# REGIONAL ASPECTS OF THE PRODUCTIVITY SLOWDOWN: AN ANALYSIS OF SPANISH SECTORAL DATA FROM 1980 TO 2003

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**D-2009-03**

**April 2009**

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The authors of this paper acknowledge and appreciate the funding received from the European Regional Development Fund (ERDF), Fundación Rafael del Pino and project. SEJ2006-05116/ECON

**Abstract**

Growth in productivity has been slowing down since the mid-1990s in Europe, whereas in the United States it has been increasing. Spain has one of the lowest productivity growth rates in Europe. This paper presents the results of a growth accounting exercise applied to regional industry data from Spain between 1980 and 2003. Growth in Total Factor Productivity (TFP) has fallen in all sectors since the mid-1990s. However, part of the productivity slowdown is the result of unbalanced economic growth across Spanish regions during this period: production has shifted in the same direction, towards construction and services, sectors where TFP has diminished. The regions with the highest levels of TFP, despite still recording the largest decreases in productivity, are the reason that aggregate TFP growth has not dropped more significantly, attracting resources since 1995. The regions with the lowest levels of TFP have lost resources, but have also helped to cushion the overall fall on registering positive growth rates in TFP.

*Keywords:*growt accounting, total factor productivity, regions
*JEL Classification:*O47, D24, O18

## 1. Introduction

This article aims to study to what extent national TFP is the result of and related to regional TFP. When analysing the TFP of a country, the literature has frequently focused on how responsible specialisation and factor allocation in certain sectors, and the behaviour of TFP in individual productive sectors were for aggregate TFP patterns. However, researchers have not analysed to what extent the regional allocation of factors and productive activity could be determining the national trend.

The concern over weak growth in productivity in Europe since the mid-1990s[1], particularly in Spain, resulted in a large number of articles focusing on international and even regional comparisons of TFP. Countries and regions are, however, not only different in terms of productive specialisation and factor endowment, but also where productivity and technology are concerned. The literature at regional level has been more concerned with convergence and the persistence of regional imbalances than with studying to what degree the regional allocation of productive resources is related to the aggregate trend in TFP[2].

Regions, just like sectors, can be more or less productive or record higher or lower TFP growth rates. While in the case of sectors it is logical to develop sectoral policies, in the case of regions it is also logical to develop regional policies. If the combination of sectors in all regions were identical to that of the country as a whole, but on a smaller scale, the same policy could be applied across the nation to stimulate productivity. However, there is a wide variety of both regions and sectors within Spain. As a result, the regional policy to be applied when a given region is less productive generally speaking across all sectors must be different to other regions when this is only the case in specific sectors.

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[1] See for example Gros and Mortensen (2004).

[2] The only exceptions are quite recent and include an in-depth study of Australia by Williams, Draca and Smith (2003), Boddy et al.(2005) for the UK, Broesma and van Dijk (2005) and Bosma, Stam and Schutjens (2009) for the Netherlands and Geppert, Gornig and Stephan (2003) for the EU, although they all focus more on analysing the determinants of regional productivity rather than establishing the relationship with aggregate trends. As an alternative to growth accounting, it is possible to use the econometric approach to productivity measurement: Marrocu, Paci and Pala (2000) estimate a production function instead of applying a growth accounting approach.

Despite regions being so different in terms of productive structure[3] it is worth studying whether or not they have suffered a similar slowdown in global productivity and whether or not each sector has recorded falls in TFP growth. Should a similar trend be observed in economies with so many differences, the underlying cause could be macroeconomic. Furthermore, a large portion of aggregate productivity growth is attributable to resource reallocation. Unbalanced growth appears to be shifting resources from sectors in which productivity growth is higher (such as farming and manufacturing) to sectors in where the rate is lower (such as construction and services). Sectoral determinants such as regional production specialisation, structural changes within regions and resource reallocation from one region to another will therefore all help to explain the slowdown in productivity.

The annual data available for 17 Spanish regions and 17 industries over the period dating from 1980 to 2003 make it possible to analyse whether sectors register similar trends across regions and to what extent all regions display a tendency towards a similar structural change. Unlike in aggregate analyses, not only is it possible to analyse the presence of sectoral determinants in the slowdown since the mid-1990s. This study also has the advantage of the 17 regional annual observations for each sector.

This paper proposes an alternative to the most common aggregation method[4] developed by Domar (1961) in which the aggregate TFP growth rate is the Domar-weighted sum of industries TFP growth rates, the Domar-weight for each industry being the coefficient between nominal gross output in each sector and nominal aggregate value-added. Over the sample period, not only has there been a structural change within each region, but also a reallocation of resources from one region to another. As a result, it is worth explaining the change in different sectors' share of the productive structure of regions and each regional industry's share of the national sector.

The paper is organised as follows. Section 2 presents the dataset and the growth accounting method used. Section 3 presents aggregate growth in TFP as the result of regional contributions, indicating to what extent the slowdown in

[3] The significant differences in terms of production specialisation and sectors' shares among regions lead to capital, labour and intermediate inputs being weighted differently. Escribá and Murgui (1998) discuss the importance of including these differences as opposed to the proposal by Bernard and Jones (1996 a, b and c).

[4] While the Domar aggregation can be considered to relate sectors to their aggregates, it makes no sense to do so on a regional scale. For a sectoral approach, the following papers can be consulted: Jorgenson et al. (1987); Harberger (1998); Jorgenson and Stiroh (2000); OECD (2001); Bartelsman et al. (2005); Roberts (2006) and Inklaar and Timmer (2007).

TFP since the mid-1990s has affected regions. Sector 4 addresses the relationship between the national aggregate and sectoral trends. Section 5 analyses the behaviour of productive sectors on a regional scale and their effect on global TFP results. Finally, Section 6 concludes with policy implications and additional comments.

## 2. Data and Methodology

Multifactorial Productivity growth is difficult to interpret. It is very volatile from year to year and even over 5 and 5 years[5]. Data cyclicality means that some care is required when choosing the periods over which to average productivity growth[6]. Nevertheless, the choice of 1995 as a cut-off point is commonplace nowadays. Figure 1 displays the trend of TFP growth over two sub periods (1980-1994 and 1995-2003). This trend depends on how inputs[7] and outputs are measured, as can be observed in the case of the national total of the private sector, depending on whether hours worked or number of employees are used. Nevertheless the productivity slowdown can be appreciated, which is what the paper aims to explain, rather than the rates of growth themselves.

In this article a sample of 17 sectors in all 17 Spanish regions over a period dating from 1980 to 2003 is used. All the data used are from the BD.MORES b-2000 data base (De Bustos et al, 2008). A description of the variables used in the analysis is included in Appendix 1. This paper analyses the non financial private sector as the aggregate. In order to do so, the residential, financial and public sectors are excluded, both where the value of production is concerned, which excludes rent and non retail services, and also employment and capital, which excludes the public sector, financial intermediation and the residential sector.

[5] Nordhaus (2004) shows how the productivity slowdown in the 1970s was not unusual, using different lengths of sample period ranging from 5 to 20 years to do so.

[6] Although the means since 1995 would change if more up-to-date regional and sectoral data were available, the productivity slowdown would remain visible and would coincide with a period of robust economic growth in Spain. In this sense, the slowdown suggests structural factors are more likely the cause than cyclical factors.

[7] The same could be adduced if regional industry data included hours worked, productive capacity utilisation, capital services or equivalent jobs.

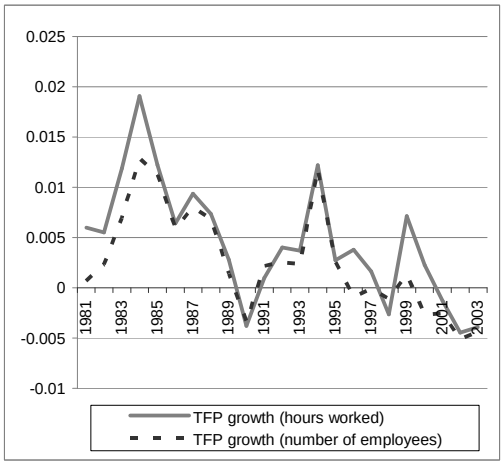


**Figure 1**. TFP Growth
Total Private Industry - Spain

In this section, the basic method employed is presented, using the value of production as outputs for each sector and region and intermediate inputs, labour and capital as inputs[8]. As opposed to relative levels of labour productivity (or any individual production input), which can be easily ranked, even at sector level, in the case of total factor productivity it is much more difficult to compare different levels[9]. Notwithstanding, in order to analyse the possible influence of the contribution of both sectors and regions to the national aggregate of TFP growth, the different levels must be available at different moments in time.

The production function for the *ith* regional industry gives the quantity of output –value of production or gross output ($Q_i$)- as a function of the primary inputs, capital ($K_i$) and labour ($L_i$); intermediate inputs ($M_i$) and the level of technology ($t$):

$$Q_i = f_i(K_i, L_i, M_i, t) \qquad i = 1....17 \text{ industries} \qquad (1)$$

The 17 industries included in our study are listed in Appendix 1. Under the assumptions of constant returns to scale, neutrality as understood by Hicks and factor compensation according to marginal productivity, the growth accounting equation for each sector is

[8] As stressed in previous research -see Escribá and Murgui (2009)- the sectoral disaggregation is most correctly integrated with the aggregates when co-movements between gross production and intermediate inputs apart from labour and capital are controlled for. Hulten (1978), Bruno (1984), Estrada and López-Salido (2001a and b), Moro (2007) and Jones (2008) can also be consulted.

