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Analyzing the role of service sector on productivity growth across European regions

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ANALYZING THE ROLE OF SERVICE SECTOR ON PRODUCTIVITY GROWTH ACROSS EUROPEAN REGIONS

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 regional level. It departs from the analysis of a sample of regions belonging to 16 European countries (EU-15 except Luxembourg, plus Norway and Switzerland) to show the relationship between structural changes, tertiarization and productivity growth at this level. Data has been extracted from Regional Databases elaborated by Cambridge Econometrics and OECD. The main result is that several service industries have shown dynamic productivity growth rates, contributing more than expected to productivity growth. Lately, a data panel model highlights some additional aspects disaggregating by market and non market services.

Key words: Service sector, Decomposition Analysis, Data Panel, Structural Change, Productivity, Regional Growth

JEL: C11, L80, O04, C67, R11.

RESUMEN

Los servicios juegan en la actualidad un papel clave, tanto en términos cuantitativos como estratégicos, en las economías desarrolladas. Por otra parte, la productividad ha sido tradicionalmente introducida como elemento explicativo del crecimiento de los servicios en dichas economías, a la vez que se ha afirmado que dicho sector presenta menores niveles y tasas de crecimiento de la productividad que otros sectores económicos. Dicha tesis está inicialmente basada en la naturaleza de muchos servicios, donde es difícil la sustitución de mano de obra por capital y la introducción de mejoras tecnológicas. Sin embargo, en los últimos años muchos trabajos y autores han rechazado o al menos limitado estas ideas convencionales.

Este trabajo analiza el impacto del crecimiento de los servicios sobre la productividad agregada a nivel regional en una muestra de regiones de 16 países europeos (UE-15 menos Luxemburgo, más Noruega y Suiza). El objetivo es mostrar la relación existente entre los cambios estructurales, el crecimiento de los servicios, y el crecimiento de la productividad agregada a nivel regional. La base de datos se ha extraído de las bases regionales elaboradas por la OCDE y Cambridge Econometrics. El principal resultado es que muchas actividades terciarias han mostrado tasas de crecimiento de su productividad dinámicas, contribuyendo más de lo esperado al crecimiento agregado. Finalmente, un modelo de datos de panel sirve para subrayar algunos aspectos adicionales desagregando entre servicios de mercado y no mercado, mostrando algunas de las causas explicativas de la relación entre terciarización y crecimiento de la productividad.

Palabras clave: Servicios, Análisis shift share, Datos de panel, Cambio estructural, Productividad, Desarrollo regional

JEL: C11, L80, O04, C67, R11.

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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. Those pioneer contributions to this topic, during the 70s and 80s, focused on two processes. On 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 decline¹. On the other, the creation of a services society or tertiarization². 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 wave of economic literature, from the foremost contribution by Fourastié (1949) and, particularly, since the seminal work by Baumol (1967) and their well-known 'cost disease', 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 down³.

The relationship between the growth of services and labour productivity, comparing different samples of OECD countries and time periods, has been revised in the recent literature. This paper tries to translate these issues to the regional sphere. Productive specialisation can be one of the main causes of the differences between regional⁴ 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.

On doing so, two hypotheses were considered. The first discusses what role structural changes play 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

¹ See, among others, Blackaby (1978) or Gemmell (1982).

² See, among others, Bell (1974) or Fuchs (1968).

³ See Maroto (2010) for a survey on the relationships between services and productivity. See Towse (1997) for more information on Baumol's 'cost disease'.

⁴ See, among others, Amiti (1999), Combes and Overman (2003), Ezcurra *et al.* (2006) or OECD (2009)

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 economies. The paper aims to assess whether a regional analysis allows us to draw similar or identical conclusions to those obtained from those studies 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-2⁵ from a sample of 16 European countries (EU-15 with the exception of Luxembourg, plus Norway and Switzerland) in the period between 1980 and 2008.

The structure of the analysis is the following. Firstly, we set out some theoretical thoughts regarding the relationships between structural changes, services and productivity (section 2). Then, we offer an overview of the results obtained from the application of shift-share techniques (Section 3). Following on from this we will contrast the previous results with estimated econometric data panel models highlighting coincidences and discrepancies (section 4). And, finally, the paper ends with some final remarks on 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. Along the second half of the 20th century, those pioneer papers on this subject⁶ have been followed by others focused on the manufacturing sector⁷. 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

⁵ In the case of Germany and the 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.

