Competition, Complementarity and Increasing Disparities Among the Regions of Spain and Portugal

Sandy Dall'erba[1]
(sandy.dallerba@etud.univ-pau.fr)

Department of Economics, University of Pau (France)

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Abstract

The aim of this paper is to investigate the role of regional competition and complementarity on increasing internal disparities within the Iberian peninsula over the last two decades. Competitive and complementary dynamics among the regions of Spain and Portugal rely on their intense trade, which is based on a combination of their comparative advantages, increasing returns and lowered transportation costs. In that purpose, we apply first the Dendrinos-Sonis model (1988) to the Gross Domestic Product of the regions of Spain and Portugal. Essentially, the model implies that growth in one region takes place at the expense of a least one other. The results show significant complementary relationships between Este, Centro and Sur; and highlight the strong influence of Este and Madrid on all the regions. Since both countries are major beneficiaries of European cohesion efforts, we extend the application to the key sectors of regional development policies: agriculture, energy, non-market services, transportation and telecommunications. The nature of the relationships that are revealed encourages policies supporting the three first sectors but not the transportation and telecommunication sector.

JEL classification: O52, R11, R15

Section 1   Introduction

Since 1986, when Spain and Portugal decided to become members of the European Community, these two countries have been respectively the fourth and second main beneficiaries of the cohesion efforts devoted by the European Commission, with a level of per capita regional development funds just below those of Ireland and Greece, but way above the rest of the countries. Over the last two decades, the Gross Domestic Products of Spain and Portugal have succeeded in converging to the European average, but regional disparities have strongly increased within both countries (Neven and Gouyette, 1995; Quah, 1996). This raises the question of identifying the forces driving to uneven regional development, given that one of the primary objectives of regional funding has been to ensure greater cohesion over the whole European territory.

Several reasons have been advanced in the literature : a) the agglomeration forces at work may be so high that giving a small advantage to a poor region will in no case alter the stability of the mechanism (Krugman, 1991; Faini, 1983); b) transportation infrastructures, which is the key sector for favoring regional cohesion according to the EU Commission, can lead to agglomeration of firms in the richer area when they are built between regions of different levels of development (Martin, 1999; Vickerman *et al.*, 1999): c) the aptitude that rich regions have to triple or quadruple the amount of regional funds devoted by the Commission in the financing of a particular project has been highlighted too (Fayolle and Lecuyer, 2000; Dall'erba, 2003). As a result, the total amount of investment some rich regions benefit from may be higher than in poor regions, since they hardly double the targeted amount of regional funds. In this paper, we investigate the role of interregional competitive and complementary relationships on increasing internal disparities within the Iberian peninsula over the last two decades.

According to the traditional international trade theory, based on the Hecksher-Ohlin model, different factor endowments, regional specialization in the most abundant local factor and free factor mobility are at the origin of regional comparative advantages and disadvantages upon which interregional trade is based. However, this basic model does not allow explaining the concentration of activities or the increasing trade that is taking place between very similar economies, as those of the European Union members for example. Therefore, Krugman (1991) introduces imperfect competition as an explanation to agglomeration: because of increasing transaction costs with distance, firms concentrate in a region with larger market and close to the supply of production factors and intermediary goods. Hence, concentrated firms benefit from greater pecuniary externalities, technological externalities and increasing returns than isolated firms. At the European level, these forces can explain how greater integration has favored interregional dependence at the expense of intraregional dependence. In addition, the structure of the European economies is becoming similar. This is reflected by a growing dominance of intraindustry trade (indicating diversification) as opposed to interindustry trade (specialization). If the Single Market has not led to a strong specialization of European economies, regional economies within countries are getting more specialized according to the technology and quality advantages of each region. Interregional trade is increasingly based on vertical differentiation (by quality) at the expense of horizontal differentiation (by variety) of products traded within the same industry. Differences in quality result from differences in factor composition. However, the latter is not due to

differences in factor endowments like in the traditional theory, but to previous investments in human capital and R&D, regional size and limited technological externalities over space. These comparative advantages are dynamic: the wealthiest regions tend to specialize in high quality goods, because their higher development and income allow them greater efforts in human capital, R&D and technological externalities, whereas the poor regions tend to specialize in lower quality goods.

The existence of cultural, social and economic similarities between the regions of Spain and Portugal suggests that their regions may become more similar over time. In this case, region-specific fluctuations would decrease, making these regions less sensitive to a specific shock. In other words, complementary relationships should overcome competitive relationships. On the contrary, it may appear that spatially limited agglomeration forces, increasing transaction costs with distance and differences in initial development levels maintain regional dynamics in the form of growing polarization/specialization. As a result, each region would be more sensitive to specific shock and competitive relationships would dominate complementary relationships. In this case, growth in one region takes place at the expense of several other regions of our sample.