[9] See Hall and Jones (1996 and 1997) and Bernard and Jones (1996 a, b and c).

$$d \ln TFP_i = d \ln Q_i - \alpha_{K_i} d \ln K_i - \alpha_{L_i} d \ln L_i - \alpha_{M_i} d \ln M_i \quad (2)$$

where $\alpha$ is the average share of the subscripted input in the *ith* industry and $TFP_i$ is industry productivity.

Furthermore, assuming Cobb-Douglas technology for each regional industry, the level of productivity can be expressed at each moment in time as:

$$TFP_i = \left(\frac{Q_i}{K_i}\right)^{\alpha_{K_i}} \cdot \left(\frac{Q_i}{L_i}\right)^{\alpha_{L_i}} \cdot \left(\frac{Q_i}{M_i}\right)^{\alpha_{M_i}} \quad (3)$$

However, as $\alpha$ have enormous differences in terms of industries within each region and the same sector in different regions, cross-sector and interregional productivity comparisons calculated using expression (3) are misleading. The reason is that, assuming Hicks neutrality, arbitrarily small differences in the $\alpha$ parameters across regional industries imply that changes in the units of measurement for an input can change the ranking of productivity levels.[10].

In order to overcome the bias that input units of measurement can cause through using specific $\alpha$ for each regional industry, as in expression (3), we follow the procedure detailed in Escribá and Murgui (2001 and 2009). Labour, capital and intermediate inputs productivity is normalised by making all aggregate productivities equal to 100. As a result, initial aggregate TFP will be 100. Sectors are therefore ranked according to relative labour, capital and intermediate input productivity with respect to aggregate values. Likewise, regional ranking is obtained according to the relative productivity of each of the factors in a given region.

TFP at a moment in time can therefore be expressed as follows:

$$TFP_i = \left[\left(\frac{Q_i}{Q}\right) \cdot \left(\frac{K}{K_i}\right)^{\alpha_{K_i}} \cdot \left(\frac{L}{L_i}\right)^{\alpha_{L_i}} \cdot \left(\frac{M}{M_i}\right)^{\alpha_{M_i}}\right] \cdot 100 \quad (4)$$

$$TFP_j = \left[\left(\frac{Q_j}{Q}\right) \cdot \left(\frac{K}{K_j}\right)^{\alpha_{K_j}} \cdot \left(\frac{L}{L_j}\right)^{\alpha_{L_j}} \cdot \left(\frac{M}{M_j}\right)^{\alpha_{M_j}}\right] \cdot 100 \quad (5)$$

Whereby the expression in the square brackets in equation (4) denotes the TFP of sector *i* with respect to aggregate TFP, the expression in the square brackets in equation (5) represents the TFP of region *j* with respect to aggregate TFP and $100 = (Q/L) = (Q/K) = (Q/CI)$. Indeed, using the above expressions as a basis, it

[10] See Escribá and Murgui (1998) for various alternatives that can be used to solve this problem.

is possible to rank sectors – by the respective levels of sectoral TFP – and regions – by the respective levels of regional TFP-.

In order to relate sector and regional levels, the same procedure is followed as in equations (4) and (5). Therefore, TFP of sector *i* in region *j* , that is, of regional industry (*ij*), is expressed as:

$$TFP_{ij} = \left[ \left( \frac{Q_{ij}}{Q_i} \right) \left( \frac{K_i}{K_{ij}} \right)^{\alpha_{K_{ij}}} \left( \frac{L_i}{L_{ij}} \right)^{\alpha_{L_{ij}}} \left( \frac{M_i}{M_{ij}} \right)^{\alpha_{M_{ij}}} \right] \cdot \left[ \left( \frac{Q_i}{Q} \right) \left( \frac{K}{K_i} \right)^{\alpha_{K_i}} \left( \frac{L}{L_i} \right)^{\alpha_{L_i}} \left( \frac{M}{M_i} \right)^{\alpha_{M_i}} \right] \cdot 100 \tag{6}$$

Once the TFP level of each sector and region has been determined, the next step is to relate aggregate TFP to sectoral and regional TFP. As a result, aggregate TFP is written as follows:

$$TFP = \frac{Q}{K^{\alpha_K} \cdot L^{\alpha_L} \cdot M^{\alpha_M}} \tag{7}$$

Being aware that $Q = \sum_i Q_i = \sum_j Q_j$ , aggregate TFP[11] can be written, both for *i* and for *j*, as

$$TFP = \sum_i \frac{Q_i}{K_i^{\alpha_{K_i}} L_i^{\alpha_{L_i}} M_i^{\alpha_{M_i}}} \cdot \left[ \frac{K_i^{\alpha_{K_i}}}{K^{\alpha_K}} \cdot \frac{L_i^{\alpha_{L_i}}}{L^{\alpha_L}} \cdot \frac{M_i^{\alpha_{M_i}}}{M^{\alpha_M}} \right] = \sum_i TFP_i \cdot w_i = \sum_j TFP_j \cdot w_j \tag{8}$$

Labelling the expression in the square brackets *w*. This expression is a composite index that estimates either the relative concentration of factors in a given sector ($w_i$) in relation to the aggregate, or the relative concentration of factors in a given region ($w_j$) in relation to the aggregate. Changes in $w_i$ capture the movement of factors from one sector to another within a region or a nation. Changes in $w_j$ capture the movement of factors from one region to another within the same sector, that is, location changes.

Therefore, the growth rate –with a circumflex accent- of aggregate TFP can be expressed by region

[11] For a region *j* $Q_j = \sum_i Q_{ij}$ and for a national aggregate $Q = \sum_i Q_i = \sum_j Q_j = \sum_i \sum_j Q_{ij}$ , in the text we maintain either the region or the national aggregate as the sum of sectors.

$$\hat{PTF} = \sum_j \hat{PTF}_j \frac{Q_j}{Q} + \sum_j \dot{w}_j \cdot \frac{\overline{PTF}_j}{PTF} \quad (9)$$

The first addend on the right shows the contribution made by regional TFP growth, assuming the regional allocation of production has not changed (this is called the Growth Effect). The second addend estimates the effect of regional mobility of productive inputs (this is called Location Change Effect). If $\dot{w}_j$ records a positive (negative) value, it means that region $j$ has attracted (expelled) factors.

The growth rate of the national aggregate of TFP (and in each region) can also be expressed by sector:

$$\hat{PTF} = \sum_i \hat{PTF}_i \frac{Q_i}{Q} + \sum_i \dot{w}_i \cdot \frac{\overline{PTF}_i}{PTF} \quad (10)$$

Once again, the first addend on the right represents the contribution made by sectoral (industrial) TFP growth, assuming the national (and regional) sectoral structure has not undergone any changes – the Growth Effect – whereby the initial share held by the output of each industry in total is maintained[12]. The second addend estimates the contribution made by Structural Change. Productive structures within an economy undergo constant change. The most productive industries expand and the least productive shrink and this has a significant impact on aggregate productivity.

## 3. Territorial penetration of Total Factor Productivity dynamics: contribution of regional Growth and Location Effects

Table 1 presents the share each factor held in both sub periods and the levels of TFP in 1980, 1994 and 2003 in each region, taking the value 100 for Spain in 1980. We can see how regions with very different levels of TFP (Madrid versus Extremadura) or with different shares of intermediate inputs (Balearic Islands versus Navarra) coexist, factors which depend on production specialization and

[12] The Domar weights will sum to more than one, reflecting the fact that each industry makes a double contribution to aggregate MFP, once in its own right and once through reducing the costs of industries that buy from it. Nonetheless, structural change should be detected by the changes in Domar weights. In practice, those pertaining to the first year are used and assumed constant, even when long periods of time are being considered, as in Jorgenson and Stiroh (2000), Napoletano et al (2004), Inklaar and Timmer (2007) and Castaldi and Sapio (2008).

the presence of agglomeration economies[13]. On comparing columns (1) to (3), we can see how TFP growth has also varied across regions.

In this section Harberger (1998) diagrams are going to be used to analyze the regional pattern of TFP growth in Spain in the two sub periods under consideration. Harberger contrasted two visions of economic growth only at sector level. *Mushrooms vision*: an unequal sectoral process in which a small percentage of industries determines aggregate TFP growth. Y*east vision:* which highlights the role of externalities related to knowledge stock, human capital and economies of scale, which would have complementary effect on the majority of sectors.

Aggregate TFP growth is the result of regional contributions: the percentage of regions that record positive (negative) contributions, using Harberger diagrams, indicates the degree of territorial penetration of TFP growth (degrowth).

Column (1) in Table 2 presents, from highest to lowest, the average rates of TFP growth in Spanish regions over the period 1995-2003[14]. Column (2) presents each region's share of the total value of non financial private sector production in Spain. Column (3) captures the Growth Effect or real cost reduction –according to Harberger (1998)- in each of the regions[15]. Column (4) is the cumulative sum of Growth Effects (or cumulative sum of real cost reduction) in column (3) and column (5) is the sum of shares in column (2). The *Sunrise-Sunset* diagrams represent column (4) on the vertical axis and column (5) on the horizontal axis.

