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The European countries: The role of services

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Services and the Territory: Spatial Aspects and Problems of Service Activities

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**REGIONAL PRODUCTIVITY GROWTH IN THE EUROPEAN
COUNTRIES. THE ROLE OF SERVICES**

(txt sent 17_06_10)

Abstract: Service industries play a core role in advanced economies, both from a quantitative a strategic point of view. Traditionally, productivity has been introduced as explaining factor of tertiarization processes in developed economies, while it has been simultaneously assessed that services display lower productivity levels and growth rates than other economic industries. Such a statement is supported initially on the personal nature of many service activities, which makes it difficult to substitute the work for capital and the introduction of technical progress. Nevertheless in recent years many papers and authors have refuted or limited this conventional thesis.

This paper focuses on the impact of tertiarization on overall productivity growth at national and regional level. It departs from the analysis of a sample of 17 European countries (EU-15 plus Norway and Switzerland) to show the relationship between structural changes, tertiarization and productivity growth at this level. The main result is that several service industries have shown dynamic productivity growth rates, contributing than expected to productivity growth. Lately, the analysis takes as reference 170 European regions in the period between 1980 and 2008, to confirm if the results at national level can also be confirmed at regional level. The analysis shows a clear coherence between both approaches. The final econometric analysis highlights some additional aspects, both at national and regional level, disaggregating by market and non market services.

Key words: Service sector, Structural Change, Productivity, Regional Growth

JEL classification : L80, O04, C67, R11.

Regional productivity growth in the EU-15 countries. The role of services.

Cuadrado-Roura, Juan R. and Maroto-Sánchez, Andrés

1. Introduction

Over recent decades, increasing attention has been paid to the relationship between the economic structure of economies and their productivity growth, particularly considering the role being played by service industries. Some previous contributions to this topic have focused on two processes: on the one hand, '*deindustrialization*' which started with the economic crisis of the 70s., trying to explain the continuous growth of service sector in the developed economies compared to the manufacturing decline (OECD, 1975; Blackaby, 1978; Gemmell, 1982); and, on the other, the creation of a services society or *tertiarization* (Chenery and Taylor, 1968; Bell, 1974; Fuchs, 1968; and Lanciotti, 1971). The majority of these works underlined that the changes involved in a transfer of labour from the sectors with low productivity to other more dynamic sectors was one of the main reasons for the overall productivity growth in an economy. On the other hand, a part of economic literature, from the first work of Fourastié (1949) and, particularly, in Baumol (1967, has supported the thesis that the continuous increase of services in the economic structures as part of the development processes, together with the low productivity in these types of activities as compared with the manufacturing industries, entail a clear threat for future growth, while its rates should be pushed down (Baumol *et al.*, 1985; Bjork, 1999; Wolff, 1985, Bonatti and Felice, 2007).

In a recent paper, Maroto and Cuadrado (2009) compared the relationship between the growth of services and labour productivity using a wide sample of OECD countries. In this paper predominantly two hypothesis were considered. The first discusses what role structural changes plays in overall economic productivity and particularly focuses on the growth of services activities. The idea underlying this hypothesis is whether the transfer of labour from less to more productive sectors does or does not propel an increase in the overall productivity of the economy. The second hypothesis tries to verify whether any differences are noted in productivity depending on the different branches of the services sector. Some recent studies have tried to demonstrate this hypothesis confirming that some tertiary branches of the most advanced countries are not just productive, but they register equal or better productivity levels than those of the manufacturing branches, and therefore demonstrating that they contribute to the overall productivity growth of their respective economies¹.

This paper aims to assess whether a regional analysis allows us to draw similar or identical conclusions to those obtained from a study based on national data. To be precise, this is not the only concern in this work, as also being considered is the possibility that differences arise and being able to explain them. For this purpose, regions taken as a reference for the analysis are NUTS-2² from a sample of 17 European countries (EU-15 plus Norway and Switzerland) in the period between 1980 and 2008.

¹ See Oulton, 1999; Baumol, 2002; O'Mahony and Van Ark, 2003; Wölf, 2003 and 2005; Triplet and Bosworth, 2004; Maroto (2009, 2010).

² In the case of United Kingdom, we have used NUTS-1 because the dimension of NUTS-2 is too small to make a realistic and accurate comparison. Additionally, Azores Islands (POR), Ceuta and Melilla (SP) and the overseas French territories have been excluded. In the case of Greece, all islands are considered as a single region.

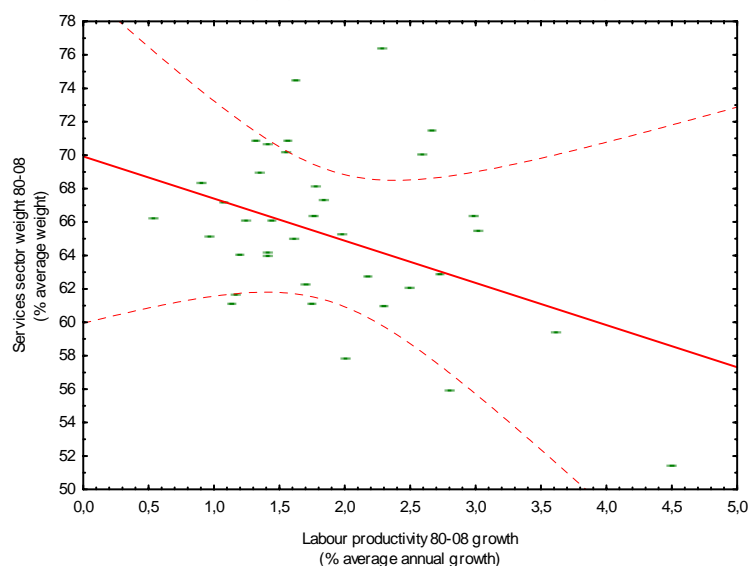
This paper is organised as follows: firstly –in section 2–, we set out some theoretical thoughts regarding the relationships between structural changes, services and productivity. Then –in section 3–, we offer an overview of the results obtained from the application of shift-share techniques, both at a national and regional level. Following on from this –in section 4– we will contrast the previous results with estimated econometric data panel models, again at a national and regional level, highlighting coincidences and discrepancies. And, finally, this paper ends with a brief synopsis of the most significant results and a summary of the questions that have been posed.

2. Structural change, Service activities and productivity growth in recent literature.

As mentioned, increasing attention has been recently paid by different authors to the relationship between the economic structure of a country and its overall productivity growth. However, the idea that the productive structure and the changes in its pattern influence growth is as old as the Economy (Reinert, 1993, 1995). The first papers on this subject (see, for example, Salter, 1960; Denison, 1967; Chung and Denison, 1976) have been followed by those focused on the manufacturing sector (Young, 1995; Dalum *et al.*, 1999; Fagerberg, 2000; Timmer and Szirmai, 2000; Carree, 2003; Hölzl and Reinstaller, 2007; Krüger, 2008). Nevertheless, the influence of services sector has not been analyzed empirically as much as would have been expected given its dominant role in highly developed countries. A controversial topic in last decades has been, precisely, the extraordinary increase in the weight of services in advanced economies, as well as its challenges and policy implications. An important aspect is whether this increasing weight of the service industries does have or not an impact on the performance of the overall productivity. Except for some papers (i.e.: Dutt and Lee (1993) and Wilber (2002)), this factor has not been dealt empirically in the depth required and only a very few papers have analyzed this problem at regional level and practically all them referred to a single country. This paper aims to contribute to plug this lack and to feed the debate around productivity in service sector.