In order to assess the nature of interregional relationships, section 2 will present the Dendrinos-Sonis (1988, 1990) model according to which growth in regional income is similar to a zero-sum game. The model has been applied to regional income distribution within various countries: the USA (Hewings *et al.*, 1996), Indonesia (Nazara *et al.*, 2001), Brazil (Magalhães *et al.*, 2001). This paper differs from previous applications for two reasons: first we introduce in section 3 the estimation results of the Gross Regional Domestic Product between the regions of two neighboring countries, including thus cross-border relationships. Second, we extend in section 4 the application to the key sectors of the European regional development policies (agriculture, energy, non-market services, transport and telecommunications) to shed some light on the nature of the spillover effects induced by these funds. This paper suggests that this method of cross-border horizontal relationships by sector is a pertinent alternative to the conventional regional models with vertical sectoral relationships.

Section 2   The Model

Our analysis is based on the application of the Dendrinos-Sonis model (1988, 1990). The basic model proceeds as follows.

Denote $x_i(t)$ as the relative income of province i, i.e. its share in the whole national income at time t. There are n regions in the economy and the relative income distribution can be written as:

$$X(t) = \left[x_1(t), ..., x_i(t), ..., x_n(t) \right] \quad i = 1, ..., n \qquad t = 1, ..., T.$$

Such a formulation could be specified for any regional socio-economic variable, normalized over a national total. The relative dynamics of the distribution of one population over multiple locations is given for each period t by:

$$x_i(t+1) = \left(\frac{F_i[x(t)]}{\sum_i^n F_j[x(t)]} \right) \qquad \text{for } i,j=1, \dots, n \text{ and } t=1,\dots, T \qquad (1)$$

where $0 < x_i(0) < 1$, $F_i[x(t)] > 0$, and $\sum_i^n x_i(0) = 1$. According to Sonis and Hewings (2000), the expression $F_i[x(t)]$ presents the locational and temporal comparative advantages enjoyed by the population at (i,t). Note that the function $F_i(.)$ can take any arbitrary form as long as it satisfies the positive value property. If the first province is considered as the numeraire or reference region, then:

$$G_j[x(0)] = \frac{F_j[x(0)]}{F_1[x(0)]} \qquad \forall j = 2, 3, \dots, n.$$

Equation (1) can then be more explicitly stated as the following system of equations:

$$\begin{cases} x_1(t+1) = \dfrac{1}{1 + \sum_{j=2}^n G_j[x(t)]} \\ x_j(t+1) = x_1(t+1)G_j[x(t)] \end{cases} \qquad \text{where } j=2,3,\dots,n. \qquad (2)$$

The numeraire has a significant role in the model since it ensures that the sum of the shares of all regions in the system is one. This may seem trivial but is essentially important, implying that a region's economic growth (in terms of competing for the national share) is not independent of the shares of other regions. Following Richardson's (1973) competitive-generative model of economic growth, the Dendrinos-Sonis model can be seen as a working framework of this competitive model in terms of proportions, i.e., regions are in competition mode to obtain the maximum possible share. In terms of the absolute number, a region's income may grow without formal constraints. However, in terms of the proportion, this is similar to a zero-sum game in which the growth in one region takes place at the expenses of a least one another.

This model can be reformulated in a log-linear specification of $G_j[x(0)]$ as suggested by Dendrinos and Sonis (1988). Formally:

$$G_j[x(0)] = A_j \prod_k x_{kt}^{a_{jk}} \qquad \text{where } j=2, \dots, n \text{ and } k= 1, \dots, n. \qquad (3)$$

where $A_j > 0$ represents the locational advantages of province j for $j= 2, \dots, n.$

The coefficient a_{jk} can be written as the following:

$$a_{jk} = \frac{\partial \ln G_j [x(0)]}{\partial \ln x_{kt}}.$$

As its form suggests, these coefficients can be interpreted as the percentage change of income, i.e., percentage growth in region j relative to that in region 1 (the numeraire), with respect to one percentage change of income in region k. In essence, they are elasticities.

The explicit form of the log-linear function is formalized as follows:

$$\ln x_j(t+1) - \ln x_1(t+1) = \ln A_j + \sum_{k=1}^{n} a_{jk} \ln x_k(t) \quad \text{where } j=2, \ldots, n \text{ and } k=1, \ldots, n. \tag{4}$$

The regional system at hand involves as many as n-1 equations. The coefficient a_{jk} is central to the competition and complementarity analysis, both in terms of its sign as well as its magnitude. A positive value would indicate complementarity growth between the two regions j and k. In other words, every one per cent income growth in region k would correspond to a a_{jk} per cent income growth in region j. On the other hand, a negative value of a_{jk} would indicate a competitive relationship between the two regions. If the share in one region grows, the other's share will decline.

Since we are dealing with a system of equations having the same explanatory variables, equation (4) is estimated using a seemingly unrelated estimator (SUR). The SUR technique employed also makes sure that the solution achieves the maximum log of the likelihood function.

The Dendrinos-Sonis model has been originally developed to explain the regional dynamics of population changes (Dendrinos and Sonis, 1988), but has also been applied to income variables in the US regional system (Hewings *et al.*, 1996; Magalhães *et al.*, 2001) and the Indonesian regional system (Nazara *et al.*, 2000 and 2001). The empirical estimation proposed in section 3 differs from the previous papers since regional interaction is not assumed to be country-limited, and more insights into the policy implications will be provided in section 4 by disaggregating the usually-used Gross Regional Domestic Product (GRP) into several sectors corresponding to regional development policies.

