regression shows signs of convergence.

## **2. Data analysis for the labour productivity**

The labour productivity for the all sectors (gross value added at basic prices, euro, deflated - 2015=100, by the number of employees) in the northern Iberian, in average over the period 2010-2016 (figure 1), presents higher performance in the Galician regions and lower values for the Portuguese regions corridor Cávado-Ave-Tâmega e Sousa.

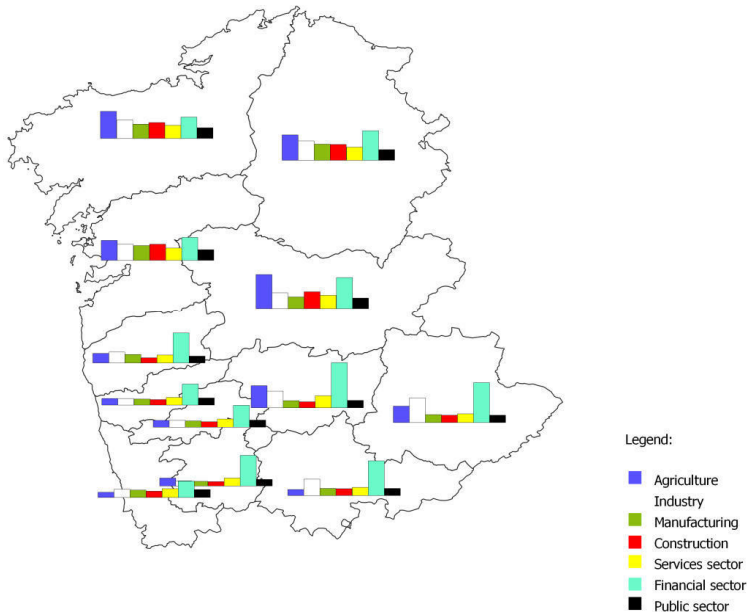
**Figure 1. Labour productivity for the all sectors (gross value added at basic prices, euro, deflated - 2015=100 by the number of employees) for the North of Portugal-Galicia NUTS 3, in average over the period 2010-2016**



Inversely to what happens in the Portuguese context, in the Galician regions the “Agriculture, forestry and fishing” sector is that with higher levels of productivity, together with the “Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities”. The “Public administration and defence; compulsory social security; education; human health and social work activities; arts, entertainment and recreation, repair of household goods and other services” are the activities with lower productivity in the Galician regions (figure 2).

In the North of Portugal regions, the “Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities” sectors are those with higher levels of productivity. On the other hand, of stressing high levels of productivity for the “Agriculture, forestry and fishing” in regions as Alto Tâmega and Terras de Trás-os-Montes.

**Figure 2. Labour productivity by sector (gross value added at basic prices, euro, deflated - 2015=100 by the number of employees) for the North of Portugal-Galicia NUTS 3, in average over the period 2010-2016**