As can be observed in Figure 2, the contribution of the Growth Effect was much less of an effect on all regions in the period 1995-2003 than in 1980-1994. This is due to the decrease in TFP growth rates that began in the mid 1990s in the majority of regions. While positive TFP growth rates were recorded across the board in the period 1980-94, most regions, with the exception of Extremadura, Asturias, Galicia and the Basque Country[16], TFP decreased in the period 1995-

[13] The regions with the highest levels of TFP are specialized in services (Madrid, Balearic Islands, Canary Islands), whereas those with the lowest levels specialize in agriculture (Extremadura, Castille la Mancha, Aragon, Galicia, Castille and Leon).

[14] To avoid making the table excessive large, we only present a table for the growth effect over the period 1995-2003, using graphs to illustrate the rest of effects and the previous period.

[15] Column (3) is the result of multiplying columns (1) and (2) using equation (9).

[16] TFP growth decreased in all regions between the two periods. As a result, furthermore, 13 of the 17 regions recorded negative growth rates. In practically all regions the Growth Effect detracts from TFP dynamics in all services and construction sectors and relatively frequently in regional terms in textiles, transport equipment and various manufacturing industries.

2003. The downturn in growth since the mid 1990s is indicates very general or macroeconomic causes[17], that is, similar trends have spread across all regions affecting the regional dynamics of TFP.

**TABLE 1. TFP in Spanish Regions**

| Region | TFP Levels | | | $\overline{\alpha}_L$ | | $\overline{\alpha}_K$ | | $\overline{\alpha}_M$ | |
|---|---|---|---|---|---|---|---|---|---|
| | **1980** | **1994** | **2003** | 1980-1994 | 1995-2003 | 1980-1994 | 1995-2003 | 1980-1994 | 1995-2003 |
| | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] |
| Andalusia | 97 | 107 | 105 | 0.26 | 0.26 | 0.19 | 0.18 | 0.55 | 0.56 |
| Aragon | 91 | 102 | 101 | 0.24 | 0.25 | 0.14 | 0.14 | 0.61 | 0.61 |
| Asturias | 97 | 101 | 106 | 0.28 | 0.29 | 0.16 | 0.16 | 0.56 | 0.55 |
| Balearic Islands | 117 | 118 | 104 | 0.36 | 0.32 | 0.18 | 0.20 | 0.47 | 0.48 |
| Canary Islands | 107 | 108 | 101 | 0.32 | 0.30 | 0.18 | 0.19 | 0.49 | 0.51 |
| Cantabria | 96 | 109 | 108 | 0.27 | 0.29 | 0.17 | 0.16 | 0.56 | 0.55 |
| Castille and Leon | 92 | 101 | 104 | 0.26 | 0.25 | 0.15 | 0.16 | 0.59 | 0.59 |
| Castille La Mancha | 90 | 100 | 98 | 0.23 | 0.25 | 0.16 | 0.16 | 0.60 | 0.59 |
| Catalonia | 102 | 109 | 108 | 0.25 | 0.27 | 0.15 | 0.15 | 0.60 | 0.58 |
| Valencia | 105 | 108 | 106 | 0.26 | 0.27 | 0.17 | 0.15 | 0.57 | 0.58 |
| Extremadura | 75 | 90 | 92 | 0.28 | 0.27 | 0.17 | 0.19 | 0.55 | 0.54 |
| Galicia | 92 | 98 | 103 | 0.27 | 0.26 | 0.17 | 0.15 | 0.56 | 0.58 |
| Madrid | 117 | 121 | 114 | 0.28 | 0.29 | 0.18 | 0.16 | 0.53 | 0.55 |
| Murcia | 98 | 106 | 104 | 0.24 | 0.24 | 0.18 | 0.18 | 0.59 | 0.58 |
| Navarra | 100 | 106 | 104 | 0.24 | 0.24 | 0.15 | 0.13 | 0.61 | 0.62 |
| Basque Country | 101 | 108 | 110 | 0.26 | 0.28 | 0.15 | 0.14 | 0.58 | 0.58 |
| La Rioja | 100 | 105 | 104 | 0.24 | 0.25 | 0.18 | 0.18 | 0.58 | 0.58 |
| Spain | **100** | **107** | **106** | **0.26** | **0.27** | **0.17** | **0.16** | **0.57** | **0.57** |

Cost reduction as a result of the regional reallocation[18] of production factors had a positive effect on national TFP dynamics in both periods, and on a global scale, of the same size. The positive contribution (Figure 3), attracting

[17] General causes do not only mean macroeconomic variables are responsible for TFP losses, but that structural changes that are similar in all regions could also be to blame. This issue will be analyzed later in the paper.

[18] Although Harberger only considers the Growth Effect, a similar procedure may be used to illustrate the Location Change (or Structural Change) Effect by ranking industries from the highest to lowest values of $w_i$ and accumulating the Location Effects of each region (or industry). The total effect will be the sum of the Growth Effect and the Location or Structural Change Effect.

resources (Figure 4) of Madrid, the Balearic Islands and the Canary Islands[19] figured prominently in both sub periods. Generally speaking, a positive relationship is observed between higher regional levels of TFP (see Table 1) and greater relative attraction of resources (see Figure 4). At the same time, the regions with higher starting levels of TFP generally register lower TFP growth rates (see Table 2, column [1])[20].

Indeed, the total national effect of TFP was negative in the period 1995-2003: ten regions that account for 60% of the Value of national Production detract from aggregate TFP growth - compared to 18% and four regions in the period 1980-94 – as can be observed in Figure 5. The four regions on the coast of the Cantabrian Sea (Asturias, the Basque Country, Galicia and Cantabria) recorded negative contributions in both sub periods. These regions not only suffered the general fall in the Growth Effect suffered by all regions between 1995 and 2003, but also, with the exception of Cantabria, a relative decrease in production resources attracted in both periods. In contrast, Madrid, Valencia, the Balearic Islands and the Canary Islands contributed the most towards cushioning the fall in national TFP growth that began in the mid 1990s.

The slowdown in TFP since halfway through the 1990s has not therefore affected only a sub set of regions, but all Spanish regions as a whole. In order to analyze how this trend spread across regions, the next two sections will establish: in the first place, the relationship between the national aggregate and sector performance, followed by the performance of productive industries in regions and their effects on global TFP results.

[19] Madrid is specialised in a wide variety of services, whereas tourism figures prominently in the Balearic and Canary Islands.

[20] Which is later confirmed again in Table 4.

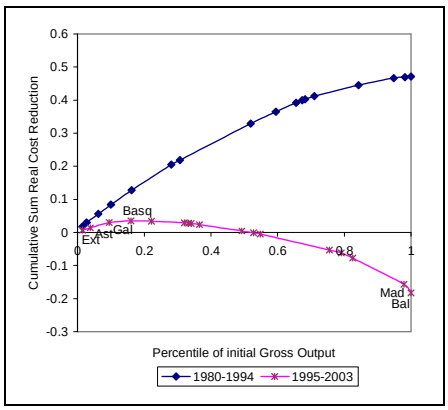


**Figure 2**. Growth Effect - Regions

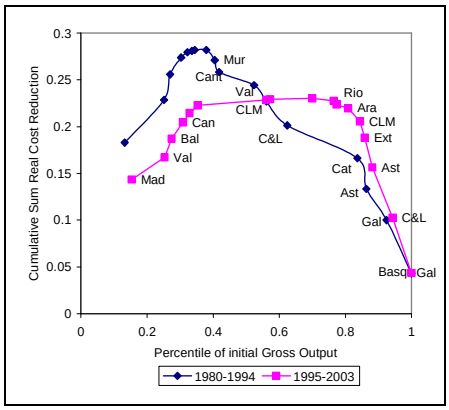


**Figure 3**. Reallocation Effect

**TABLE 2. Territorial Penetration of the Growth Effect of TFP**
**Period: 1995-2003**

| **Region** | $P\hat{T}F_i$ | $Q_i/Q$ | Growth Effect | Cumulative Growth Effect | Cumulative $Q_i/Q$ |
|---|---|---|---|---|---|
| | [1] | [2] | [3] | [4] | [5] |
| Extremadura | 0.485 | 0.015 | 0.007 | 0.007 | 0.015 |
| Asturias | 0.306 | 0.023 | 0.007 | 0.014 | 0.037 |
| Galicia | 0.282 | 0.057 | 0.016 | 0.030 | 0.095 |
| Basque Country | 0.072 | 0.065 | 0.005 | 0.035 | 0.160 |
| Castille and Leon | -0.013 | 0.061 | -0.001 | 0.034 | 0.221 |
| Valencia | -0.046 | 0.099 | -0.005 | 0.030 | 0.320 |
| Cantabria | -0.095 | 0.012 | -0.001 | 0.028 | 0.332 |
| La Rioja | -0.122 | 0.008 | -0.001 | 0.027 | 0.341 |
| Murcia | -0.132 | 0.025 | -0.003 | 0.024 | 0.365 |
| Andalusia | -0.154 | 0.127 | -0.020 | 0.004 | 0.493 |
| Aragon | -0.160 | 0.035 | -0.006 | -0.001 | 0.528 |
| Navarra | -0.160 | 0.020 | -0.003 | -0.004 | 0.548 |
| Catalonia | -0.234 | 0.207 | -0.049 | -0.053 | 0.755 |
| Castille La Mancha | -0.240 | 0.036 | -0.009 | -0.061 | 0.790 |
| Canary Islands | -0.472 | 0.034 | -0.016 | -0.078 | 0.825 |
| Madrid | -0.514 | 0.154 | -0.079 | -0.157 | 0.979 |
| Balearic Islands | -1.223 | 0.021 | -0.026 | -0.183 | 1.000 |