Figure 1: Relationship between service sector weight and productivity growth 1980-2008. OECD countries sample.

(X: LP annual average growth 80-08; Y: average weight 80-08)



Source: Maroto and Cuadrado (2009)

W. Baumol (1967, 1985 and 1989) produced some suggestive ideas on the relationship between the progressive growth of services in advanced economies and their low productivity. Nusbaumer (1987) and De Bandt (1991) have also agreed on Baumol's approach. Using the labour force in order to explain the differences in productivity among industries, such theories concluded that economic growth and overall productivity growth of 'service' economies would show a trend to a slowdown. **Figure 1** shows aggregate evidence on this for a wide group of OECD countries. It can be seen that there is a negative relationship between the overall labour productivity growth rate of the economy and the weight of the services sector³. Data show that the economies having higher productivity growth are also those in which the services sector still has a lower percentage of the total, as occurs in the case of Korea, Ireland and some of the New Members of the EU. On the contrary, countries showing a high percentage of services (in total production and employment) register lower productivity growth rates, as it is the case of US, Canada, the Netherlands or France.

The latter affirmation is based on the hypothesis of the low productivity growth of the of the services sector. But, in recent years this hypothesis has been refuted by empirical evidence in some papers. Even Baumol (2002) rectified his previous position by admitting that it is necessary to differentiate between types of services and stressing the role of innovation and technology in the evolution of services. Triplett and Bosworth (2003) have also criticized the traditional theories on the services sector and even believe they have found the 'cure' for Baumol's cost disease. Generally speaking, criticism and revision are based on the following components (Rubalcaba and Maroto, 2007): 1) the need to take into account the indirect effects of some service activities on the productivity growth within other industries⁴; 2) biases in the definition and measurement⁵; or 3) the possibility of using indirect indicators of productivity as consequence of the conceptual and statistical debates generated over the last ten years⁶ (OECD, 2003 and 2005; EU Commission, 2004, 2005 and 2007). Additionally, the theories which currently explain the reason for the growth of services and which condition their productivity are not limited exclusively to the labour factor, but are related to multiple factors, such as those linked to the nature of the services, the organization and segmentation of their markets, or the special substitution relationships between labour and capital (Kox, 2002)⁷.

Some empirical studies have proved that the traditional affirmation that services contribute to the stagnation of overall productivity growth in the long term might actually be questioned. The data at international level highlights the patterns of dynamic productivity in some branches of services, mainly those related to ICT, both in Europe (O'Mahony and van Ark, 2003; van Ark and Piatkowski, 2004) and in the US (Stiroh, 2001; Triplett and Bosworth, 2003; Bosworth and Triplett, 2007).. These high growth rates have been almost continuous

³ Specifically, the correlation coefficient in the case of employment is -0.5223 , significant to 1% (p-value = 0.0040). Results are robust if the weight of service sector is measured in terms of value added. Then, the correlation coefficient is -0.5838 , also significant to 1% (p-value = 0.0015).

⁴ This hypothesis would limit the results of the theories of Baumol to the final consumer services and not to those allocated to intermediate use. See: Raa and Wolff, 1996; Fixler and Siegel, 1999; Oulton, 1999.

⁵ Griliches, 1992; McLean, 1997; Ahmad *et al.*, 2003).

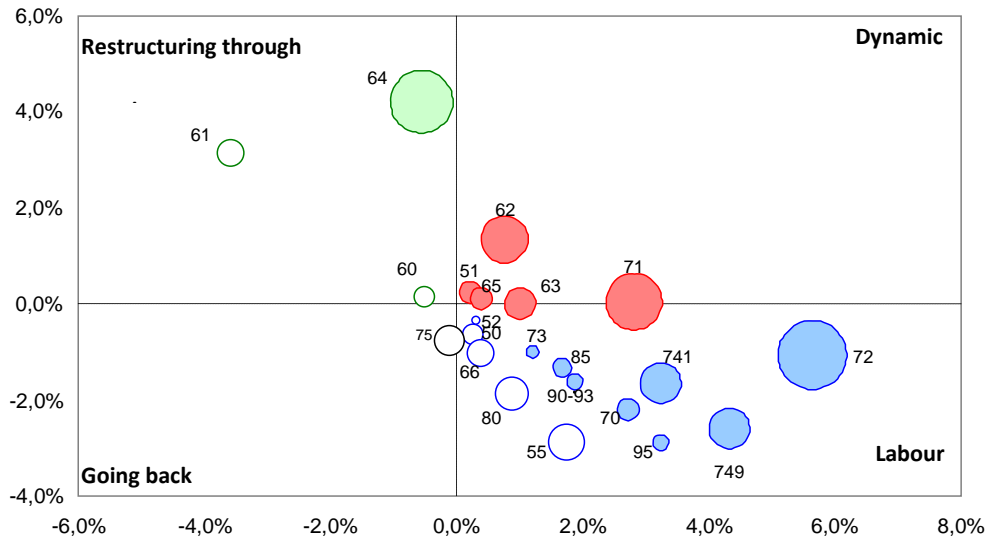
⁶ See: Gadrey and Gallouj (2002), OECD (2003 and 2005); EU Commission (2004, 2005 and 2007).

⁷ Some authors (François, 1990 a, b; François and Worz, 2008) have related growth of some services – producer services in particular – to the liberalization of trade in products and services which boosts the import and export of both, with greater specialization determining increases in the efficiency and productivity of the economy. Other authors have highlighted the interrelationship between globalization, trade and growth of services (Cuadrado *et al.*, 2002; Daniels, 2002)

over the last decades, which suggest that these service industries do not seem to be asymptotically 'stagnant'. On the contrary, this dynamism observed in some advanced economies from the middle of the 90s. may indicate an environment for potential improvements in the future.

Figure 2. **Typology of European^a services growth, 1980-2005**

(Axis X: Employment; Axis Y: Productivity; Size: GVA)



^a European Union 15

Note: 50 = Commercial and motor vehicle repair; 51 = Wholesale (except motor vehicles); 52 = Retailing (except motor vehicles) and repair; 55 = Catering; 60 = Land Transport; 61 = Sea Transport; 62 = Air Transport; 63 = Auxiliary Transport Activities; 64 = Communications; 65 = Financial Services (except insurance and pensions); 66 = Insurance and Pensions; 67 = Auxiliary Financial Activities; 70 = Real Estate Renting; 71 = Renting of Equipment and Machinery; 72 = Computing Services; 73 = R&D; 741-3 = Legal, technical and Publicity Services; 749 = Other Business Services; 75 = Public Services; 80 = Education; 85 = Health Care; 90-93 = Other Social, Personal and Community Services; and 95 = Domestic Service Personnel.

Source: Maroto and Cuadrado (2009)

As can be observed in **Figure 2** for the European case⁸, the empirical evidence shows that productivity growth in relation to the evolution of employment and production is not homogeneous in all service branches. Communications and some branches of transport show high productivity growth rates, although without regard for strong employment reduction processes. On the other hand, part of the transport services, the financial activities, wholesale trade and renting services are characterized by an intensive use of factors boosting productivity, such as innovation or human capital. All of them show also positive employment growth.