Section 3 Interregional Income Dependence

We use the GRP over 1980-1999 from the REGIO database for our first empirical estimation. The results are displayed in two different forms: first, the regression results involving the various estimated coefficients with their statistical properties, and second, the qualitative analysis of the results, with only the signs of the regional interactions. Figure 1 below shows the regions of the Iberian peninsula upon which the estimation is based. These are six official Spanish NUTS 1 regions (Canarias islands are excluded due

to their remoteness) and one Portuguese NUTS 1 region (Azores and Madeira are excluded for the same reason)[1].

<<Insert figure 1 here>>

<<Insert table 1 here>>

<<Insert table 2 here>>

The coefficients displayed in tables 1 and 2 have been estimated using equation (4), with Noreste as the numeraire[2]. They show that for the growth of Centro, Este and Sur, the behavior of all the regions has been significantly complementary, while it has been either complementary or competitive for Madrid, Portugal and Noroeste. For each of these two last regions, only two regions are acting in complementary mode (positive elasticities) on their growth: themselves and Este for Portugal, Sur for Noroeste. Intuitively, each region is benefiting positively from its own growth. So how could we explain that Este is also in a complementary mode for the growth of Portugal (respectively Sur for Noroeste) when it is located at the extreme opposite of Portugal (resp. Noroeste) within the Iberian peninsula? As suggested in the introduction, space is not the variable that determines the nature of the relationships between regions, but it is rather each region's quality and technology advantages that lead to differences in the structure of their economies and thus to increasing specialization. Este is a very developed region, within which NUTS 2 region Cataluña alone has a share of GRP of high as the one of Portugal. Actually Cataluña is the richest Spanish region, with a per capita GDP also higher than the European average. It is specialized in high quality goods, reflecting its efforts in human capital, R&D and technology. On the contrary, Portugal is still lagging behind and specializes in low technology and low quality goods. As a result, the behavior of Este is complementary with Portugal's growth, which in turn is also in complementary mode with all the other regions (except Noroeste). This analysis is also true for the relationship between Noroeste and Sur. If Sur's share of GRP is 1.6 times greater than the one of Noroeste, it only reflects the fact that Sur is 1.5 times wider than Noroeste, because this last's per capita GDP is 1.5 time greater.

The magnitude of the elasticities reflects the significant role of Este and to a lower extent Madrid, the two richest regions of our sample, on the growth of all the regions. In other words, other regions' behavior has a lower impact on each region's economic growth. Moreover, Este is the most self-sufficient region, in the sense that the highest economic impact on its growth comes from its own economic growth. Its leading role in the Iberian peninsula is so important that it is also Este that has the greatest impact on Madrid's growth.

Greater specialization of the regions in conjunction with the major influence of the developed regions of Este and Madrid have favored increasing disparities within the Iberian peninsula. If the per capita incomes of Spain and Portugal converge slowly to the European average, both countries have experienced strongly increasing disparities among their regions over the last two decades (Quah, 1996; Dall'erba and Hewings, 2002).

Empirical evidence seems therefore to confirm Krugman's model (1991) with increasing returns and decreasing transportation costs that lead to agglomeration of activities and possible regional disparities in the absence of smoothing effects to reduce these agglomeration forces.

Because of very low labor mobility between but also within country and the limited capacity of each country to reduce internal disparities, the European Commission has increased its efforts to favor cohesion as a prerequisite to further economic integration. Currently, regional development policies represent as much as one third of the European budget and focus more especially on Ireland, Greece, Portugal and Spain (also called cohesion countries). We may then wonder why the efforts of the European Commission have not succeeded in reducing internal disparities. The answer mainly comes from the type of infrastructures regional funds finance. The next section therefore extends the methodology to the interregional interactions for each of the keys sectors of regional development policies. Moreover, the GRP is an aggregated measure of the gross values added by sector and taxes on value added. In other words, even if the regions of our sample are mainly complementary, it is obvious that it could be not the general path for all the sectors and that, for some sectors, regions can have good degree of competition.

Section 4   Application to the Key Sectors of Regional Development Policies

Tables 3 to 6 display the qualitative analysis of GVA for each of the following sectors: agriculture, energy, non-market services, transportation and telecommunication. Non-market services include governmental expenses for education, social aids and general administration. All these data come from the Regional database of Cambridge Econometrics and cover the 1977-2000 period.

Compared to table 1, tables 3 to 6 show the results of the qualitative analysis of the within NUTS 1 region relationships by including each of the NUTS 2 region in the analysis. This is relevant with policy implications since regional development funds are allocated according to criteria determined at the NUTS 2 or NUTS 3 level. However, because of a limitation in the degree of freedom, we cannot consider all NUTS 2 regions together. We therefore assess for each NUTS 1 region the relationships between its NUTS 2 regions and the relationships with the other NUTS 1 regions (Nazara *et al.*, 2001). For the numeraire, we use the following: Centro for the region Noroeste, Noroeste for the region Noreste, Este for the region Madrid, Noroeste for the region Este, Centro for the region Sur and Sur for the region Portugal. The results in tables 3 to 6 display significant coefficients at 10% or less in most of the regions but in Noreste and Portugal. As pointed out by Nazara *et al.* (2001), the non-significant results represent coefficient of zero values from a statistical point of view. However, the empirical evidence shows that interregional interactions, through trade, are anyway taking place between all these regions. They suggest therefore that in this methodology the non-significance reflects the absence of clear determination of competitive versus complementary relationship rather than the total absence of relationship.