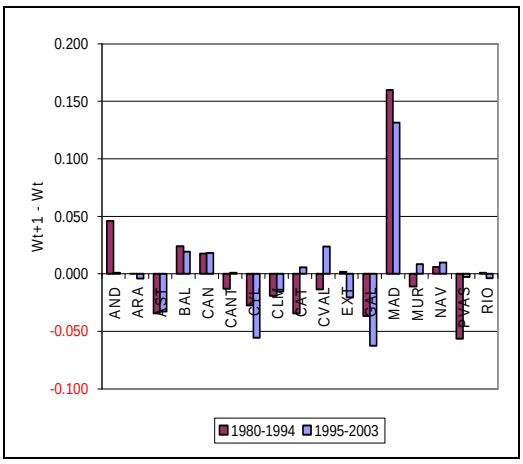


**Figure 4**. Attraction or loss of Factors - Regions

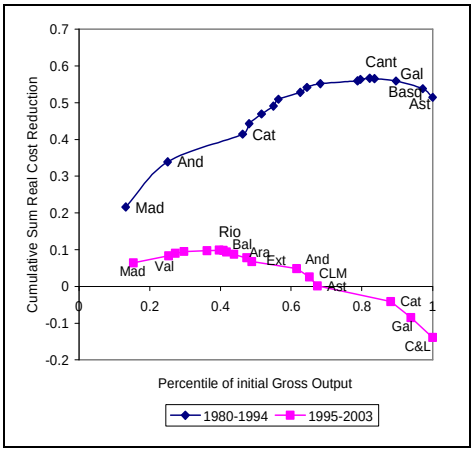


**Figure 5**. Total Effect - Regions

## 4. National aggregate resulting from sectors or industries: Contribution of Growth Effects and Structural Change Effects.

Table 3 shows the considerable differences between the levels of TFP in the various sectors or industries, particularly in 1980: agriculture represents barely a quarter of other market services, while most industries have register intermediate scores. On comparing columns (1) to (3) an inverse relationship is generally observed between levels and the increase over the period, and above all the extremes: TFP falls in other market services, retail trade and catering and picks up considerably in agriculture. Table 3 also presents each sector's share of inputs: substantial differences are observed in the share of intermediate inputs, for example, between the food and retail trade and catering sectors or other market services, and in the share of labour between energy and retail trade and catering. These differences must be taken into account when carrying out an analysis disaggregated by sectors.

All sectors, except for retail trade and catering and other market services recorded positive growth rates over the period 1980-94. As a result, the national Growth Effect stands at 0.045. Notwithstanding, the Growth Effect contributed less than 10% to aggregate TFP, and the sectors that most contributed included agriculture, construction, transport and communications, food and chemicals (see Figure 6). Structural Change –see Figure 7- contributed more than 90%, shifting towards sectors such as other market services, retail trade and catering, transport and communications, construction, energy and some manufacturing

industries such as transport equipment, paper and electrical, electronic and optical equipment, from sectors such as agriculture, metallurgy, textiles, food, chemicals, other manufacturing industries, non metallic mineral products and machinery and equipment. The total sector effect, which is positive (see Figure 9), mainly originated in services sectors and construction, as well as the energy sector and in two sectors with a high technological content: transport equipment and electrical, electronic and optical equipment.

**TABLE 3. TFP by Sector**

| Industries | TFP Levels | | | $\overline{\alpha}_L$ | | $\overline{\alpha}_K$ | | $\overline{\alpha}_M$ | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 1980-1994 | 1995-2003 | 1980-1994 | 1995-2003 | 1980-1994 | 1995-2003 |
| | **1980** | **1994** | **2003** | | | | | | |
| | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] |
| Agriculture and fisheries | 52 | 71 | 74 | 0.28 | 0.27 | 0.21 | 0.31 | 0.51 | 0.41 |
| Mining, quarrying and energy | 85 | 91 | 95 | 0.11 | 0.09 | 0.22 | 0.22 | 0.67 | 0.69 |
| Food, beverages and tobacco | 88 | 95 | 95 | 0.13 | 0.14 | 0.09 | 0.08 | 0.78 | 0.79 |
| Textiles, clothing, leather and footwear | 88 | 92 | 91 | 0.17 | 0.21 | 0.10 | 0.08 | 0.72 | 0.72 |
| Paper, printing and graphic design | 110 | 110 | 113 | 0.24 | 0.23 | 0.13 | 0.13 | 0.63 | 0.65 |
| Chemical products | 92 | 109 | 119 | 0.15 | 0.19 | 0.13 | 0.12 | 0.71 | 0.69 |
| Rubber and plastic | 95 | 106 | 111 | 0.23 | 0.22 | 0.11 | 0.11 | 0.66 | 0.67 |
| Non metallic mineral products | 92 | 102 | 109 | 0.27 | 0.25 | 0.13 | 0.12 | 0.61 | 0.63 |
| Metallurgy and metallic products | 93 | 99 | 108 | 0.21 | 0.22 | 0.15 | 0.11 | 0.65 | 0.66 |
| Machinery and mechanical equipment | 98 | 107 | 118 | 0.25 | 0.26 | 0.11 | 0.10 | 0.64 | 0.64 |
| Electrical, electronic and optical equipment | 86 | 100 | 104 | 0.22 | 0.21 | 0.07 | 0.08 | 0.71 | 0.71 |
| Transport equipment | 85 | 96 | 98 | 0.18 | 0.14 | 0.04 | 0.07 | 0.77 | 0.79 |
| Other manufacturing industries | 93 | 95 | 94 | 0.21 | 0.23 | 0.08 | 0.07 | 0.71 | 0.70 |
| Construction | 111 | 116 | 107 | 0.29 | 0.29 | 0.10 | 0.09 | 0.62 | 0.62 |
| Retail trade and Catering | 121 | 108 | 98 | 0.44 | 0.40 | 0.16 | 0.20 | 0.39 | 0.41 |
| Transport and Communications | 96 | 106 | 102 | 0.27 | 0.25 | 0.21 | 0.23 | 0.52 | 0.52 |
| Other market services | 199 | 143 | 115 | 0.29 | 0.36 | 0.31 | 0.22 | 0.40 | 0.42 |
| Total Private Sector | **100** | **107** | **106** | **0.26** | **0.27** | **0.17** | **0.16** | **0.57** | **0.57** |

In the period 1995-2003, TFP growth slowed or was even negative in all sectors, with the exception of agriculture. Indeed, the number of sectors to record negative TFP growth increased: all services, along with construction, textile and other manufacturing industries. The rest of manufacturing industries registered positive growth, albeit weak, which meant that the national Growth Effect was negative and significant (-0.351) in the total private productive sector. On comparing the Growth Effects –see Figure 6 – in both sub periods, a widespread loss of efficiency is observed in all economic activities, which appears to confirm a *Yeast vision*. However, there is also a clear *Mushrooms vision* confined to retail trade and catering and other market services between 1980 and 1994, accompanied by construction, transport and communications, textiles and other manufacturing industries since 1995.

The Structural Change Effect –see Figure 7- fails to offset the Growth Effect. Except for retail trade and catering, relative input concentration has increased in all services sectors and construction –see Figure 8- that is, resources have been reallocated to sectors where TFP has not increased, but also to most manufacturing industries where TFP growth rates are positive, but weak. The effect of structural change on manufacturing sectors has also been minimal, with the exception of transport equipment.

Total sector Effects are positive in most manufacturing sectors, such as transport equipment, metallurgy, non metallic mineral products, chemical products, machinery and mechanical equipment, rubber and plastic and other manufacturing industries, as well as construction and services with the exception of retail trade and catering. The Total sector Effect is negative (-0.162) due to the negative contribution of sectors, as in Figure 9, which illustrates the widespread loss of efficiency in all economic activities when comparing the two sub periods. The most negative contribution, particularly between 1980 and 1994, can be attributed to the manufacturing industries due to their loss of production resources, not because the record negative TFP growth rates. The role played by retail trade and catering has been decisive since 1995, with both Growth and Structural Change Effects being strongly negative. The rest of sectors that recorded total negative effects were industrial and exclusively as a result of Structural Change Effects. Structural change in both periods focused on the sectors with the most negative TFP growth. These Structural Change Effects have always been positive due to initial level of TFP being higher, but levels are becoming increasingly low, resulting in the persistent reallocation of resources to the same sectors exerting increasingly downward pressure on global TFP growth rates. Resources have shifted from sectors with lower levels of TFP but higher

growth rates (agriculture and other manufacturing industries) to sectors with higher levels of TFP but lower or even negative TFP growth rates.