⁸ The methodological approach applied was the one proposed by Camagni and Capellin (1985). The central idea of this approach consists of studying the evolution of the apparent labour productivity in a determined branch of activity in accordance with the variables which constitute it, taking the growth of these variables at national aggregated level as a reference. This makes it possible to differentiate four clusters of sectors: dynamic; those going back; those in restructuring by employment; and, finally, labour intensive activities.

3. Structural change, service sector and productivity growth: A decomposition analysis.

3.1. Data and methodology

To develop this analysis the *European Regional Database* provided by Cambridge Econometrics will be used. It offers indicators on gross value added, employment and other relevant economic variables both for countries and regions at a sector level since the beginning of the 80s. Despite the narrow industrial disaggregation of this source, we have chosen it due to the homogeneity with the following sections in the paper. The sample of countries used includes all of the EU-15, plus Norway and Switzerland. The time span used is the one available in the chosen source, which ranges from 1980 to 2008. Finally, the selected breakdown by economic sectors is as follows: agriculture (01-05 level of the ISIC), manufacturing and mining (10-39), construction (45), market services (50-74), and non-market services (75-99). As service sector constitutes the focus of our analysis, market services have been broken down into five branches: distribution (50-52), hotels and restaurants (55), transport and communications (60-64), financial and insurance services (65-67), and other market services, including real state and business services (70-74).

To analyze what is the impact of structural changes on the productivity growth we will use the data above described, pointing out the heterogeneity of the different branches within service sector. To do it, a *shift-share* type analysis is used. This technique provides a convenient tool to research how aggregate growth is mechanically linked to differential growth of labour productivity and the reallocation of labour between industries. It breaks down overall productivity growth into two effects: structural changes and the within-sector productivity growth. Formally, the method applied here may be derived as follows:

$$\dot{\pi} = \frac{\pi_t}{\pi_{t-n}} = \frac{\sum_{i=1}^N \pi_{i,t} (s_{i,t} - s_{i,t-n}) + \sum_{i=1}^N (\pi_{i,t} - \pi_{i,t-n}) (s_{i,t} - s_{i,t-n}) + \sum_{i=1}^N (\pi_{i,t} - \pi_{i,t-n}) s_{i,t}}{\pi_{t-n}} \quad (1)$$

where: π is the labour productivity; $t-n$ is the initial year; t is the final year; N is the set of sectors; i corresponds to each economic sector; j to economic unit of decision (countries or regions), and s is the sector weight in terms of employment $s_i = \frac{L_i}{L}$.

According to the methodology, the overall growth of labour productivity can be broken down into three differentiated effects. The first is the contribution from changes in the allocation of labour between industries. The second measures the interaction between changes in productivity in individual industries and changes in the allocation of resources. Finally, the third term would be the contribution from productivity growth within individual industries (weighted by the share of these in total employment).

Decomposition techniques do not just allow us to analyse structural changes over time and their effects on productivity, but also structural changes in space and their effects. For this purpose, we have used a decomposition technique (shift-share) in order to analyse the regional productivity growth (and the variables it depends on: production and employment) by using two effects of a multiplicative nature⁹: the country effect (CE) and the net effect (NE) of

⁹ Instead of the additive nature which is usually used in this kind of techniques. There are two reasons for this. On the one hand, the elimination of effects of scale originated from the use of several variables with different units. On the other hand, the possibility of combining the three variables under

the region. The latter can also be broken down into the product of the proportional effect (PE), based on the productive structure of the region, and the differential effect (DE), which represents the rest of the identifying variables of the region itself. Although equation (1) will be used for both the analysis by countries and by regions, the technique described below will only be used for the regional analysis.

Each index or effect can be greater than one (if the region has grown above national average) or lower than one (otherwise). The mathematical expression in the analysis of production and employment would be as follows:

$$\dot{\xi}_r = \frac{\xi_t}{\xi_{t-n}} = \frac{\sum_{i=1}^N \xi_{ir,t-n} \left(\frac{\sum_i \sum_r \xi_{ir,t}}{\sum_i \sum_r \xi_{ir,t-n}} \right)}{\sum_{i=1}^N \xi_{ir,t-n}} \cdot \frac{\sum_{i=1}^N \xi_{ir,t}}{\sum_{i=1}^N \xi_{ir,t-n} \left(\frac{\sum_i \sum_r \xi_{ir,t}}{\sum_i \sum_r \xi_{ir,t-n}} \right)} = CE_\xi \cdot NE_\xi \quad (2)$$

$$NE_r = \frac{\sum_{i=1}^N \xi_{ir,t}}{\sum_{i=1}^N \xi_{ir,t-n} \left(\frac{\sum_i \sum_r \xi_{ir,t}}{\sum_i \sum_r \xi_{ir,t-n}} \right)} = \frac{\sum_{i=1}^N \xi_{ir,t-n} \left(\frac{\sum_i \xi_{ir,t}}{\sum_i \xi_{ir,t-n}} \right)}{\sum_{i=1}^N \xi_{ir,t-n} \left(\frac{\sum_i \sum_r \xi_{ir,t}}{\sum_i \sum_r \xi_{ir,t-n}} \right)} \cdot \frac{\sum_{i=1}^N \xi_{ir,t}}{\sum_{i=1}^N \xi_{ir,t-n} \left(\frac{\sum_i \xi_{ir,t}}{\sum_i \xi_{ir,t-n}} \right)} = PE_\xi \cdot DE_\xi \quad (3)$$

where ξ represents the analysis variable (gross value added, Y , or employment, L), i represents the N productive sectors, r corresponds to the regions considered, and t and $t-n$ are the two points of time chosen in the analysis (1980 and 2008).

Regional productivity growth can be obtained from the previous equations as the quotient between the growth of gross value added and regional employment. The aforementioned productivity growth π can be broken down again into its country, proportional and differential effects, on the basis of the following equation:

$$\dot{\pi} = \frac{\pi_t}{\pi_{t-n}} = \frac{\dot{Y}}{\dot{L}} = \frac{CE_Y \cdot NE_Y}{CE_L \cdot NE_L} = \frac{CE_Y \cdot PE_Y \cdot DE_Y}{CE_L \cdot PE_L \cdot DE_L} = CE_\pi \cdot PE_\pi \cdot DE_\pi \quad (4)$$

In accordance with formulas (2) and (3), a region r can be classified according to six different typologies or categories, three with a NE greater than one and three with a NE lower than one:

- i) $NE, PE, DE > 1$: *Dynamic regions*
- ii) $NE, PE > 1$, but $DE < 1$: *Regions specialised in dynamic sectors*
- iii) $NE, DE > 1$, but $PE < 1$: *Regions with advantages of location*
- iv) $NE, PE, DE < 1$: *Backward regions*

consideration: productivity, added value and employment, in just one indicator, in line with what was previously shown in a graphic manner in Figure 2.

- v) NE, PE < 1, although DE > 1: Regions *specialised in backward sectors*
vi) NE, DE < 1, although PE > 1: Regions with *disadvantages of location*

3.2. National results

The results (according to equation (1) in section 3.1) of the country calculations for the period 1980-2008 are shown in **Table 1**, both for the Euro-zone and the sample of 17 European economies, broken down into individual contributions by the three main economic sectors. **Table 2** shows the results of the *shift-share* for the same economic areas, broken down by specific service industries. In line with the equation (1) on the breakdown of the overall productivity, the sum of the static and dynamic effects, as well as the within-industry growth, is equal to the average growth rate of labour productivity in the according aggregate (first cell in each sub-table). This is how the data sums up horizontally. Vertically, for each of the three components, the contributions made by each sector also sum up to the according number in the first line of each sub-table (Peneder, 2002 and 2003). As additional information, the number in brackets show (Table 2) the average growth of labour productivity within individual sectors or service industries, and sum up neither in the horizontal nor in the vertical dimensions. They facilitate us to identify whether there are any regular patterns of differential productivity growth between industries.