<<insert table 3 here>>

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Table 3 displays the results for the agricultural sector. This sector plays an important role in the policies that favor even regional development through the subsidies of the Common Agricultural Policy and through the Objective 5a and 5b funds. The results show that the majority of the regions are complementary one to another. There are two exceptions to this type of relationships: all the regions are significantly in competition with Noroeste and Madrid, whereas they both act positively on other regions' share in the agricultural sector. Noroeste and Madrid are the smallest regions of our sample, with a size respectively 5 and 27 times smaller than the one of Centro, the biggest region of our sample. Due to land limitation, the two strongly populated regions are widely dependent on the supply of agricultural products from other regions. In other words, they are net importers. The regions within Noroeste are also in competitive mode.

With regards to the results of Portugal and Noreste, the non-significance of the coefficients does not allow to conclude on the impact of other regions' share on their own share. However, both regions are in complementary mode with Centro, Este and Sur. The results presented in table 3 suggest that subsidies to agriculture would have interesting equity issues since growth in this sector acts positively on regional share of the poorest regions (Centro and Sur) and the richest one (Este), but negatively on two rich regions (Madrid and Noroeste). However, looking into the future, the lack of innovation and technology in agriculture does not make the agricultural sector as the best choice for promoting long-run income convergence between regions. We need therefore to consider other sectors with a greater impact on each region's growth to favor a more even development between regions.

<<insert table 4 here>>

The role of energy is investigated in table 4. Energy consumption (fuel, gas, coal and electricity) is an essential element of the production function in the sense that it offers the ability to perform work. However, looking at the GVA in this sector, it is the interaction between regional shares in energy production and energy infrastructures that we are evaluating. As for the preceding sector, all the regions are in complementary mode with the regions of Centro, Este Sur and Portugal, but in competition with Madrid and Noroeste. Note that for the growth of Asturias, within Noroeste, the regions have been in complementary mode. Madrid produces almost no energy products and balances its energy needs thanks to imports from surrounding regions. That is why Madrid's growth in the energy sector depends negatively on other regions' growth. Within Noroeste, the reason may be similar for Cantabria, but is not sufficient enough to explain the competitive behavior of all the regions on Galicia's growth since this region is net exporter of energy products. Similarly, Portugal does not produce enough energy to cover its energy needs, and all the regions are in complementary mode with it. These last findings confirm that the complementary or competitive nature of the linkages between regions is based on more complex relationships than trade direction. Portugal has devoted great efforts to develop its energy sector over the last two decades in order to become more self-sufficient. As a result, its share in the Iberian energy sector has been multiplied by five over 1977-2000, whereas Spanish regions' share has remained constant or has decreased.

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As for agriculture, it seems that a policy favoring growth in the energy sector via subsidized energy production or energy infrastructures would reduce the production share of two wealthy regions (Madrid and Noroeste) and increase the one of three poor regions (Portugal, Sur and Centro) and a rich one (Este).

<<insert table 5 here>>

Table 5 displays the results for the non-market services sector. Basically, it represents the governmental expenses in education, social aids and general administration. This sector tries to capture the effect of Objective 3 funds. They support the adaptation and modernisation of systems of education, training and employment. This Objective serves as a reference framework for all measures that promote human resources in a national territory without prejudice to the specific features of each region.

Since the 1978 Constitution, each Spanish region is pretty independent from Madrid for the administrative decisions related to its territory, which may explain the competitive impact of each region on Madrid. Among the significant results, it appears that Noroeste is acting negatively on the regions of Noreste, Este and Sur, whereas all the other regions act positively on Centro, Este, Sur and Portugal. Within each NUTS 1 region, the results display the presence of at least one NUTS 2 region acting negatively on the others. This is the case of Asturias in Noroeste, Aragon in Noreste, Extremadura in Centro, Baleares in Este, Murcia and Ceuta y Melilla in Sur, Lisboã and Algarve in Portugal. It is interesting to note that within each NUTS 1 region, the NUTS 2 regions cited above are the ones where per capita GVA in the non-market services sector has increased the most. Moreover, they are the poorest region of the NUTS 1 region they belong to (except for Lisboã in Portugal and Baleares in Este). This may reflect the redistribution efforts within each NUTS 1 region and may explain why the growth of their share in this sector acts negatively on the growth of other NUTS 2 regions' share.