⁶ See, for example, Salter (1960); Denison (1967); and Chung and Denison (1976).

⁷ See, among others, Young (1995); Fagerberg (2000); Timmer and Szirmai (2000); Carree (2003); or Krüger (2008).

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; Maroto and Cuadrado, 2007 and 2009), 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 from a regional perspective.

W. Baumol (1967) and himself with the collaboration of Blackman and Wolff (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. Empirical evidence commonly shows that there is a negative relationship between the overall labour productivity growth and the weight of the services sector in advanced economies.

The latter affirmation was based on the hypothesis of a lower productivity growth within the services sector. But, in recent years this thesis has been smothered or even 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 knowledge in the evolution of services. Triplett and Bosworth (2006) 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 (Maroto, 2010): 1) the need to take into account the indirect effects of some service activities on the productivity growth within other industries; 2) biases in the definition and measurement; or 3) the possibility of using indirect indicators of productivity as consequence of the conceptual and statistical debates generated over the last ten years.

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 (Rubalcaba, 2007). Finally, others authors have highlighted the interrelationship between globalization, trade and growth of services (Cuadrado et al., 2002).

On the other hand, 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 (Oulton, 1999; Triplett and Bosworth, 2004; Bosworth and Triplett, 2007). The data at international level highlights the patterns of

dynamic productivity in some branches of services, mainly those related to ICT, both in Europe and in the US. These high growth rates have been almost continuous 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. 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.

3. STRUCTURAL CHANGE, SERVICE SECTOR AND PRODUCTIVITY GROWTH: A DECOMPOSITION ANALYSIS.

European Regional Database provided by Cambridge Econometrics will be used in order to develop our analysis. 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 with the exception of Luxembourg, 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 (net or static effect and dynamic effect) and

the within-sector productivity growth. Formally, the method applied here may be derived as follows:

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

where: π is the labour productivity; $t-n$ is the initial year; t is the final year; i corresponds to each economic sector; r to regions, and s is the sector weight in terms of employment $s_i = L_i / L$.

The results, according to equation (1), of the regional calculations for the period 1980-2008 are shown in **Table 1**, both for the regions belonging to the Euro-zone and to the sample of 16 European economies, broken down into individual contributions by the three main economic sectors. **Table 2** shows analogous results 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. 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.
Decomposition analysis of productivity growth, 1980-2008

	Labour productivity growth	Net or static effect	Interaction or dynamic effect	Within effect
Regions belonging to the 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
Regions belonging to the sample of 16 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 areas⁸, 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-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.

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-elasticity⁹.

⁸ 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.

⁹ See: Schettkat and Yocarini (2006) for a review of the literature on the shift to services employment. Fourastie (1949) and Fuchs (1968) have been pioneers introducing this theory. Some empirical applications on this hypothesis are: Peneder *et al.* (2003); or Gregory *et al.* (2007).

TABLE 2.
Decomposition analysis. Service industries, 1980-2008

	Labour productivity growth	Net or static effect	Interaction or dynamic effect	Within effect
Regions belonging to the 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
Regions belonging to the sample of 16 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.

If we deep into the service sector (**Table 2**), calculations show that productivity growth of the service sector in the sample of 16 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 16 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 EU16 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*¹⁰ 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.

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 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.

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. However, as previously mentioned, this source only provides information on production, employment and physical capital. In order to complement those items

¹⁰ 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.

and to explore some additional explanatory factors the *Regional Database* provided by the OECD will be used as well. The only disadvantage of using both sources is the different time range. While that provided by Cambridge Econometrics begins at 1980, the starting date in the one provided by the OECD is 1995 in most cases, getting shorter the size of the sample.

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 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 variables 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 the gross stock of physical capital over GDP), the demographic composition changes (as the relationship between active and total population), the level of human capital (approximated through the percentage of employees with secondary and higher education in the total employment), and the degree of trade openness of the country which each region belongs to.