Table 1. **Shift-share analysis of productivity growth.**
Country analysis, 1980-2008

	Labour productivity growth	Net or static effect	Interaction or dynamic effect	Within effect
Euro Zone				
TOTAL	1.33 =	0.67	- 0.54	1.19
		=	=	=
Manufacturing	(2.85)	+ 0.04	- 0.02	+ 0.07
Services	(0.60)	- 0.01	+ 0.00	+ 0.00
Rest	(1.88)	+ 0.64	- 0.52	+ 1.12
Sample of 17 European countries				
TOTAL	1.50 =	0.51	- 0.47	1.46
		=	=	=
Manufacturing	(3.06)	+ 0.07	- 0.05	+ 0.21
Services	(0.83)	- 0.01	+ 0.00	+ 0.00
Rest	(2.12)	+ 0.45	- 0.43	+ 1.25

NOTE: 'Rest' refers to those main sectors not included under 'manufacturing' or 'services', i.e. 'agriculture' and 'construction'.

Source: Based on Cambridge Econometrics.

Supported by data from **Table 1**, some stylized facts can be underlined. First of all, consistent with results obtained by some authors referred to other economic areas¹⁰, the structural components emerge to be generally dominated by the within effects of productivity growth. This means that, in aggregated terms, the reallocation of labour among those sectors with low and high productivity has only had a weak net effect on overall growth. This fact is even more noteworthy since the mid-90s, a period in which productivity growth rates of the European countries in relation to other areas such as the US began to fall notably. Secondly, it can be seen that there are not significant differences between the two areas analyzed. Euro-

¹⁰ See: Peneder (2002 and 2003) for 28 countries of the OECD; Havlik (2005) for the new Eastern European countries belonging to the EU; Fagerberg (2000) for the manufacturing sectors in 39 countries based on the UNIDO; Timmer and Szirmai (2000) for the manufacturing sectors of four Asian countries; Maroto and Cuadrado (2007 and 2009) for Spanish economy, and EU-15 and US, respectively; and van Ark (1995) for a group of 8 countries of the EU and the USA.

zone performance differs somewhat from the case of the broader sample, where the productivity growth rate is a little bit higher (due to the higher productivity growth rates experienced in most of Northern European countries) and the structural effects, both static and dynamic, are barely lower than in Euro-zone countries. Thirdly, the data obtained show the simultaneous operation of opposing mechanisms captured under the static and the dynamic shift effects. The structural burden of resource reallocation seems to be robust in the European case, where the dynamic effect is negative for the broad 3-sector break down. Finally, if we analyze the performance by sectors, most of the effects on the overall productivity come from non-tertiary activities. This suggests that, despite the progress obtained as regards productivity by the services sector; those non tertiary activities are still providing the major contribution to the growth of the overall productivity of the advanced economies.

Table 2. **Shift-share analysis. Service industries, 1980-2008**

	Labour productivity growth	Net or static effect	Interaction or dynamic effect	Within effect
Euro Zone				
SERVICES	0.60 =	0.55	- 0.07	0.12
Distribution	(0.94)	- 0.08	- 0.02	+ 0.03
Hotels and restaurants	(0.09)	- 0.05	+ 0.00	+ 0.00
Transport and communications	(1.09)	+ 0.08	+ 0.02	+ 0.04
Financial and insurance	(1.16)	+ 0.09	+ 0.03	+ 0.04
Other market services	(-0.73)	+ 0.62	- 0.09	+ 0.00
Non market services	(0.24)	- 0.11	- 0.01	+ 0.00
Sample of 17 European countries				
SERVICES	0.83 =	0.57	0.00	0.27
Distribution	(1.15)	+ 0.24	+ 0.02	+ 0.06
Hotels and restaurants	(0.25)	+ 0.63	+ 0.01	+ 0.00
Transport and communications	(1.44)	- 0.50	- 0.04	+ 0.10
Financial and insurance	(1.86)	+ 0.03	+ 0.00	+ 0.11
Other market services	(-0.14)	- 0.47	+ 0.00	+ 0.00
Non market services	(0.29)	+ 0.64	+ 0.01	+ 0.00

Source: Based on Cambridge Econometrics.

This aggregated approach could conceal important structural aspects in each individual sector. This aspect is particularly interesting in the case of the service sector, where the overall contribution to productivity is divided practically between two of the components analyzed here: the within growth and the static effect. In other words, services contribute to GDP per capita via two different channels. Firstly, it does through their within growth of the GDP per hour worked, just as in any other sector. However, and this is an exclusive factor of services sector, it also contributes through the growth of the weight their activities suppose in terms of employment. This is consistent with the traditional hypothesis on growing percentages in the demand for the services sector due to its greater income-elasticity¹¹

¹¹ See: Schettkat and Yocarini (2006) for a review of the literature on the shift to services employment. Fourastie (1949) and Fuchs (1968) have been the first authors introducing this theory. Some empirical applications on this hypothesis are: Summers (1985); Appelbaum and Schettkat (1999); Baumol (2001); Guo and Planting (2000); Peneder *et al.* (2003); Schettkat (2004); or Gregory *et al.* (2007).

If we deep into the service sector (**Table 2**), calculations show that productivity growth of the service sector in the sample of 17 European countries (0,83 per 100) is rather higher than the growth in the Euro-zone (0,60 per 100) and both rather distant from the one in the US (1,3 per 100). But, disaggregating the heterogeneous branches of services, there are some, particularly transport and communications and financial services, which show high within growth (last column), similar to those within sectors traditionally characterized by higher productivity levels. As well, most of the productivity growth comes from the reallocation of resources and not from the within growth. Consequently, the traditional view of the (aggregated) service sector being scarcely productive might be refuted when certain tertiary activities are studied, consistent with the findings of some of the more current empirical studies. Again, the case of the Euro-zone differs to some extent from the broader sample of 17 countries. Additionally, detailed analysis of these data shows, as in **Table 1**, that *structural burden* hypothesis is clearly confirmed for the service sector in the Euro-zone, although the effect in the EU17 is null. Alternatively, the *structural bonus* hypothesis (positive static effect) can also be observed – with few exceptions - in most service industries

The results presented are consistent with those found by other authors for previous periods (Van Ark, 1995; Fagerberg, 2000; Peneder, 2002 and 2003; Maroto and Cuadrado, 2007 and 2009, and Bonati and Felice, 2008). The *structural change*¹² has a positive effect, although this is relatively weak, on the overall productivity growth. No clear or univocal tendency to the reallocation of labour to those sectors with higher productivity levels has been found. However, the robust existence of a so-called structural burden can be observed due to the fact that, in the sectors with faster productivity growth, the expansion of production is not generally accompanied by growth in employment. Thus, it is possible to speak about a stylized fact. In contrast with periods previous to the economic crises of the 70s, the results during the period analyzed here show that the structural changes do not notably boost productivity growth. Novelty of our results emerges, neither the methodological approach used nor the main conclusions arisen, but from the disaggregated focus of the service industries, clearly characterized by a heterogeneous composition of activities. This will extend findings of previous papers to the service sector, the most important agent in advanced economies.