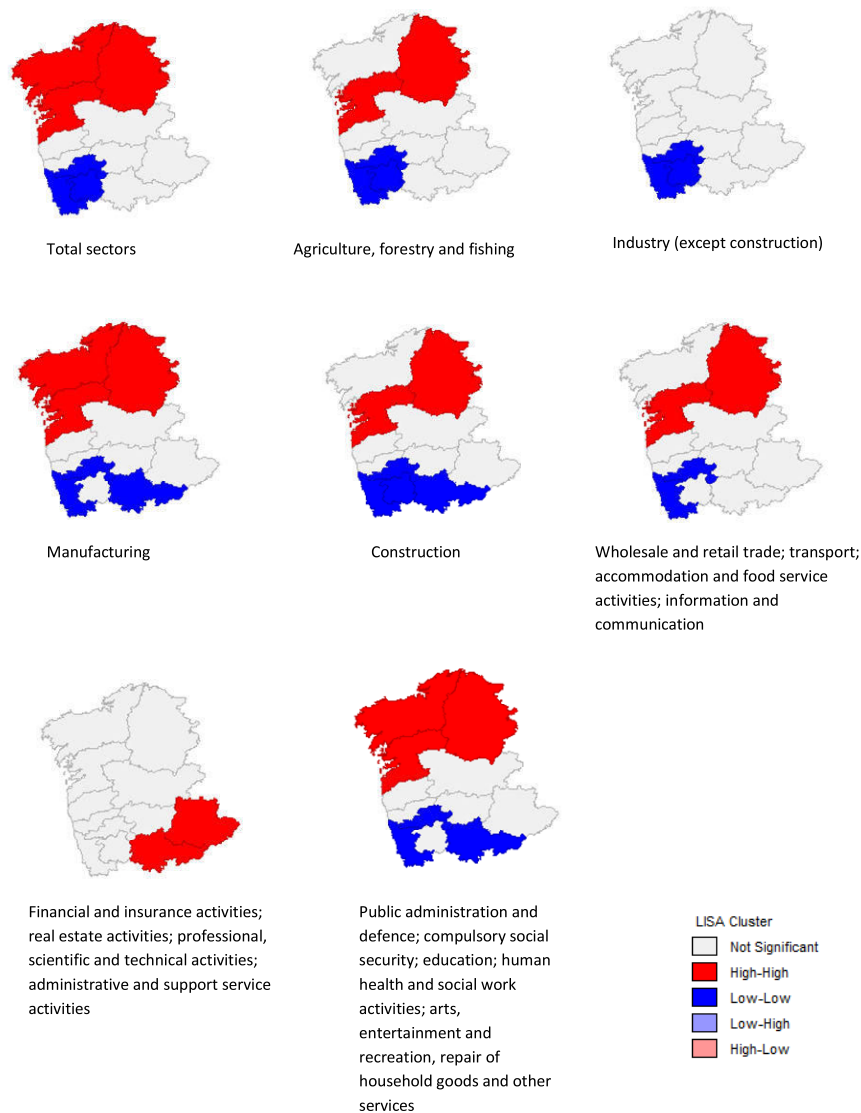


Note: Agriculture - Agriculture, forestry and fishing; Industry - Industry (except construction); Manufacturing - Manufacturing; Construction - Construction; Services sector - Wholesale and retail trade; transport; accommodation and food service activities; information and communication; Financial sector - Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities; Public sector - Public administration and defence; compulsory social security; education; human health and social work activities; arts, entertainment and recreation, repair of household goods and other services.

### 3. Spatial autocorrelation analysis

The spatial autocorrelation research presented in figure 3 was performed with the GeoDa software for several sectors of the northern Iberian regions. In this figure, the clusters high-high and low-low represent positive spatial autocorrelation, for high and low values, respectively, and the clusters high-low and low-high represent negative spatial autocorrelation (GeoDa, 2020).

**Figure 3. Local spatial autocorrelation analysis for the North of Portugal-Galicia NUTS 3, in average over the period 2010-2016**



The figure 3 reveals that there are positive spatial autocorrelation between the northern Iberian regions, but only between the Galician regions (in general for higher values) and between the North of Portugal regions (in general for lower values). The absence of spatial autocorrelation between the Galician and North of Portugal regions difficult the implementation of common policies for a balanced impact in neighbours regions. This is an aspect that should be addressed deeper in future researches.

#### 4. Results from the several regressions

The results presented in the table 1 for the Verdoorn law model present that increasing returns are higher in the manufacturing (higher coefficient of regression, 0.830) and lower for the “Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities” sectors (0.374, without statistical significance). Construction, also, shows that increasing returns to scale are low, and the result for the coefficient of regression from the “Agriculture, forestry and fishing; Industry” seems exaggerated and not expected by the theory. However, it is usual to obtain this kind of results for this sector, maybe because the changes verified in the last decades for the agricultural sector. For the theory, it is expected to obtain greater increasing returns to scale in the manufacturing, considered the engine of the economy, producing tradable goods.

**Table 1. Panel data estimation results based on the Verdoorn law model for the economic sectors, over the period 2010-2016 and across the North of Portugal-Galicia NUTS 3**

Sectors	Total sectors	Agriculture	Industry	Manufacturing	Construction	Services	Finance	Public services
Model	Fixed effects	Random effects	Random effects	Random effects	Random effects	Random effects	Random effects	Random effects
Constant		-0.002 (-0.520)	0.002 (1.130)	0.002 (0.840)	0.009 (1.030)	-0.005 (-0.980)	-0.000 (-0.110)	-0.006** (-1.940)
Output growth	0.670* (11.650)	1.029* (9.910)	0.798* (16.220)	0.830* (20.210)	0.456* (7.450)	0.701* (10.180)	0.374 (1.540)	0.760* (13.400)
Independent variable lagged	-0.113 (-0.520)	-0.835* (-4.680)	-0.699* (-8.010)	-0.701* (-8.560)	-0.347* (-2.590)	-0.263 (-1.100)	0.322 (-1.170)	0.366 (1.580)
Dependent variable lagged	-0.415 (-1.530)	0.703* (4.600)	0.770* (7.120)	0.739* (6.240)	0.557* (2.810)	-0.395 (-1.510)	0.711* (5.930)	-0.556** (-1.680)
Error term lagged	0.867* (14.820)	-0.150 (-0.430)	-0.362 (-1.100)	-0.590** (-1.910)	0.051 (0.150)	0.789* (8.650)	-0.744* (-2.570)	0.764* (6.190)
Hausman test	14.150*	0.120	0.100	0.730	1.560	1.060	0.810	1.210

Note: \*, statistically significant at 5%; The variables were lagged with a queen contiguity matrix.

Agriculture - Agriculture, forestry and fishing; Industry - Industry (except construction); Manufacturing - Manufacturing; Construction - Construction; Services sector - Wholesale and retail trade; transport; accommodation and food service activities; information and communication; Financial sector - Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities; Public sector - Public administration and defence; compulsory social security; education; human health and social work activities; arts, entertainment and recreation, repair of household goods and other services.