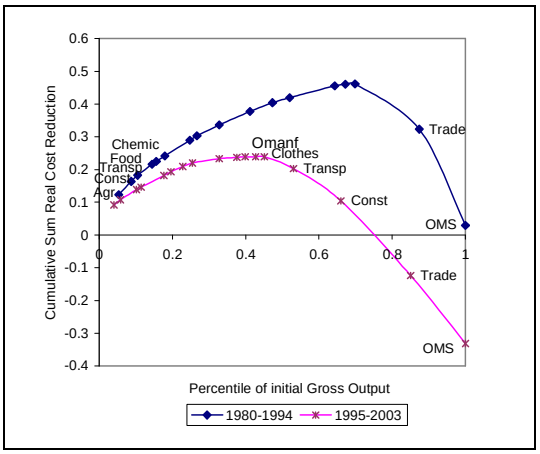


**Figure 6**. Growth Effect – Sectors

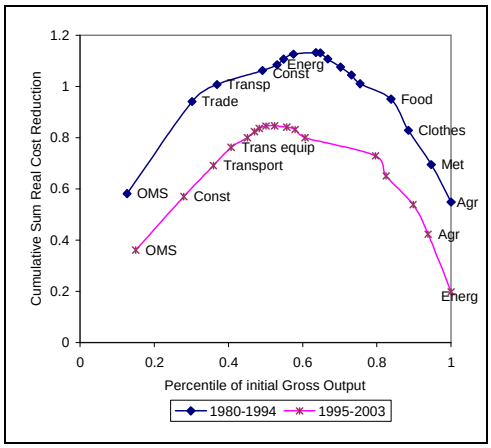


**Figure 7**. Structural Change Effect

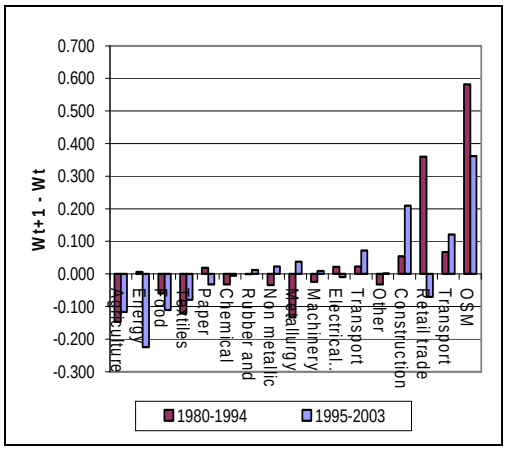


**Figure 8**. Attraction or loss of Factors - Sectors

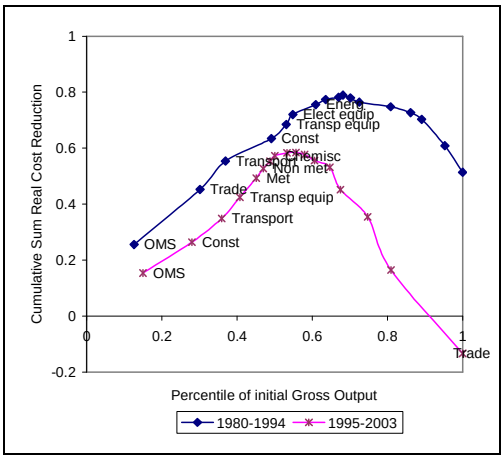


**Figure 9**. Total Effect – Sectors

## 5. Regional performance of productive industries TFP dynamics: Growth and Location Change Effects by Sector

Although Appendix 2 includes information on all the regions and sectors or industries, this section groups industries according to their technological content, following the OECD and Spanish National Institute of Statistics classifications. The sectors with high technological content – which generally demand highly skilled workers – are chemical products, electrical, electronic and optical equipment, transport equipment and machinery and mechanical equipment. The sectors with low technological content, in which low skilled work is predominant, are food, textiles, wood and other manufacturing industries and paper. The rest of industries are considered to have intermediate technological content: energy, metallurgy, rubber and plastic and non metallic mineral products. The aim is to analyze the regional performance of these groups and agriculture, construction and market services[21].

Generally speaking, as illustrated in the previous section, resources have moved from agriculture and some manufacturing sectors to construction and services over the two sub periods under consideration. Notwithstanding, regions differ in terms of productivity and also in the extent to which they have attracted or lost resources in the various sectors. The sign of their growth effects in each sector, however, are not so different. While national aggregate TFP depends on that of its sectors, the evolution of each sector on a national scale is the result of its performance in the different regions.

Regions have different levels of productivity, as could be observed in Table 1. Figure 10 shows how regional TFP dispersion for the global private productive sector is converging and considerably lower than that of gross output per worker. Figure 11 reveals that sigma convergence barely occurs among regions in specific sectors, while there is a clear divergence in agriculture[22]. The differences in TFP from one region to another are therefore the result of productive specialization.

The regions with higher levels of TFP (specialized in market services and construction) attract resources, possibly due to the presence of agglomeration

[21] Unfortunately, we cannot disaggregate services according to their technological content: postal service and telecommunications, computer activities, research and development are high technology services that belong to larger sectors in our decomposition.

[22] In fact, agriculture figures prominently when it comes to explaining regional performance. On the one hand, less productive regions are normally specialized in agriculture; on the other hand, it is in these regions where the TFP growth rate drops the least, due to the positive effect of agriculture.

economies, but display lower growth rates. Apart from agriculture and high technology manufactures[23], beta convergence is observed in all sectors, as can be appreciated in Table 4.

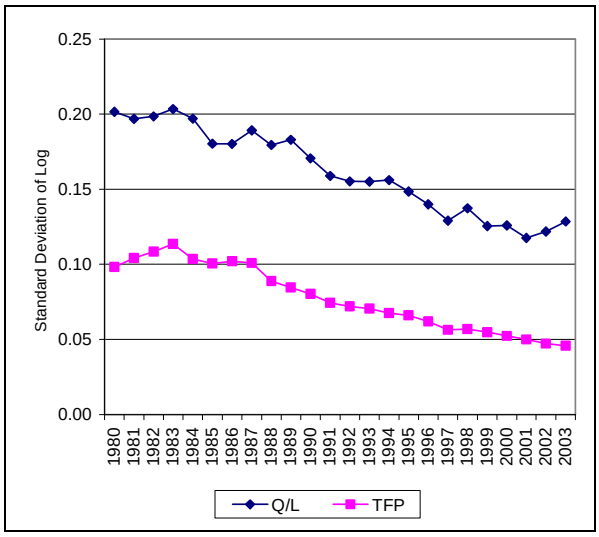


**Figure 10**. σ-Convergence of Total Private Productive Sector

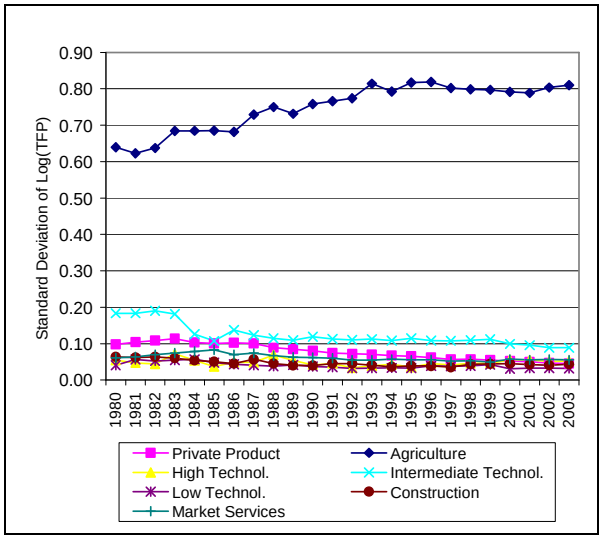


**Figure 11**. σ-Convergence of TFP

[23] Increasingly highly concentrated in Catalonia and Madrid.

**TABLE 4. TFP Convergence**

| SECTOR | B | Standard errors | β | $R^2$ |
|---|---|---|---|---|
| **Total Priv. Prod.** | -0.285 | 0.034 | 0.075 | 0.80 |
| **Agriculture** | 0.192* | 0.091 | | 0.17 |
| **High tech.** | -0.082* | 0.258 | -0.005 | 0.36 |
| **Medium tech.** | -0.256* | 0.033 | 0.069 | 0.78 |
| **Low tech.** | -0.210* | 0.063 | 0.058 | 0.38 |
| **Construction** | -0.155* | 0.029 | 0.041 | 0.62 |
| **SDM** | -0.144* | 0.058 | 0.036 | 0.24 |

**Note**: Estimated coefficients are obtained from the OLS estimation, with cross-section data (17 observations referring to the 17 Spanish regions), from the equation: $\hat{TFP}_j = a + b\,Ln(TFP_j)_{1980} + \varepsilon_j$. Implicit convergence speed β is obtained from $b = -1/T\left(1 - e^{-\beta T}\right)$. *Values significant at 5%.

Regional TFP growth rates were lower in all sectors in the second period than in the previous period (see Figure 12). Not one diagram representing growth effects displays significant curves, perhaps with the exception of industries with intermediate technological content, where regional trends are more varied in the period 1980-94[24]. When TFP grows in one sector, it normally grows in all regions, whereas this does not occur in the case of the growth rates of the sectors, which are very different. When TFP growth began to decrease in manufacturing industries halfway through the 1990s, the same occurred in all regions, although this was particularly the case of high and low technology industries.