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

$$\Delta\pi_i = \alpha + \beta\pi_{i,t-n} + \gamma\Delta s_i + \delta s_{i,t-n} + \phi Z_{i,t} + \nu_i + \varepsilon_{i,t}$$

where $i = 1, 2, \dots, K$ are the regions in the sample (with $K = 170$), 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 $\Delta\pi_i$ represents the labour productivity growth rate. Z_i is the matrix of auxiliary variables. ν_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.

Table 3 summarizes the main results of the model with a panel¹¹ of regional data belonging to the 17 European countries of our sample. A

¹¹ A standard OLS regression model in a cross-section (for example, in Fagerberg, 2000, or Maroto and Cuadrado, 2009) has also been implemented. Additionally, estimations with subsamples and different time spans have been developed. Conclusions, although calculations are

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 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.

TABLE 3.
Structural change and productivity growth in European regions, 1980-2008^a

	3.1	3.2	3.3	3.4 ^b
Service sector growth	1.10***	1.06***	1.09***	0.89**
Initial productivity level		-3.82e ⁻⁶ ***	-9.42e ⁻⁶ ***	-1.51e ⁻⁵ ***
Initial services weight			1.17***	0.42***
Physical capital				0.14***
Human capital				0.01***
Demographic composition				0.25**
Openness				0.10***
Adjusted R ²	0.50	0.53	0.57	0.67
Num. Observations	4688	4688	4688	1140

^a Data panel estimation, random effects.

^b 1995-2008.

***, ** 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 and OECD Regional Database

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 tests¹² were implemented (Granger, 1969). According

not included in the text, do not differ from the conclusions drawn in the paper based on a panel-data regression model.

¹² A time series X is said to Granger-cause Y if it can be shown, usually through a series of F -tests on lagged values of X (and with lagged values

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.

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.

With respect to the auxiliary matrix, and taking into account its incorporation into the model as a complement to the central analysis, all ancillary variables are statistically significant and have a positive coefficient. Both physical and human capital, measured in this analysis as levels, in line with various papers which stress the role of these two factors in economic growth and in the positive performance of the productivity growth, have a positive impact on the growth of overall productivity. This is greater in the case of physical capital. Those regions with a greater quantity of qualified working population and more extended capitalization processes are those which have presented a more dynamic growth in productivity. Additionally, demographic issues and the degree of openness of the countries where regions are located also boost productivity growth.

Finally, results of the last column in the Table 3 show that the positive effect of structural changes, and particularly of the services sector growth, is lower when other auxiliary variables are included in the model. This does imply a lower effect of tertiarization on the productivity growth since the mid-90s. While this effect accounted for 1.1 in the 1980-2008, the relative coefficient was only up to 0.6 when we analyze only the 1995-2008 period. This result follows some of the most recent works in the literature. The role of structural changes over the productivity growth in advanced economies has lost its major role for the within productivity effects since the 80s (Cuadrado et al., 1999). However, the responsibility of tertiarization, and specially the growth of some professional and dynamic market services since the mid-90s, has played an important role in the productivity growth of these economies¹³.

of Y also known), that those X values provide statistically significant information about future values of Y .

¹³

See, among others, Bosworth and Triplett (2007) and Triplett and Bosworth (2004) for the United States; Crespi *et al.* (2006) for the

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 4** 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. 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.

TABLE 4.
Structural change and productivity growth, 1980-2008^a:
Market services versus non-market services

	4.1	4.2	4.3	4.5 ^b
Market services	0.61***	0.60***	0.60***	0.16***
Non market services	0.43***	0.42***	0.45***	0.11***
Initial productivity level		-3.68e ^{-6***}	-8.71e ^{-6***}	-1.47e ^{-5***}
Initial market services weight			1.02***	0.49***
Initial non market services weight			1.26***	0.70***
Physical capital				0.58***
Human capital				0.02***
Demographic composition				0.63***
Openness				0.13***
Adjusted R ²	0.50	0.52	0.54	0.61
Num. Observations	4688	4688	4688	1140

^a Data panel estimation, random effects.

^b 1995-2008.

***, ** 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 and OECD Regional Database

United Kingdom; McLachlan *et al.* (2002) for Australia; Maroto and Cuadrado (2009) for a simple of OECD countries; and Maroto and Rubalcaba (2008) for the European Union.

5. FINAL REMARKS AND OPEN RESEARCH ISSUES

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 other papers, 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.

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. 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 is 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. However, as 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 econometric analysis carried out has 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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