<<insert table 6 here>>

The role of transportation and telecommunication on interregional relationships is investigated in table 6. Unfortunately, the database we use does not differentiate the GVA in the transportation sector from the one in the telecommunication sector. Improvement in transportation infrastructures plays a key role in the efforts to reduce regional and social disparities according to the European Commission. It therefore devotes respectively 30% and 60% of structural and cohesion funds to it. All the regions are in competitive mode with Portugal and in complementary mode with Madrid, Centro, Este and Sur. The nature of interregional relationships reveals the peripherality of Portugal, which is located at the edge of the Iberian transportation network, and the central place of Madrid, Centro and Este in this network. In other words, Portugal benefits negatively from other regions' expansion in the transportation sector, whereas the other regions benefit positively from Portugal's growth in this sector. The reason is that the most important part of Portugal's exports are destined to or have to pass through Spain before being delivered to other EU members. Therefore, it is quite surprising to find that all the regions are in complementary mode with the peripheral region Sur.

As noted by Venables and Gasiorek (1999), recent developments in the Iberian transportation network have reinforced the place of Madrid as a central location through which traffic traveling from one edge of the peninsula to another has to pass. The Madrid Ring road which connects the most important Spanish highways to each other has strongly contributed to it. In terms of regional development, it does not mean that peripheral regions do not benefit of the new network, but the gains in accessibility will always be higher in the core region (Vickerman *et al.*, 1999). In their study, Venables and Gasiorek (1999) estimate also the impact of a new bridge, called Tagus Crossing, in Lisboã. Their results show that building new transportation infrastructures within a peripheral region acts as a public infrastructure capital within the region itself, but has very low spillover effects outside the region. That is why intraregional transportation infrastructures do not necessarily promote the aggregate growth, even if they may favor local development. On the other hand, promoting the aggregate growth through interregional transportation infrastructures mainly benefits the core region (Martin, 2000). Transportation infrastructures thus cannot always be seen as an efficient instrument to reduce interregional disparities.

Section 5   Conclusion

Increasing internal disparities within the Iberian peninsula is an aspect of regional development policies the European Commission does not like to stress in its reports. This paper tries to shed some light on this problematic issue by investigating the complementary or competitive nature of the relationships between the regions of Spain and Portugal. Increasing intraindustry trade between Iberian regions does not necessarily reflect similarities between their economic structures, but, on the contrary, increasing specialization in either high or low quality goods, according to each region's investments in human capital and R&D. The empirical evidence shows that regions with different economic structures and levels of economic development can move in complementary mode with each other. This is the case of the well developed Este and the two poor regions: Centro and Sur. On the opposite, the behavior of all the regions on Portugal, Madrid, Noroeste and Noreste is not clear. The results also highlight the strong influence of Este and Madrid, the two richest regions of our sample, on all the Iberian regions.

Section 4 of the paper investigates interregional relationships in each of the key sectors of regional development policies. For both agriculture and the energy sector, the results show that a policy favoring growth in these sectors would reduce the production share of two wealthy regions (Madrid and Noroeste) and increase the one of two poor regions (Sur and Centro) and a rich one (Este). With regards to the non-market services sector, all the regions behave in complementary mode with each other but with Madrid. Interestingly, within each NUTS 1 region (but Portugal and Este), the less developed NUTS 2 region is competitive to the other NUTS 2 regions, reflecting some evidence of redistribution efforts within NUTS 1 regions. It should be noted however that these empirical findings might, in part, result from the particular nature of the model we use. Finally, the transportation and telecommunication sector, upon which the European Commission relies the most important part of its efforts to enhance cohesion, confirm theoretical and other empirical investigations according to which gains in accessibility due to interregional transport infrastructures will always be relatively higher in the core

region than in the peripheral one (Venables and Gasiorek, 1999; Vickerman *et al.*, 1999). Transportation infrastructures thus cannot always be seen as an efficient instrument to reduce interregional disparities. Current developments in regional science call the European Commission for focusing more on the other aspects of regional policies since transportation infrastructures are only one part of the program for balanced regional development. Cohesion countries too claim for a reform of the objectives and criteria of regional policy, otherwise the future enlargement to the poor Central and East European countries will considerably modify the map of less developed regions.

Notes:
1. NUTS: Nomenclature of Territorial Units for Statistics. The Commission uses as regional statistical concept the spatial classification established by Eurostat on the basis of national administrative units. Europe can therefore be divided either into 77 NUTS I level regions, or 211 NUTS II, 1031 NUTS III, 1074 NUTS IV or 98433 NUTS V. Regional policy objectives are however mostly designated at NUTS II or NUTS III level.
2. We use the software Eviews 3.0.