3.3. Regional results

The previous section revealed the relationships between structural changes and, particularly, the growth of the services sector and the evolution of aggregate productivity in the European countries. However, the objective of this section is to demonstrate the degree of influence of productive specialisation on the evolution of regional productivity in Europe, paying special attention to the role played by the growth of services.

Productive specialisation can be one of the main causes of the differences between regional¹³ behaviour and that of the countries. The evolution of those regions with a higher specialisation in dynamic activities will be far higher than the average of their corresponding countries. The main objective of this section is to analyse the importance of these factors, where the contribution of services activities to growth is particularly significant. The main

¹² This combined effect of the static and dynamic components is named “*structural effect*” or simply the “*effect of structural change*” by some authors (Maddison, 1996), and analyzed together although the analysis is deeper if both effects are distinguished.

¹³ See, among others, Daniels (2004), Combes and Overman (2003), Midelfart-Knarvik *et al.* (2003), Ezcurra *et al.* (2006), Amiti (1999), Haaland *et al.* (1998), Cuadrado and Maroto (2008), Hallet (2000), Molle (1996).

conclusion drawn is that services play a role in the growth of productivity in the European regions under consideration. In order to reach this conclusion, the decomposition techniques described in equations (2)-(4) are used. The results obtained with this methodology are detailed in **Tables A.1-4**.

The starting hypothesis of this work was the existence of a positive relationship between the weight of the services sector and the evolution of productivity in the European economies. The previous section revealed the first evidences at a state level. This section tries to draw the same conclusion at a regional level. By using the concept of Camagni and Capellin (1985), which we previously applied in order to create Figure 2 in section 1, we try to analyse the evolution of labour productivity in a certain European region, together with the evolution of production (added value) and employment of such a region, taking the average behaviour of the country where each region belongs to as a reference. For this purpose, we consider the regional net effects –once isolated from the country effect– shown in **Tables A.1-4**.

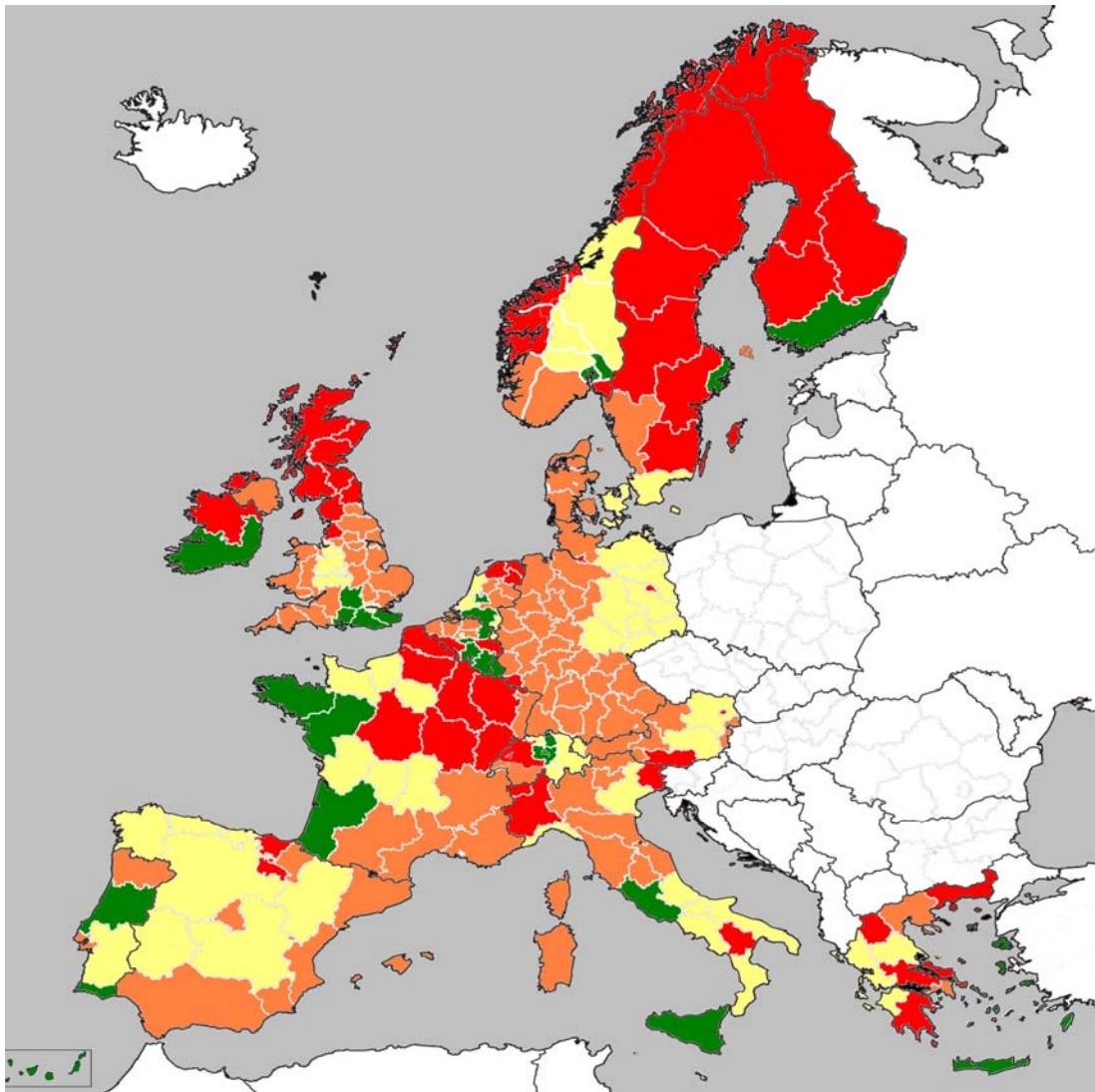
The aforementioned allows us to simplify the information included in the previous tables by classifying the European regions into four different groups or typologies: i) dynamic regions with net effects greater than one regarding productivity and employment; ii) regions under reconstruction through employment (dynamism regarding productivity arises mainly due to net effects lower than one regarding employment); iii) creation of employment-intensive regions (the net effect greater than one regarding employment leads to a lower growth regarding productivity); and, finally, iv) backward regions (which show a lower growth regarding both productivity and employment).

Map 1 shows this classification for the regions analysed during the 1980-2008 period. It is difficult to draw general conclusions from the data obtained due to the high level of heterogeneity between the 170 regions included in the sample, as behaviours and explaining factors of a different nature and origin are intertwined. However, European regions can be classified, in a broad outline, according to their productivity growth and their capacity to simultaneously create employment or not.

Thus, dynamic regions (those with good results regarding both productivity and employment) are concentrated in some capitals and financial centres, such as Zürich, Lazio, Oslo, Stockholm or Luxembourg, as well as in some small developing outlying regions, such as Algarve, Limburg, Utrecht and the Greek Islands. Some regions belonging to the group of developing European regions of Spain (Extremadura, Galicia, Castile-La Mancha and Castile and Leon), Portugal (Alentejo), Germany (Sachsen, Sachsen-Anhalt, Thuringen and Brandenburg) and Greece (Ipeiros, Dytiki Ellada and Ionia Nisia), as well as some capitals (Paris, London and Brussels) have also registered a dynamic net effect regarding productivity. However, the positive results of productivity achieved by these regions are mainly due to processes of low creation, or even destruction, of employment.