[24] The decrease in TFP growth rates was not as pronounced in these industries in the second sub period as in other groups of sectors. Furthermore, regional trends are more varied, particularly in the energy, metallurgy and rubber sectors in the period 1980-94, which affected the Canary Islands, Galicia, Asturias and La Rioja and in 1995-2003, which affected the Canary Islands and Murcia.

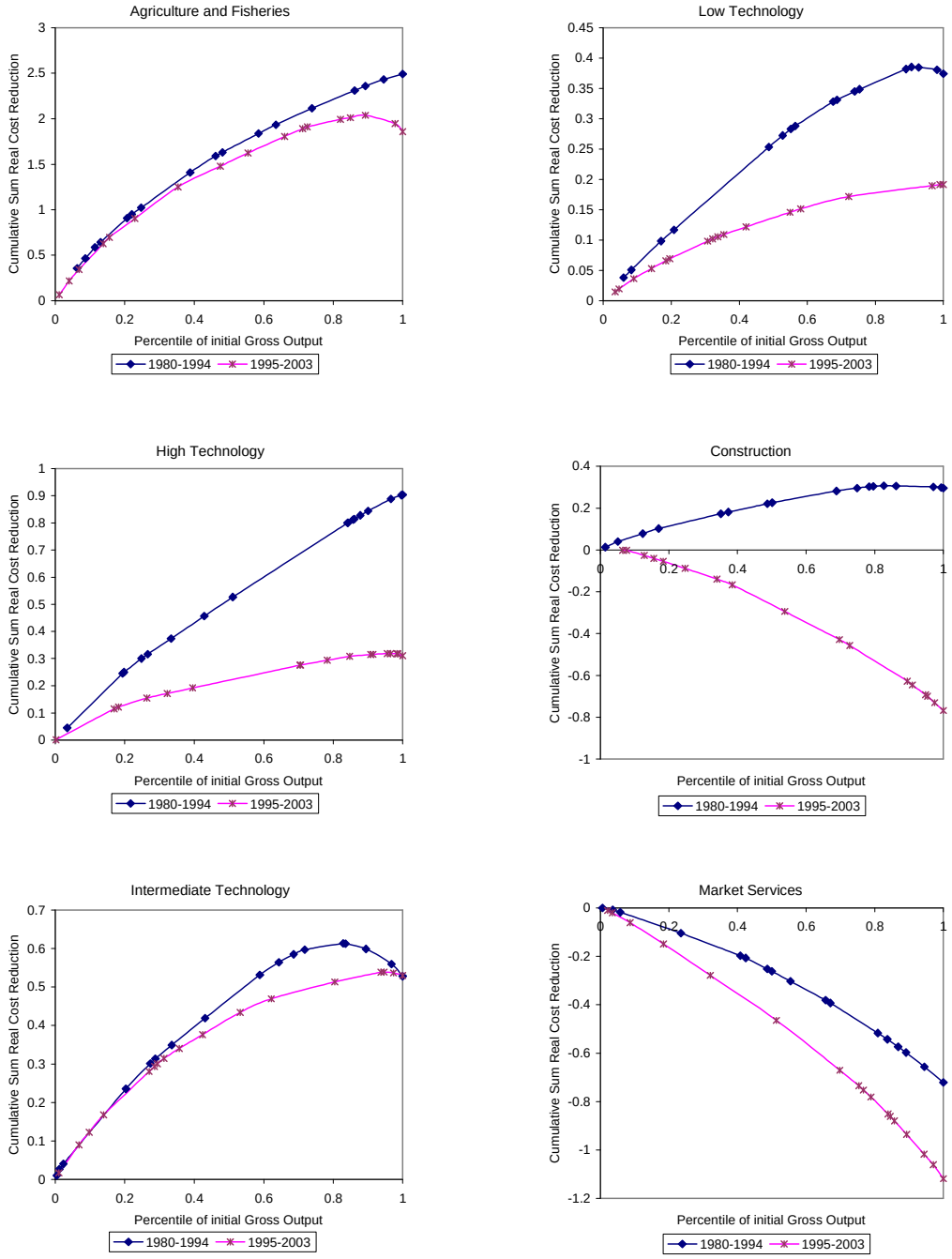


**Figure 12**. Growth Effects

All sectors, except for market services (see Figure 12) display a positive growth effect in practically all regions, albeit much smaller since the mid 1990s. Construction is a special case, which went from recording positive TFP growth in all region in the period 1980-94 to negative growth also in all regions in the period 1995-2003. This sector, intense in low skilled labour and responsible for the strong growth in employment in Spain those years, together with services[25], has played a decisive role in the downturn in TFP growth in Spain and all its regions.

The fact that TFP growth, and therefore the Growth Effect, went in the same direction in each sector the majority of regions suggests that the slowdown in TFP growth is not a regional problem, but a global problem or one perhaps related to sector specialization. The graphs above illustrate the situation clearly: even if regions had maintained their share in each sector, TFP would have fallen in each sector and globally. If the fall in TFP is widespread, the problem should be addressed with macroeconomic policy measures to boost investment in R+D, human capital and infrastructures, as well as in institutional and market reforms. If sectors play a part in the fall in TFP, emphasis would have to be placed on modifying the current productive structure to increase the importance of manufacturing and services sectors with high technological content[26].

In previous sections we have verified on a national scale that: resources tend to be allocated in regions with higher TFP and tend to be invested in sectors with higher TFP. The question now is to what extent has there been a change in each sector regarding resource reallocation in regions where the same sector displays higher productivity. Resource mobility is observed particularly in agriculture, as can be appreciated in Figure 13. In fact, in regional mobility is a term that cannot really be used for agriculture, but a greater expulsion of resources in less productive regions. The situation in the rest of sectors is so similar, that there is practically no incentive for mobility[27], which means structural change is primarily what reallocates resources in regions with higher TFP.

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[25] Although all branches of services are addressed as a group in this section, as mentioned previously, the trend in retail trade and catering, which is also intense in unskilled labour, has been decisive.

[26] In fact, industry is not evenly distributed among regions: Catalonia and Madrid account for half of the high technology industries, while Catalonia, Valencia and Andalusia account for more than half of the low technology industries and Catalonia, Madrid, Valencia and the Basque Country for more than half of the intermediate technology industries.

[27] There is absolutely no mobility whatsoever in manufacturing industries and mobility is extremely weak in construction and market services. When considering these two sectors, more than regional mobility, we should talk of greater attraction.

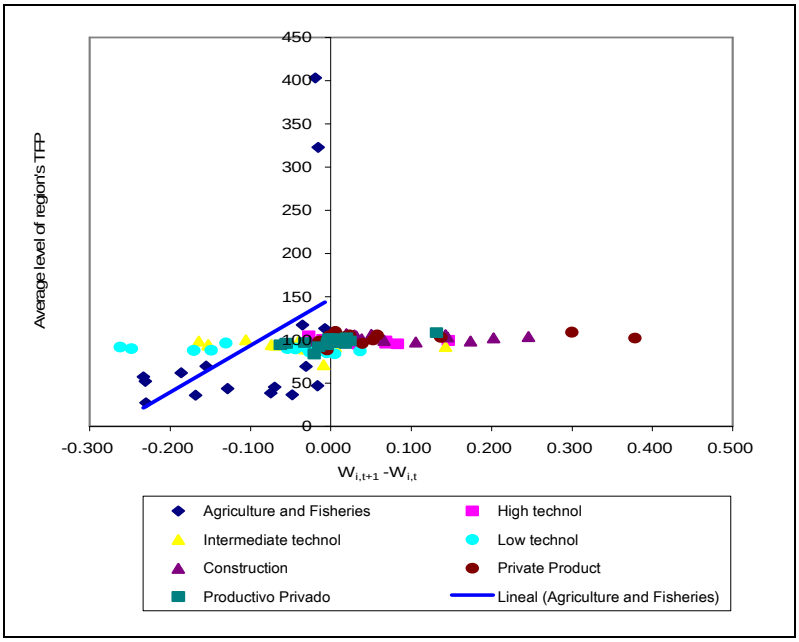


**Figure 13**. Regional Mobility of Resources

## 6. Conclusions and final comments

Similar TFP growth (or degrowth) trends, and therefore Growth Effects, in the majority of Spanish regions and in each sector suggests that the slowdown in TFP growth is not so much a regional problem, but mainly a global problem with regional effects closely related to sector specialization. The slowdown in productivity is largely the result of unbalanced growth.

TFP growth began to drop in all regions in the mid 1990s. Identical changes occurred in the productive structure of all regions (increase in services and also construction) - and well before the mid 1990s. These sectors displayed initial levels of TFP that were relatively higher than a large number of the sectors that have seen their presence diminish in Spanish regions (particularly agriculture, energy, food and textiles). However, precisely the sectors that have been attracting resources for some time now also display the lowest (or even negative) growth rates in TFP. This structural change has resulted in regional and national TFP contributing increasingly less to growth.

TFP growth rates have decreased more markedly in regions where initial levels were higher. There has been (sigma and beta) convergence due to the regions with higher initial levels of TFP being more specialized in services and

construction, which display the lowest growth rates, even negative. TFP has risen the most in regions with lower initial levels and where agriculture had a strong presence (the sector with the highest TFP growth rate). These regions, through the growth effect, have helped to cushion the fall in the growth rate in Spain.