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Figure 1. The regions of Spain and Portugal
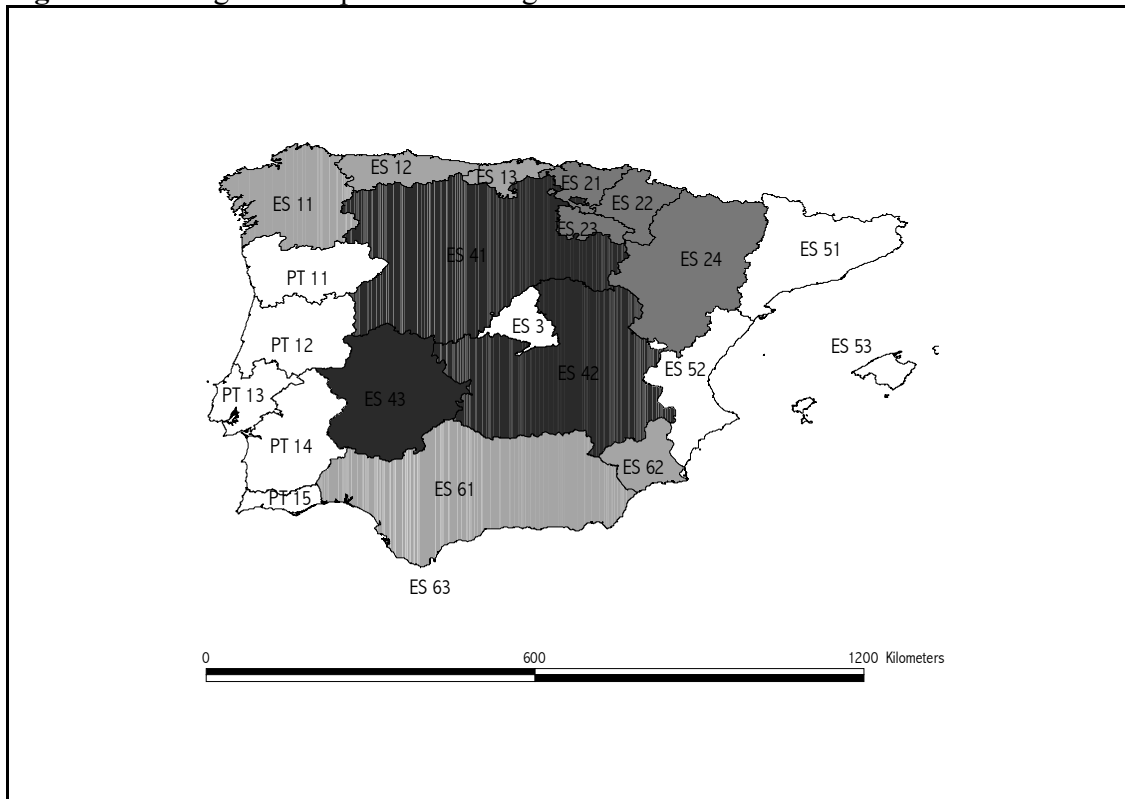
Noroeste: ES 11 (Galicia), ES 12 (Asturias), ES 13 (Cantabria)
Noreste: ES 21 (Pais Vasco), ES 22 (Navarra), ES 23 (La Rioja), ES 24 (Aragón)
Madrid: ES 3 (Madrid)
Centro: ES 41 (Castilla y León), ES 42 (Castilla-la-Mancha), ES 43 (Extremadura)
Este: ES 51 (Cataluña), ES 52 (Communidad Valenciana), ES 53 (Baleares)
Sur: ES 61 (Andalucia), ES 62 (Murcia), ES 63 (Ceuta y Melilla)
Portugal: PT 11 (Norte), PT 12 (Centro), PT 13 (Lisboã e Vale do Tejo), PT 14 (Alentejo), PT 15 (Algarve)

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Table 1. Space-time model of relative dynamics (numeraire: Noreste)

	Portugal	Este	Noroeste	Madrid	Centro	Sur	Noreste	Constant	R2
Centro	2.770 (4.61)***	5.654 (4.30)***	2.133 (4.01)***	2.955 (3.73)***	1.978 (4.46)***	3.181 (5.73)***	1.493 (3.15)***	37.670 (4.41)***	0.865
Este	1.672 (2.71)**	4.004 (2.97)***	1.268 (2.33)**	2.162 (2.66)***	1.105 (2.43)**	1.807 (3.17)***	0.541 (1.11)	23.942 (2.74)***	0.971
Sur	2.354 (2.81)***	5.723 (3.13)***	1.664 (2.25)**	3.111 (2.82)***	1.370 (2.22)**	2.102 (2.72)***	1.694 (2.57)**	33.389 (2.81)***	0.942
Madrid	0.441 (0.57)	1.628 (0.97)	-0.064 (-0.09)	1.221 (1.21)	0.138 (0.24)	-0.339 (-0.48)	-0.078 (-0.13)	4.945 (0.45)	0.988
Portugal	0.340 (0.12)	1.994 (0.32)	-0.174 (-0.07)	-1.376 (-0.37)	-2.028 (-0.98)	-0.915 (-0.35)	-1.703 (-0.77)	-9.763 (-0.24)	0.939
Noroeste	-0.519 (-0.44)	-1.496 (-0.58)	0.004 (0.00)	-1.502 (-0.97)	-1.207 (-1.39)	0.288 (0.26)	-0.700 (-0.76)	-9.862 (-0.59)	0.874

t-statistics in brackets

***significant results at 1%, **significant results at 5%.

Table 2. Qualitative analysis of the complementary/competitive relationship

	Portugal	Este	Noroeste	Madrid	Centro	Sur	Noreste
Centro	+	+	+	+	+	+	+
Este	+	+	+	+	+	+	+
Sur	+	+	+	+	+	+	+
Madrid	+	+	-	+	+	-	-
Portugal	+	+	-	-	-	-	-
Noroeste	-	-	+	-	-	+	-