The spatial effects were considered in this model through the dependent and independent variables lagged spatially through a queen contiguity matrix, following Stata (2020) procedures. There were, too, considered random spatial effects through the error term lagged. In general, the spatial effects from the independent variable lagged are negative, and those from the dependent variable lagged are positive (except for the public sector with a level of significance of 10%). This result means that, for this model, the productivity growth of each region is influenced negatively by the output growth from the neighbours` regions and influenced positively by the productivity of closer regions. The random spatial effects are positive for all regional economies, services, and public sectors and negative for the manufacturing and financial sectors.

The results in table 2 reveal that there are signs of convergence in all sectors, except for the services and public sectors. This convergence is stronger in the industry, agriculture, and manufacturing and weaker the construction and financial sectors. The spatial effects, in this model, are positive for the independent variable lagged and, in general, positive, too, for the dependent variable lagged (exception for the services and financial sectors). The spatial random effects are negative for the economy, industry, manufacturing and public services, and positive for construction, services and financial sectors.

The absence or lower levels of convergence of the more essential sectors for northern Iberian should deserve special attention from policymakers, because this framework may compromise a balanced regional development. This sectors include “Wholesale and retail trade; transport; accommodation and food service activities; information and communication”, “Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities”, and “Public administration and defence; compulsory social security; education; human health and social

work activities; arts, entertainment and recreation, repair of household goods and other services”. In turn, the sector “Wholesale and retail trade; transport; accommodation and food service activities; information and communication” presents strong signs of increasing returns to scale that favour the asymmetric regional growth.

**Table 2. Panel data estimation results based on the convergence model for the economic sectors, over the period 2010-2016 and across the North of Portugal-Galicia NUTS 3**

Sectors	Total sectors	Agriculture	Industry	Manufacturing	Construction	Services	Finance	Public services
Model	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Random effects	Fixed effects	Random effects
Constant						-0.037 (-0.320)		-0.019 (-0.410)
Productivity logarithm	-0.708* (-6.470)	-0.743* (-6.070)	-0.807* (-6.400)	-0.651* (-4.690)	-0.297* (-4.410)	0.005 (0.250)	-0.282* (-3.520)	-0.002 (-0.340)
Independent variable lagged	0.531* (3.770)	0.306 (0.690)	0.768* (5.430)	0.622* (3.010)	0.098 (0.410)	0.003 (0.620)	0.010 (0.050)	0.005* (2.610)
Dependent variable lagged	0.837* (12.770)	0.484 (0.910)	0.814* (10.750)	0.670* (4.410)	0.401** (1.710)	-1.061* (-5.350)	-0.716* (-2.390)	0.936* (41.800)
Error term lagged	-0.906* (-3.760)	0.085 (0.110)	-0.983* (-4.190)	-0.677* (-2.060)	0.399** (1.690)	0.810* (8.770)	0.745* (6.160)	-1.226* (-7.780)
Hausman test	40.020*	37.840*	33.130*	19.480*	14.780*	4.960	45.360*	***

Note: \*, statistically significant at 5%; \*\*, statistically significant at 10%; \*\*\*, results for the regression with fixed effects not statistically robust; The variables were lagged with a queen contiguity matrix.

Agriculture - Agriculture, forestry and fishing; Industry - Industry (except construction); Manufacturing - Manufacturing; Construction - Construction; Services sector - Wholesale and retail trade; transport; accommodation and food service activities; information and communication; Financial sector - Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities; Public sector - Public administration and defence; compulsory social security; education; human health and social work activities; arts, entertainment and recreation, repair of household goods and other services.

## 5. Conclusions

This work intended to bring more insights about the socioeconomic growth process in the northern Iberian regions. The analysis was performed by sector considering the data available in the Eurostat for the gross value added (deflated by the Harmonised Index of Consumer Prices, 2015=100) and for the number of employees. These data were explored through descriptive analysis and spatial autocorrelation approaches. Regressions based on the Verdoorn law and convergence theory were performed with panel data and allowing for spatial effects.

The data analysis stresses that the levels of productivity, for the all economy, are higher in the Galician regions and the lower values from the Portuguese context are verified in the regions Cávado, Ave, and Tâmega e Sousa. A significant part of this framework is explained by the lower levels of the productivity, in general, verified in the several sectors of the regions from the North of Portugal, except for the “Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities”.

The spatial autocorrelation approach highlight the absence of spatial autocorrelation between the Galician and the North of Portugal regions, which difficult the implementation of common strategies. In fact, in the presence of positive spatial autocorrelation, it could be possible to establish agreements to implement policies in some strategic regions and wait for expected spreading effects for the neighbours regions, saving resources and obtained a more effective implementation.

The regression results show that the sectors with higher relative importance, in these regions, as “Wholesale and retail trade; transport; accommodation and food service activities; information and communication” and “Public administration and defence; compulsory social security; education; human health and social work activities; arts, entertainment and recreation, repair of household goods and other services”, are those with higher increasing returns to scale and absence of convergence. In turn, the “Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities” sectors are, too, relevant sector with lower levels of convergence.

In conclusion, the visible effects from adjusted policies take time and are lagged in time; however, these frameworks described before could be interesting bases for the several

Portuguese and Spanish stakeholders. In any case, public interventions are needed to correct this unbalanced development between the North of Portugal and Galicia.

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