On the other hand, some French (Lorraine and Picardie), Dutch (Drenthe and Groningen) and German (Berlin, Bremen, Hamburg and Saarland) regions, as well as other regions from the North of Scandinavia (Ovre Norrland, Sor-Ostlandet, Nord-Norge and Småland) and the western area of Ireland, the North of the United Kingdom and some Greek regions (Dytiki Makedonia and Sterea Ellada) show a deterioration, because they have registered regional net effects below the national average regarding both productivity and employment.

Map 1: Regional clustering according productivity and employment, 1980-2008



NOTE: Green coloured regions identify dynamic regions; yellow coloured regions recognize restructuring regions; orange coloured categorize labour intensive regions; and, finally, red coloured regions classify backward regions.

Source: Own elaboration. Data Cambridge Econometrics

Finally, some Spanish (Madrid and Catalonia), German (Schleswig-Holstein, Hesse, Baden-Württemberg, Niedersachsen, Rheinland-Pfalz and Nordrhein), British (Wales and Yorkshire), French (Provence) and Portuguese (Lisbon) regions do not register good results regarding productivity either. However, this fact is due more to dynamic net effects regarding employment than just to a lack of productivity or efficiency.

Data obtained with this methodology allow us to highlight several stylised facts. Firstly, there is a reverse relationship between the behaviour of regions regarding productivity and employment, although the relationship between productivity and economic growth is positive¹⁴. Regions which have created employment to a greater extent in recent decades are

¹⁴ See, among others, Salter (1960), Freeman (1988), Appelbaum and Schettkat (1993, 1995), Baumol et al. (1989).

generally associated with lower growths of productivity. More specifically, the correlation coefficient between the growth of employment and the growth of productivity in the sample of analysed regions is -0.226 (with a p -value of 0.000), while the correlation coefficient between the growth of productivity and the growth of added value is 0.570 (which is also statistically significant for any significance level). When only the services sector is taken as a reference of employment and production compared to the productivity of the region in question, the results obtained are similar.

However, the relationship between the evolution of productivity and the growth of the weight of the services sector, regarding production and employment, is significantly positive (with a correlation coefficient of 0.151), though not very high. Data seem to show a slight relationship between the weight of services and the growth of productivity in the regions under analysis during the period from 1980 to 2008. This is an important conclusion as it coincides with what was obtained in the previous section 3.1 regarding the national analysis, but even more so because it can be used as a link and foundation for the econometric analysis constituting the core of section 4. The objective of that section 4 is, precisely, to statistically contrast the existence of the aforementioned relationship between the growth of the weight of services in European regions and the evolution of their productivity.

4. Tertiarization and productivity growth: An econometric analysis.

The results obtained until now should not be taken as an implication that the structural changes or growth of services do not play an important role in the evolution of overall productivity. What it does show is that structural changes, on average, do not involve significant growth in that area. One economic sector that deserves an in-depth analysis in this respect is the service sector. Based on this fact, we will analyze the impact of the growth of services on overall productivity growth in the sample of seventeen European countries since 1980. From a merely accounting point of view (as in Figure 2 and Table 2), some service industries are characterized by both high productivity levels and high growth rates. Nevertheless, the methodology developed previously does not obtain the indirect effects that the tertiarization of the economies have on other sectors (outsourcing, off-shoring, etc.), and maintains the intrinsic difficulties concerning definition and measurement.

4.1. Data and methodology:

To develop this analysis the *European Regional Database* provided by Cambridge Econometrics will be used again in order to homogenize our results with those in the previous section. The aim of this section will be to explore to what extent an increase in the share of resources assigned to the service industries is relevant to the productivity growth of an economy. First, at national level, and, later, at a regional level. To achieve this, a panel data model was used, carrying out regressions of the overall productivity growth over the change in the weight of services. Additionally, two other explanatory variables¹⁵ are included: the initial level of productivity (introduced to achieve *catching-up* or technological convergence) and the initial weight of the service sector (which distinguishes between those countries (regions) which, while undergoing equal growth in the percentages of employment, differ significantly in their levels or weight). As overall productivity growth is also influenced by other variables, besides structural change, a matrix of auxiliary conditioning variables has also been included in the regressions. This matrix includes the investment effort (measured as the ratio between

¹⁵ The source of every variable included in our model is *European Regional Database* provided by Cambridge Econometrics.

investment and GDP) or the demographic composition changes (as the relationship between active and total population)¹⁶.

The final specification of the model to be used is the following:

$$\dot{\pi}_i = \alpha + \beta\pi_{i,t-n} + \gamma\dot{s}_i + \delta s_{i,t-n} + \phi Z_{i,t} + v_i + \varepsilon_{i,t}$$

where $i = 1, 2, \dots, K$ are the countries/regions in the sample (with $K = 17$ in section 4.2 and $K = 170$ in section 4.3), n is the length of the period considered (with $n = 28$), s_i is the weight of the service sector (over total employment) in the country i , and $\dot{\pi}_i$ represents the labour productivity growth rate. Z_i is the matrix of auxiliary variables. v_i is the random effects component, and $\varepsilon_{i,t}$ the residue of the model. The idea of fixed effects is discarded despite its generalised use in panel data models, as this does not admit within-group constant variables, such as the case of the initial weight of the service sector or the initial productivity level in our analysis.

4.2. National results:

Table 3 summarizes the main results of the model defined above¹⁷. A simpler model relates the growth of overall productivity only to services growth (column 3.1). Then we have added the initial level of productivity (3.2) and the initial level of tertiarization (3.3). Finally, the matrix of auxiliary variables was included in our model (3.4). The main result is that the increase in the weight of services, from 1980 to 2008, had a positive¹⁸ effect on overall productivity growth. However, this positive effect is limited. An absolute increase of 1 per 100 in the weight of the service sector in terms of employment would be associated to an increase of 0.3 points in the rate of absolute overall productivity growth (during the whole period). The estimations are highly significant (at 1%) and stable throughout the different specifications of the model.

Convergence or *catching-up* effect (approximate for the level of labour productivity in 1980) is also statistically significant, with a negative coefficient, as predicted by the traditional theories, although this is relatively low. Those countries which started with higher levels have

¹⁶ These two variables have been selected in order to compare the results at national level with the ones at the regional level, where only both are available. In our first analysis on national economies, physical capital and human capital (measured as levels) demographic composition and the openness of the economies have been considered. Physical and human capital have shown to have a positive impact on the growth of overall productivity. Additionally, demographic changes and the openness degree of the economies also boost productivity growth.

¹⁷ A standard OLS regression model in a cross-section (for example, in Fagerberg, 2000) has also been implemented. Conclusions, although calculations are not included in the text, do not differ from the conclusions drawn in the paper based on a panel-data regression model.

¹⁸ The positive relationship between service growth (regressor) and labour productivity (dependent variable) might be endogenous, so results could be influenced by reverse causation matters. In order to solve this, Granger causality tests¹⁸ were implemented (Granger, 1969). According to our data, the growth of services could explain productivity growth (with the usual number of lags up to 14, null hypothesis that growth of services does not cause productivity growth will be rejected with any usual level of statistical confidence). Nevertheless, reverse causality will not be accepted (null hypothesis that productivity growth does not cause growth of services will not be rejected with any usual level of statistical confidence). Summarizing, likely reverse causation matters seem to be solved in the model regressed here.

seen how their overall growth rates were below those which were further behind at the end of the 70's. Additionally, the weight of services at the beginning of the period is also statistically significant and demonstrates a positive sign. This fact may support the hypothesis that those countries which were more tertiarized from the beginning had a more dynamic overall productivity growth rate than those which started with a lower weight of services.