Complementarity
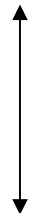
Competition
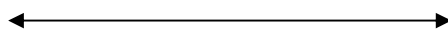
Complementarity ⟷ Competition

Table 3. Qualitative analysis of GVA in the agricultural sector

		Noroeste			Noreste				Madrid	Centro			Este			Sur			Portugal				
		ES 11	ES 12	ES 13	ES 21	ES 22	ES 23	ES 24	ES 3	ES 41	ES 42	ES 43	ES 51	ES 52	ES 53	ES 61	ES 62	ES 63	PT 11	PT 12	PT 13	PT 14	PT 15
ES11	Galicia	-***	-**	+	-*				-	-***			-***			-**			-***				
ES12	Asturias	-***	+**	-	-**				-	-***			-***			-**			-***				
ES13	Cantabria	-***	-	+	-**				-***	-***			-**			-**			-***				
ES21	Pais Vasco	+			-***	-**	+	+	-***	+			+*			+			+				
ES22	Navarra	+			+	-**	+***	+***	-	+			+**			+			+				
ES23	La Rioja	+*			+	-	+	+	+	+			+			+			+				
ES24	Aragón	+			-	-	+**	+	+	+			+*			+			+				
ES3	Madrid	-**			-*				+**	-**			-			-*			-*				
ES41	Castilla y León	+***			+***				+	+***	+***	+***	+***			+***			+***				
ES42	Castilla-la-Mancha	+***			+***				+	+***	+***	+***	+***			+***			+***				
ES43	Extremadura	+***			+**				-***	+***	+**	+***	+***			+***			+***				
ES51	Cataluña	+***			+***				+	+***			+***	+**	+	+***			+***				
ES52	Com. Valenciana	+***			+***				+***	+***			+***	+***	-	+***			+***				
ES53	Baleares	+***			+***				+***	+***			+***	+***	-	+***			+***				
ES61	Andalucia	+***			+***				+***	+***			+***			+***	+***	-*	+***				
ES62	Murcia	+***			+***				+***	+***			+***			+***	+***	-	+***				
ES63	Ceuta y Melilla	+***			+***				+	+***			+			+***	+*	+	+***				
PT11	Norte	+			+				+**	+			+			+			+*	+	-	+	+***
PT12	Centro	+			+				+*	+			+			+			+	+*	-	+	+
PT13	Lisboã eVale do Tejo	+			+				+	+			-			+			-	+	+	+	+
PT14	Alentejo	-**			-***				-	-			-			-**			-	-**	-***	-	+
PT15	Algarve	-			-				-	+			+			+			-	+***	-	-	-

Significance level: ***: p<0.01 **: p<0.05 *: p<0.1

Table 4. Qualitative analysis of GVA in the energy sector

		Noroeste			Noreste				Madrid	Centro			Este			Sur			Portugal				
		ES 11	ES 12	ES 13	ES 21	ES 22	ES 23	ES 24	ES 3	ES 41	ES 42	ES 43	ES 51	ES 52	ES 53	ES 61	ES 62	ES 63	PT 11	PT 12	PT 13	PT 14	PT 15
ES11	Galicia	-**	+	-***	-				-	-***			-***			-			-***				
ES12	Asturias	+	+***	-***	+***				-	+***			+***			+***			-				
ES13	Cantabria	-***	+	-***	-				-***	-***			-***			-***			-***				
ES21	Pais Vasco	-			-	-	+	-	+	-			-			-			-				
ES22	Navarra	-***			+	+	+***	+***	-**	-			-			-			+***				
ES23	La Rioja	-***			-	-	+***	+**	-**	-			-			-**			+**				
ES24	Aragón	+*			+	-***	+	-	+	+			+			-			-**				
ES3	Madrid	-			-				+***	-			-***			-**			-***				
ES41	Castilla y León	+			+**				-***	+**	-	+***	+***			+***			+***				
ES42	Castilla-la-Mancha	+			+***				-***	+***	+	+***	+***			+***			+***				
ES43	Extremadura	+			+*				-	-	+	+***	+***			+			+				
ES51	Cataluña	-			-				+***	+***			+	-***	-***	+***			-				
ES52	Com. Valenciana	+			+**				+***	+***			+***	-	-**	+***			+**				
ES53	Baleares	+			+**				+***	+***			+***	-	-*	+***			+*				
ES61	Andalucia	-			+***				+***	+***			+***			+***	+*	+***	+				
ES62	Murcia	+			+***				+***	+***			+***			+***	+***	+***	+				
ES63	Ceuta y Melilla	+			+***				-	+***			+**			+	+***	-	+*				
PT11	Norte	-			-				+***	+**			+			+			-	+	+	-	+
PT12	Centro	+			+				+	+*			+***			+**			+*	-	+**	-	-
PT13	Lisboã eVale do Tejo	+			+				+***	+***			+			+			+	+	+	-	-
PT14	Alentejo	-			+				+***	+***			+			+***			-***	-	+***	-***	+***
PT15	Algarve	+			+				+***	+***			+***			+***			+	-*	+**	-	+