The regions with the highest initial levels of TFP have attracted resources. This reallocation process, albeit weak, has been their contribution towards mitigating the fall in global TFP. The regions that have recorded lower TFP growth have propped up global TFP growth by attracting resources and being the most productive. The positive contribution this change has made to the global TFP growth rate would become increasingly smaller if directed towards the same sectors. In fact, in view of the current crisis in the construction and tourism sectors (so oversized in Spain), the Spanish economy at present has no choice but thoroughly modify its productive model.

Spain and its regions have not only suffered the widespread fall in TFP growth in Europe since the mid 1990s, but also the fact that their own growth rates have been lower than in Europe and the United States. Factors related to a production model specialized in industries and services that do not exactly use state-of-the-art technology, but rather unskilled labour, have undoubtedly played a part in Spain and its regions recording lower TFP growth rates. However, the global nature of both the slowdown and the low level of TFP suggests the responsibility of highly structural factors ranging from labour force training and infrastructure deficiencies, reduced spending on R+D and the size of enterprises and the minimal use of ICT to the need for profound structural reform in markets and institutions in Spain.

Nevertheless, sectoral and structural explanations do not appear to be so independent: long periods of lower growth in productivity than in other neighbouring countries affect relative costs and competitiveness. Therefore, marketable goods will be most affected, resulting in resources fleeing manufacturing industries and tending to settle in services and construction. Spanish regions are at a disadvantage when they compete with countries that can offer lower prices in low technology sectors intense in unskilled labour, such as food, textiles and various manufacturing industries, which in addition are the sectors with the lowest TFP in Spain.

The prolonged boom in the Spanish economy which ran from the mid 1990s until the outbreak of the crisis – GDP grew by an annual 3.7% - was significantly boosted by construction and unskilled labour-intensive services, sectors that acquired an even greater presence in the majority of regions from

2003 onwards. The Spanish economy is finding it extremely difficult to redirect specialization towards high technology industries with strong prospects for growth in productivity. Although the most structural measures aimed at boosting productivity take time to bear fruit, Spain should "take advantage" of the crisis to begin adjusting the productive model, avoiding policies aimed at protecting regional industries and companies that are showing they have little future and making the most of short term stimulus packages not only to temporarily increase local employment, but also their training, in order to invest in an economy based on knowledge, technological and scientific infrastructures and education. In order for the new model to develop, reforms must be undertaken in regional, administrative and labour institutions to facilitate the reallocation of resources in emerging industries.

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## APPENDIX 1

Basic data for the seventeen Spanish regions are taken from the BD.MORES b-2000 database. The level of regional disaggregation corresponds to NUTS2 in the Eurostat nomenclature of statistical territorial units and the level of industry disaggregation corresponds to NACE-CLIO R.25 (See De Bustos et al., 2008).

The regional data base BD.MORES b-2000 is compiled by the Dirección General de Presupuestos del Ministerio de Economía y Hacienda. This data base serves regional studies and is for assessing the economic impact of regional policies. Since its first version, compiled in 1995, the data base uses official statistics, units of measurement and sector and regional definitions and classifications. This applies to all GDP items, in current and constant prices.

This data base structures its core regional economic information using the figures from the various data sets of the *Contabilidad Regional de España-CRE-(Instituto Nacional de Estadística –INE-)*, taking national figures for economic aggregates as an obligatory reference, starting with the latest estimations (data set base 2000 CRE) which date back to the year of origin of the data sets (1980).

The variables that make up the data base can be classified in three groups: *Demand* (fixed investment and consumption); *Supply* (output, population, employment and physical, technological and human capital); *Income* (wages and gross operating surplus). At present, the BD.MORES b-2000 is the most complete data base on a regional level available for Spain: most variables have been disaggregated into 20 branches of activity since 1980 and some since 1964. The BD.MORES b-2000 data base can be accessed free at:

http://www.sgpg.pap.meh.es/SGPG/Cln_Principal/Presupuestos/Documentacion/Basesdatosestudiosregionales.htm

The series taken from this database are:

***Output*** $(Q_{ijt})$: Value of production in each regional industry valued in basic prices according to the European System of Accounts (ESA95)[28] (it does not include taxes on products, but does include product subsidies). It is obtained from the estimations of Value added, in basic prices, adding intermediate inputs valued in purchase prices. Data are expressed in constant 2000 prices.

***Labour*** $(L_{ijt})$***:*** The number of employees in each regional industry. The concept used in the BDMORES b-2000 data base is that proposed by the *CRE* base 2000

[28] The ESA 95 is currently the obligatory method of reference in all countries in the European Union for the elaboration of their National Accounts.

and base 95 referring to employment: jobs (one person can simultaneously hold various posts), distinguishing between wage earners and employed population.

***Intermediate Inputs*** $(M_{ijt})$***:*** Intermediate inputs for each regional industry valued in purchase prices and expressed in constant 2000 prices.

***Private Capital*** $(K_{ijt})$***:*** Net capital stock for each regional industry. The method followed to estimate net capital stock is the permanent inventory method. Investment flows, data sets used are consistent both in terms of level and evolution with the main macroeconomic variables included in the National Accounts in current prices and 2000 euros. Individual deflators are used for each sector that have been constructed taking into account the composition of each sector as far as assets are concerned. As regards the method of depreciation, depreciation rates for each sector are based on the composition of assets in each productive sector, the average service life of the different assets in each sector (OECD, 2000) and the BEA declining balance rate for each type of asset (Hulten and Wykoff, 1981).

***Labour Shares:*** Labour income for each regional industry are obtained by summing wages and an estimate of the wages earned by self-employed workers. More specifically, for all sectors except agriculture and fisheries, wage rates – obtained from the CRE – and a similar opportunity salary for wage earners and non wage earners or self-employed workers. For more detail, see Dabán et al (1998), section V.1.

**Disaggregation:**

| **Industries** | **R.20** | | **Regions** |
|---|---|---|---|
| Agriculture and fisheries | 01 | | Andalusia |
| Mining, quarrying and energy | 02 | | Aragon |
| Food, beverages and tobacco | 03 | | Asturias |
| Textiles, clothing, leather and footwear | 04 | | Balearic Islands |
| Paper, printing and graphic design | 05 | | Canary Islands |
| Chemical products | 06 | | Cantabria |
| Rubber and plastic | 07 | | Castille and Leon |
| Non metallic mineral products | 08 | | Castille La Mancha |
| Metallurgy and metallic products | 09 | | Catalonia |
| Machinery and mechanical equipment | 10 | | Valencia |
| Electrical, Electronic and optical equipment | 11 | | Extremadura |
| Transport equipment | 12 | | Galicia |
| Other manufacturing industries | 13 | | Madrid |
| Construction | 14 | | Murcia |
| Retail trade and catering | 15 | | Navarra |
| Transport and communications | 16 | | Basque Country |
| Financial intermediation | 17 | | La Rioja |
| House/flat rentals | 18 | | |
| Other market services | 19 | | |
| Non market services | 20 | | |