One of the features that characterizes the service sector is a marked heterogeneity (as observed, among other results, in the calculations shown in **Figure 2 and Table 2**), as well as its atomization and diversification of supply due to the fact that market activities and other non-market services coexist in this sector. Consequently, it is reasonable to suppose that the likely impact on overall productivity growth might differ depending on the different kind of services involved. In order to differentiate the results obtained so far depending on service clusters, bottom-block in **Table 3** shows the results of our model. The innovation is the way in which we distinguish between market and non-market services.

Table 3. Structural change and productivity growth in European countries, 1980-2008^a

	3.1	3.2	3.3	3.4
Service sector growth	1.68***	1.68***	0.70***	0.30***
Initial productivity level		-1.28e ⁻⁷	-1.23e ⁻⁵ ***	-1.27e ⁻⁵ ***
Initial services weight			2.22***	2.27***
Physical capital				0.26***
Demographic composition				0.46
Adjusted R²	0.70	0.71	0.73	0.75
Num. Observations	476	476	476	476
Market services	1.22***	1.22***	1.22***	1.20***
Non market services	0.45***	0.45***	0.47***	0.48***
Initial productivity level		-4.72e ⁻⁷	-5.65e ⁻⁶	-5.83e ⁻⁶
Initial market services weight			1.31**	1.33***
Initial non market services weight			1.46***	1.50***
Physical capital				0.22***
Demographic composition				0.28
Adjusted R²	0.72	0.72	0.72	0.73
Num. Observations	476	476	476	476

^a Data panel estimation, random effects.

***, ** and * Statistical significance level at 1, 5 and 10% respectively. Constant coefficient is not shown, although it was included in the model.

NOTE: Specifications 3.1, 3.2 and 3.3 have been run on the reduced sample which is used in specification 3.4 and the results are robust with those presented in this table.

Source: Own elaboration. *Data* Cambridge Econometrics

The results highlight that, following the logic stated above, the market services have a higher (and statistically significant) coefficient than that observed in the case of the non-market services. Thus, an increase of 1% in the weight of market services would suppose an increase in the absolute overall productivity growth amounting to 1.2 percentage points, whilst the same increase in those services outside the market involves a relatively lower change amounting to 0.45 percentage points. Additionally, the performance of the other variables included in our model follows the same behaviour patterns as when the service sector as a whole was analyzed in up-block in the Table 3.

4.3.Regional results

Table 4 summarizes the main results of the model defined in the section 4.1 with a panel of regional data belonging to the 17 European countries of our sample. The organization of the table follows the same logic as the Table 3 for the country panel data.

Table 4. **Structural change and productivity growth in European regions, 1980-2008^a**

	4.1	4.2	4.3	4.4
Service sector growth	1.10***	1.06***	1.09***	1.10***
Initial productivity level		-3.82e ⁻⁶ ***	-9.42e ⁻⁶ ***	-9.47e ⁻⁶ ***
Initial services weight			1.17***	1.17***
Physical capital				0.08***
Demographic composition				1.45***
Adjusted R ²	0.54	0.54	0.54	0.55
Num. Observations	4688	4688	4688	4688

^a Data panel estimation, random effects.

***, ** and * Statistical significance level at 1, 5 and 10% respectively. Constant coefficient is not shown, although it was included in the model.

NOTE: Specifications 3.1, 3.2 and 3.3 have been run on the reduced sample which is used in specification 3.4 and the results are robust with those presented in this table.

Source: Own elaboration. *Data* Cambridge Econometrics

The main result is that the increase in the weight of regional service sector, from 1980 to 2008, had a positive effect on overall productivity growth. An absolute increase of 1 per 100 in the weight of the service sector in terms of regional employment would be associated to an increase of 1.1 points in the rate of absolute regional productivity growth (during the whole period). The estimations are highly significant (at 1%) and stable throughout the different specifications of the model. The explanatory capacity of the model, through its adjusted R-squared, is also relatively acceptable. Moreover, regional results not only argue with previous country ones, but the positive coefficient is even a little bit higher.

Related to the other explanatory variables of the model, convergence or *catching-up* effect is also statistically tested in the model, although its role is quite low. Those regions which started with higher levels have seen how their overall growth rates were below those which were further behind at the end of the 70's. Additionally, the weight of services at the beginning of the period is also statistically significant and demonstrates a positive sign. Finally, capital and demographical issues also have a positive effect in the aggregate productivity growth within European regions.

Following the schedule applied in the previous section and looking for differentiating the results obtained so far depending on market and non-market services, **Table 5** shows the results of our model. The results highlight that, following the logic stated above, the market services have a higher (and statistically significant) coefficient than that observed in the case of the aggregate sector. In those non-market services, the behaviour is quite the opposite. Thus, an increase of 1% in the weight of market services would suppose an increase in the absolute overall productivity growth amounting to 0.61 percentage points, whilst the same increase in those services outside the market involves a relatively lower change amounting to 0.43 percentage points. Additionally, the performance of the other variables included in our model follows the same behaviour patterns as when the service sector as a whole was analyzed in Table 3. These results again follow those concluded at the national level.

Table 5. **Structural change and productivity growth, 1980-2008^a:**
Market services versus non-market services

	4.1	4.2	4.3	4.5
Market services	0.61***	0.60***	0.60***	0.60***
Non market services	0.43***	0.42***	0.45***	0.45***
Initial productivity level		-3.68e ⁻⁶ ***	-8.71e ⁻⁶ ***	-8.73e ⁻⁶ ***
Initial market services weight			1.02***	1.01***
Initial non market services weight			1.26***	1.26***
Physical capital				0.04**
Demographic composition				0.02*
Adjusted R ²	0.53	0.54	0.54	
Num. Observations	4688	4688	4688	4688

^a Data panel estimation, random effects.

***, ** and * Statistical significance level at 1, 5 and 10% respectively. Constant coefficient not shown, although it was included in the model.

NOTE: Specifications 3.1, 3.2 and 3.3 have been run on the reduced sample which is used in specification 3.4 and the results are robust with those presented in this table.