Significance level: ***: p<0.01 **: p<0.05 *: p<0.1

Table 5. Qualitative analysis of GVA in the non-market services sector

		Noroeste			Noreste				Madrid	Centro			Este			Sur			Portugal				
		ES 11	ES 12	ES 13	ES 21	ES 22	ES 23	ES 24	ES 3	ES 41	ES 42	ES 43	ES 51	ES 52	ES 53	ES 61	ES 62	ES 63	PT 11	PT 12	PT 13	PT 14	PT 15
ES11	Galicia	+*	-***	+***	-				+*	+			-			+			+				
ES12	Asturias	+	-***	+***	-				+	+			-**			+			-				
ES13	Cantabria	+*	-**	+***	-				+	+			-			+			+				
ES21	Pais Vasco	-***			+***	-	+***	-***	-**	+			-			-			-				
ES22	Navarra	-			+	+	-	-***	-	+			+			-*			-				
ES23	La Rioja	-			+	-	+	-***	-	+*			+			-			-				
ES24	Aragón	-*			+	+	+	-***	-	+			+*			-			-				
ES3	Madrid	-			-				-	-*			-***			-			-				
ES41	Castilla y León	+***			+***				+***	+***	+	-	+***			+***			+***				
ES42	Castilla-la-Mancha	+***			+***				+***	+***	+	-	+***			+***			+***				
ES43	Extremadura	-			+				+**	+***	+	-**	+***			+			+***				
ES51	Cataluña	-***			+*				+***	+***			+***	+***	-***	+***			+***				
ES52	Com. Valenciana	-			+*				+***	+***			+***	+***	-***	+***			+***				
ES53	Baleares	-***			+				+***	+***			+***	+***	-***	+***			+***				
ES61	Andalucia	-***			+**				+***	+***			+***			+***	+	-*	+***				
ES62	Murcia	-***			+***				+***	+***			+***			+***	-	-	+***				
ES63	Ceuta y Melilla	-**			+***				+	+***			+***			+	-***	+	+*				
PT11	Norte	+			+				+	+			-			+			+***	+***	-***	+	-***
PT12	Centro	+***			+				+	+***			-			+			+***	+***	-	+**	-***
PT13	Lisboã eVale do Tejo	+			+				-	+**			-**			-			+***	+***	-***	+	-***
PT14	Alentejo	+*			+				+*	+***			+			+**			+***	+**	-	+***	-***
PT15	Algarve	+**			+				+	+***			+			+			+***	+***	-***	+**	-***

Significance level: ***: p<0.01 **: p<0.05 *: p<0.1

Table 6. Qualitative analysis of GVA in the transportation and telecommunication sector

		Noroeste			Noreste				Madrid	Centro			Este			Sur			Portugal				
		ES 11	ES 12	ES 13	ES 21	ES 22	ES 23	ES 24	ES 3	ES 41	ES 42	ES 43	ES 51	ES 52	ES 53	ES 61	ES 62	ES 63	PT 11	PT 12	PT 13	PT 14	PT 15
ES11	Galicia	+***	+	+*	+***				+***	+***			+***			+**			+***				
ES12	Asturias	+**	+	+	-				-	-			-			-			-				
ES13	Cantabria	+	-***	+***	+				+	-			-			-			-				
ES21	Pais Vasco	+			-***	+	-***	-	-	-**			-			-			-				
ES22	Navarra	-***			+***	+	-	+	-	+***			-			-			-				
ES23	La Rioja	-**			+	-***	+	-	-	+			-			+			-				
ES24	Aragón	+			-***	-***	-***	-*	-***	-***			-***			-***			-***				
ES3	Madrid	-			+***				+	+			+			+			+				
ES41	Castilla y León	+***			+***				+***	+***	+***	+***	+***			+***			+***				
ES42	Castilla-la-Mancha	+**			+***				+***	+***	+***	+***	+***			+***			+***				
ES43	Extremadura	-			+***				+	+	+*	+**	+***			+			+***				
ES51	Cataluña	+**			+***				+***	+***			+***	+***	+***	+***			+***				
ES52	Com. Valenciana	+**			+***				+***	+***			+***	+***	+***	+***			+***				
ES53	Baleares	+***			+***				+***	+***			+***	+***	+***	+***			+***				
ES61	Andalucia	+**			+***				+***	+***			+***			+***'	+***	-	+***				
ES62	Murcia	+			+***				+***	+***			+***			+***	+***	-	+***				
ES63	Ceuta y Melilla	+			+***				+***	+***			+***			+***	-*	-***	+***				
PT11	Norte	+			-*				-	-*			-			-			-	-	-	+	+**
PT12	Centro	-			-***				-**	-***			-**			-			-***	-	-*	-	+
PT13	Lisboã eVale do Tejo	-			-				-	-			-			-**			-	+***	-	+***	-
PT14	Alentejo	+			-**				-**	-***			-*			-			-***	-	-	+	+***
PT15	Algarve	+			-				+	-			+			+			-	+	+	-*	+*

Significance level: ***: p<0.01 **: p<0.05 *: p<0.1