**TABLE A.2.1. GROWTH EFFECT 1995-2003**

| | Agriculture and fisheries | Mining, quarrying and energy | Food, beverages and tobacco | Textiles, clothing, leather and footwear | Paper, printing and graphic design | Chemical products | Rubber and plastic | Non Metallica mineral products | Metallurgy and metallic products | Machinery and mechanical equipment | Electrical, electonic and optical equipment | Transport equipment | Other manufacturing industries | Construction | Retail trade and catering | Transport and communications | Other market services | Private product |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tech. | | Med | Low | Low | Low | High | Med | Med | Med | High | High | High | Low | | | | | |
| AND | 0.180 | 0.072 | 0.063 | -0.005 | 0.037 | 0.086 | -0.041 | 0.104 | 0.063 | 0.072 | 0.030 | -0.054 | 0.010 | -0.127 | -0.219 | -0.092 | -0.092 | -0.020 |
| ARA | 0.086 | 0.064 | 0.006 | -0.001 | 0.025 | 0.006 | 0.012 | 0.016 | 0.028 | 0.078 | 0.032 | -0.032 | 0.026 | -0.029 | -0.035 | -0.055 | -0.081 | -0.006 |
| AST | 0.067 | 0.051 | 0.005 | -0.044 | 0.005 | -0.001 | -0.009 | 0.021 | 0.084 | 0.015 | -0.007 | -0.002 | 0.005 | -0.014 | -0.030 | -0.037 | -0.026 | 0.007 |
| BAL | -0.089 | 0.011 | 0.005 | -0.001 | 0.010 | 0.001 | 0.001 | 0.006 | -0.005 | 0.003 | -0.003 | 0.002 | -0.003 | -0.031 | -0.091 | -0.042 | -0.019 | -0.026 |
| CAN | 0.071 | -0.002 | 0.006 | 0.002 | -0.008 | 0.002 | -0.004 | 0.021 | -0.010 | 0.002 | 0.002 | -0.004 | 0.002 | -0.046 | -0.090 | -0.040 | -0.007 | -0.016 |
| CANT | 0.206 | 0.014 | -0.004 | 0.008 | 0.003 | 0.020 | 0.010 | 0.002 | 0.019 | 0.026 | 0.002 | -0.003 | 0.000 | -0.001 | -0.019 | -0.011 | -0.023 | -0.001 |
| CYL | 0.348 | 0.118 | 0.018 | 0.007 | -0.015 | 0.032 | 0.116 | 0.029 | 0.047 | 0.032 | 0.012 | 0.006 | 0.018 | -0.033 | -0.079 | -0.034 | -0.090 | -0.001 |
| CLM | 0.146 | 0.026 | 0.034 | -0.011 | 0.004 | 0.008 | 0.002 | 0.065 | 0.015 | 0.002 | 0.006 | -0.006 | -0.001 | -0.028 | -0.032 | -0.036 | -0.071 | -0.009 |
| CAT | 0.227 | 0.025 | -0.051 | -0.011 | 0.153 | 0.130 | 0.182 | 0.044 | 0.022 | 0.160 | -0.070 | 0.097 | -0.002 | -0.171 | -0.186 | -0.045 | -0.285 | -0.049 |
| VAL | 0.281 | -0.012 | 0.037 | -0.009 | 0.012 | 0.021 | 0.066 | 0.074 | 0.030 | 0.071 | 0.011 | -0.013 | -0.012 | -0.052 | -0.043 | -0.119 | -0.152 | -0.005 |
| EXT | -0.092 | 0.045 | 0.008 | -0.005 | 0.002 | 0.000 | 0.002 | 0.013 | 0.008 | 0.006 | -0.002 | 0.000 | -0.001 | -0.014 | -0.004 | -0.014 | -0.046 | 0.007 |
| GAL | 0.128 | 0.072 | 0.011 | 0.025 | 0.039 | 0.011 | 0.013 | 0.038 | 0.032 | 0.028 | 0.014 | 0.008 | 0.017 | -0.001 | -0.096 | -0.036 | -0.106 | 0.016 |
| MAD | 0.149 | -0.103 | 0.019 | -0.003 | 0.096 | 0.149 | 0.036 | 0.086 | 0.148 | 0.187 | 0.024 | 0.095 | -0.020 | -0.135 | -0.258 | 0.068 | -0.284 | -0.079 |
| MUR | 0.027 | -0.027 | 0.013 | -0.002 | 0.002 | -0.005 | -0.005 | 0.004 | 0.014 | 0.009 | -0.005 | -0.004 | -0.006 | -0.037 | -0.000 | -0.024 | -0.028 | -0.003 |
| NAV | 0.019 | 0.016 | -0.003 | 0.002 | 0.017 | 0.009 | 0.026 | 0.014 | 0.008 | 0.017 | 0.011 | -0.014 | 0.003 | -0.018 | -0.008 | -0.008 | -0.013 | -0.003 |
| B.C. | 0.019 | 0.092 | 0.016 | 0.006 | 0.018 | 0.029 | 0.163 | 0.025 | 0.152 | 0.190 | 0.011 | 0.003 | -0.007 | -0.025 | -0.091 | 0.015 | -0.077 | 0.005 |
| RIO | 0.084 | 0.000 | 0.006 | 0.001 | 0.001 | 0.002 | 0.007 | 0.014 | 0.011 | 0.006 | -0.001 | -0.001 | -0.001 | -0.008 | -0.019 | -0.005 | -0.002 | -0.001 |
| SPAIN | 0.092 | 0.036 | 0.013 | 0.000 | 0.011 | 0.016 | 0.008 | 0.011 | 0.031 | 0.016 | 0.001 | 0.004 | 0.000 | -0.099 | -0.228 | -0.036 | -0.208 | -0.143 |

**TABLE A.2.2. Resource Mobility 1995-2003**

| | Agriculture and fisheries | Mining, quarrying and energy | Food, beverages and tobacco | Textiles, clothing, leather and footwear | Paper, printing and Graphics design | Chemical products | Rubber and plastic | Non Metallica minteral products | Metallurgy and Metallica products | Machinery and mechanical equipment | Electrical, electronic and optical equipment | Transport equipment | Other manufacturing industries | Construction | Retail trade and catering | and communications | Other market services | Private product |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tech. | | Med | Low | Low | Low | High | Med | Med | Med | High | High | High | Low | | | | | |
| AND | -0.262 | -0.381 | -0.498 | -0.020 | -0.109 | -0.377 | -0.136 | 0.363 | 0.254 | 0.160 | 0.149 | 0.018 | 0.165 | 0.383 | -0.178 | 0.114 | 0.433 | 0.001 |
| ARA | -0.075 | -0.174 | -0.043 | -0.143 | -0.016 | 0.012 | 0.011 | 0.062 | 0.060 | -0.064 | 0.087 | 0.110 | 0.251 | 0.049 | -0.022 | 0.028 | 0.038 | -0.004 |
| AST | -0.116 | -0.174 | -0.076 | -0.089 | -0.044 | 0.048 | -0.028 | 0.012 | -0.039 | -0.015 | 0.006 | -0.012 | -0.001 | 0.030 | -0.014 | -0.049 | 0.039 | -0.033 |
| BAL | -0.011 | 0.014 | -0.049 | -0.082 | -0.004 | -0.001 | -0.004 | 0.039 | -0.015 | -0.004 | 0.002 | 0.031 | -0.005 | 0.103 | -0.016 | 0.026 | 0.090 | 0.019 |
| CAN | -0.109 | -0.161 | -0.027 | 0.001 | -0.065 | -0.019 | -0.019 | 0.084 | -0.008 | 0.015 | -0.007 | 0.006 | -0.003 | 0.164 | -0.035 | 0.108 | 0.174 | 0.018 |
| CANT | -0.030 | -0.092 | -0.050 | -0.017 | 0.018 | -0.033 | 0.057 | 0.020 | 0.068 | 0.027 | 0.030 | 0.010 | 0.016 | 0.053 | 0.009 | -0.009 | 0.020 | 0.001 |
| CYL | -0.241 | -0.367 | -0.138 | -0.044 | -0.077 | 0.031 | 0.059 | -0.029 | 0.113 | -0.045 | 0.049 | 0.038 | 0.036 | -0.009 | -0.084 | -0.050 | 0.087 | -0.056 |
| CLM | -0.048 | -0.196 | 0.016 | -0.080 | 0.003 | -0.026 | 0.093 | 0.071 | 0.044 | -0.026 | -0.015 | 0.012 | 0.000 | 0.008 | -0.025 | -0.052 | 0.052 | -0.015 |
| CAT | -0.363 | -0.866 | -0.288 | -0.987 | -0.253 | 0.124 | 0.307 | 0.061 | 0.283 | 0.222 | -0.310 | 0.557 | -0.171 | 0.226 | 0.022 | 0.331 | 0.417 | 0.006 |
| VAL | -0.359 | 0.410 | -0.114 | -0.951 | -0.000 | 0.018 | 0.078 | 0.441 | -0.064 | 0.048 | 0.000 | -0.032 | -0.162 | 0.270 | -0.040 | 0.021 | 0.325 | 0.024 |
| EXT | -0.094 | -0.120 | 0.013 | -0.029 | 0.008 | -0.001 | 0.021 | 0.030 | 0.023 | 0.015 | -0.006 | 0.002 | 0.026 | -0.041 | -0.021 | -0.012 | 0.018 | -0.021 |
| GAL | -0.358 | -0.449 | 0.040 | 0.160 | -0.034 | 0.050 | 0.111 | 0.053 | 0.084 | 0.086 | 0.054 | 0.239 | 0.067 | -0.007 | -0.103 | -0.014 | 0.103 | -0.062 |
| MAD | -0.055 | -0.535 | -0.168 | -0.301 | -0.256 | 0.101 | -0.085 | -0.124 | 0.020 | 0.036 | -0.483 | 0.029 | -0.131 | 0.222 | 0.180 | 0.999 | 0.534 | 0.131 |
| MUR | -0.200 | -0.065 | -0.045 | -0.027 | -0.010 | -0.006 | -0.018 | 0.125 | 0.015 | 0.086 | -0.014 | 0.047 | -0.002 | 0.059 | 0.012 | -0.005 | 0.089 | 0.009 |
| NAV | -0.026 | -0.012 | -0.052 | -0.021 | -0.097 | -0.021 | 0.037 | 0.009 | 0.022 | 0.020 | 0.065 | 0.114 | -0.010 | 0.046 | 0.001 | 0.002 | 0.039 | 0.010 |
| B.C. | -0.026 | -0.289 | -0.024 | -0.063 | -0.214 | -0.075 | 0.362 | -0.063 | 0.004 | -0.036 | -0.011 | 0.323 | -0.051 | 0.079 | -0.011 | 0.096 | 0.070 | -0.003 |
| RIO | -0.024 | -0.013 | -0.007 | -0.033 | -0.022 | -0.021 | 0.080 | 0.017 | -0.008 | -0.017 | 0.003 | -0.021 | 0.009 | 0.031 | -0.012 | -0.008 | 0.017 | -0.004 |
| SPAIN | -0.186 | -0.259 | -0.126 | -0.093 | -0.031 | -0.005 | 0.012 | 0.024 | 0.039 | 0.009 | -0.009 | 0.079 | 0.001 | 0.203 | -0.072 | 0.124 | 0.316 | 1.000 |