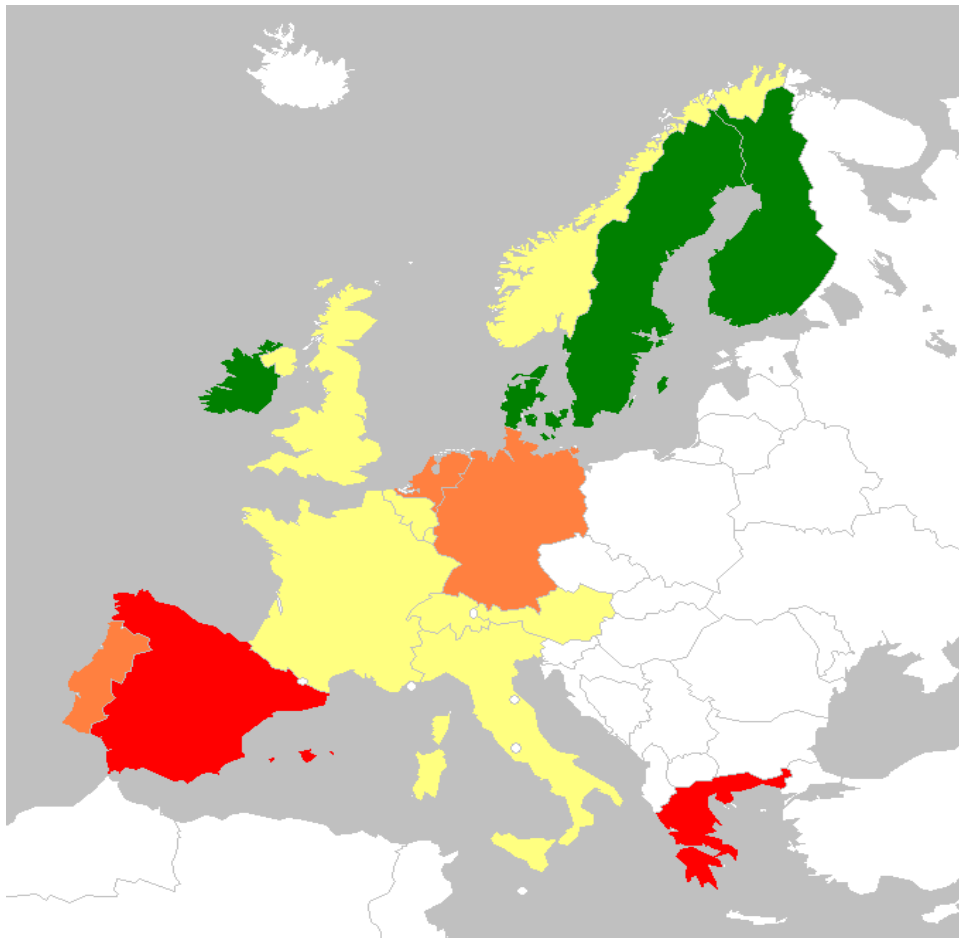
Source: Own elaboration. Data Cambridge Econometrics

Nevertheless, the results obtained in the previous regressions could conceal some specific behaviour which differs among the countries which make up our sample. One plausible reason, as Quah observed in 1996, is that regions under analysis are often considered such as islands, forgetting the effects on the economic growth of their belonging to a specific country and their physical contiguity to other regions. But the existence of strong state distortions or the links between regional and national behaviors are well known. A core block of the literature¹⁹ on disparities in Europe has extensively analyzed those stylized facts.

Map 2 shows the results of the relationship between the growth of the service sector and overall productivity by countries. In doing so, 17 different OLS cross-region regressions have been run (one for those regions belonging to each European country in the original sample). Estimators for the growth of service sector on aggregate productivity growth have been reported and analyzed their differences. Concretely, the Scandinavian (Denmark, Sweden and Finland) and Irish are the countries where a more positive impact of the growth of the regional services sector is observed as regards productivity growth. In Central countries (France, Belgium, Austria, Switzerland), Italy and United Kingdom the positive estimator is also above the average although it is not as remarkable as in the firstly cited ones. At the other extreme, countries such as Germany, Netherlands, Portugal and, specially, Greece or Spain show an impact which is below the general effect shown in the **Table 4**.

¹⁹ See Rodriguez Posse, 1994 and 1996; Dewhurst and Mutis-Gaitan, 1995; Borrás-Alomar et al., 1994; Armstrong, 1995; Cheshire and Carbonaro, 1995; Quah, 1996; Cuadrado and Maroto, 2008; or Lopez Bazo et al., 1999, among others.

Map 2. Differences in the effect of tertiarization on productivity growth in Europe



NOTE: Green coloured countries show an estimated coefficient above $[\mu+\sigma]$, yellow coloured countries show an estimated coefficient between μ and $[\mu+\sigma]$, orange coloured countries show an estimated coefficient between $[\mu-\sigma]$ and μ ; and, finally, red coloured countries show an estimated coefficient below $[\mu-\sigma]$.

Source: Own elaboration. Data Cambridge Econometrics

5. Final remarks

As established in the introduction, the two starting hypotheses of this paper were related to the impact of the growth of services on the evolution of productivity. The first entailed verification of the role played by structural changes, and particularly the growth of services, on the evolution of economic productivity. The second determined whether the variety of services branches demonstrated different behaviours in this field, in contrast to what has been considered by some more traditional approaches. Furthermore, the preparation of this paper has been inspired by two facts. On the one hand, the results obtained in a recent article (Maroto and Cuadrado, 2009), which showed that structural change has played an important role in the evolution of productivity in a wide sample of developed countries. And, on the other hand, to verify if this is also so at a regional level, due to services playing an increasingly important role, although there are notable differences among regions.

The analysis by countries, which has been replicated taking 17 European economies as a reference and using data for a substantial period of time (1980-2008), does not produce

different results from those obtained in the previous study based on a sample of OECD countries from 1980 to 2005. Conventional theory regarding the relationships between the services sector and labour productivity, according to which the expansion of the former would cause a lower growth of such productivity, cannot be supported in absolute terms. Some services branches register an increase in productivity which are comparable to, or even higher, than those corresponding to manufacturing, although those services branches characterised by a high and irreplaceable use of labour register comparatively low productivity levels.

At a regional level, the results obtained from the sample of 170 European regions during the same period (1980-2008) lead us to conclude that structural change still plays a significant role in the improvement of productivity of each region as a whole. However, as it was previously verified at a national level, most of the growth of this variable was due to the improvement within each activity branch and not just to the reallocation of resources between the various sectors.

The shift-share analysis used allowed us to break down the productivity growth in the regions into two components of a multiplicative nature: the country effect and the net effect of the region itself. The latter can also be broken down into the product of the proportional effect and the differential effect. The calculations made have shown that regions can be classified into different categories according to the results of the net, proportional and differential effects. Data obtained have been simplified in order to make up four categories or groups of European regions, as illustrated in Map 1. Despite this synthesis effort, there is a great heterogeneity in the evolution of the different regions, as many behaviours and different factors have an influence on this. However, the analysis reveals that the most dynamic regions are concentrated in various large capital cities and European financial centres, as well as in some outlying regions and regions of a lower weight, some of these related to the growth in tourism. Other comparatively backward regions must be included, where structural change has boosted the increase of productivity to a greater extent than in the most developed regions.

The econometric analysis carried out, both for countries and regions, have added some interesting results related to the role played by services. It has been demonstrated that the growth of services and productivity is positive and significant. Moreover, it has been verified that there is a process of convergence regarding productivity between those regions registering higher productivity levels at the beginning and the most backward regions. It is also confirmed that those regions specialising in services to a greater extent also register more positive dynamics regarding productivity growth. And, finally, as was expected, those services branches subject to market conditions have a greater impact on the variation of productivity, and this is contrary to the case of non-market services.

This analysis leaves an open door for further exploration of some analytical possibilities. Therefore, firstly, the differentiated behaviour of regions must be analysed in more depth and more detailed explanations must be pursued. Furthermore, it seems necessary to verify if the training levels of population -human capital- have an influence on productivity and to what extent. And, finally, a method to delve deeper into the issues considered could be to focus on significant countries or, as an alternative, to make a detailed analysis of those regions included in some of the aforementioned categories.

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