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Productivity and Tertiarization in Industrialized Countries. A Comparative Analysis

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**PRODUCTIVITY AND TERTIARIZATION IN INDUSTRIALIZED
COUNTRIES. A COMPARATIVE ANALYSIS**

Andrés Maroto-Sánchez* and Juan Ramón Cuadrado-Roura^

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Abstract: The low productivity growth in many advanced economies has traditionally been associated to some structural changes they undergo. Concretely, conventional theories stressed a negative role to the performance and high incidence of services in these economies. Nevertheless, the latest empirical work shows that several service activities have registered similar or even higher productivity growth rates than ones in the most dynamic manufacturing industries, while their contribution to the growth of overall productivity plays a more important role than was historically believed. This article endeavours to analyse how the growth of services in advanced economies influences the aggregate productivity, both from a theoretical and an applied point of view. A decomposition analysis has been applied in order to break down the effect of the structural changes on the growth of overall productivity. Subsequently, the effect of the growth of services on the productivity growth of the advanced economies is contrasted econometrically.

Key words: Tertiariation, Productivity, Structural Change.

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1. Introduction

One of the main focuses of the debate on the current political-economic and academic situation involves the gap in productivity between the European countries and the US. The data leaves no room for doubt regarding the poor, even negative, evolution of the European average shown by all the indicators since the middle of the 90s. Thus, during the 2004-2006 period, productivity per hour worked in the European Union increased by 1.27%, at some distance from the 1.91% productivity growth of the US economy for the same period¹.

The role of the structural changes in economic growth and in productivity has been taken into consideration since the studies of A. Smith and D. Ricardo. The studies have traditionally focussed on two processes²: on the one hand, 'tertiarization' or the creation of a services society (Chenery and Taylor, 1968; Bell, 1974; Fuchs, 1968; and Lanciotti, 1971, among others); and, on the other, on the effects of 'deindustrialization' which started in the economic crisis of the 70s. (OECD, 1975; Blackaby, 1978; Gemmell, 1982, among others). Some of these authors considered that the changes involved in a transfer of labour from the sectors with low productivity to other more dynamic sectors constituted one of the main reasons for the overall productivity growth in an economy (see, for example, Kuznets, 1966). In this regard, from the first work of Fourastié (1949) and, particularly, in Baumol (1967), a part of economic literature has maintained the thesis that the growth of services in the development processes, together with the low productivity in these types of activities as compared with the manufacturing industries entail a clear disadvantage for the expectation of growth in the future (Baumol et al., 1985; Bjork, 1999; Wolff, 1985, among others).

The objective of this article is to analyse the effects of the growth processes of the tertiary sector on the evolution of the overall productivity in the advanced economies. After reflecting on the theoretical approach to the relationship between the structural changes, services sector and productivity (section 2), in third section, a disaggregated analysis of the performance of the services sector will be carried out since, as most recent studies have demonstrated (see: Oulton, 1999; Baumol, 2002; Triplett and

¹ If productivity per worker is adopted instead of using the productivity indicator per hour worked, the figures show a similar differential as regards the European case (1.17%) and the US (1.81%).

² For further information, consult Siniscalco (1985).

Bosworth, 2004; Wölfl, 2005), several of these branches are not unproductive and they do contribute positively to the growth of the overall productivity of the economy. This means at least a partial refutation of the traditional theories on the productivity of the services sector. In section 4, the structural changes of the evolution of the aggregated productivity are introduced, based on a *shift-share* analysis. After this analysis of the structural changes, in section 5 an analysis is made of the impact of the growth of the services sector on the performance of the overall productivity from an econometric viewpoint. This covers the 1980-2003 period for a broad sample of OECD countries.

2. A walk through the relationships between service sector and productivity

Services account progressively more in production and employment in all the highly developed countries. Nevertheless, these activities show productivity growth rates which are low or even negative in some countries. This fact could confirm the patterns of unbalanced growth introduced by W. Baumol, which is generally known as Baumol's 'cost disease'. This thesis states that, in certain cases, the disparate growth of economic sectors can induce a reallocation of resources to those sectors with low or null growth (in particular, services), which would slow down aggregated growth (Baumol, 1967).

Despite the fact that this approach has been widely accepted for a number of years, and that it continues to have a certain validity, at the present time, it is not clear whether the services contribute to this stagnation of the growth in overall productivity in the long term. Firstly, productivity growth is not the same in all the service activities and some of these, such as business services, financial services, some transport activities, and communications, are characterised by an intense use of factors which boost productivity growth, such as human capital or innovation, as well as the capital per worker in some of these activities. Moreover, it cannot be denied that services such as transport, communications, market studies, technological support services, etc. contribute directly and indirectly to the production in other sectors by substantially improving the manufacturing industries and a substantial number of service branches. Finally, the weak productivity growth in services could also be due to biases or mismeasurements relative to the definition and estimation issues within the sector.

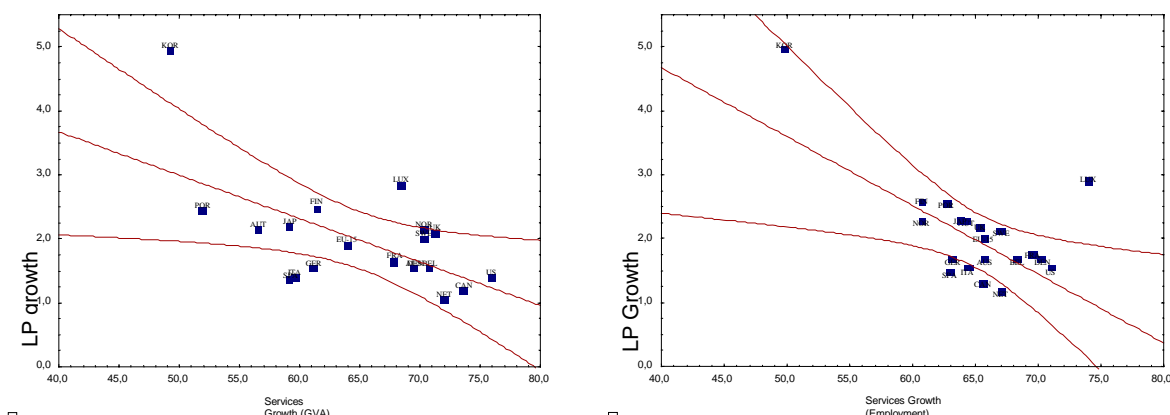
This section will attempt to review these aspects of the relationship between productivity and the services sector.

Some of the most suggestive ideas on the relationship between the progressive growth of the services in the advanced economies and their low productivity are due to W. Baumol, in three of his papers (1967, 1985, 1989)³. Baumol uses the labour factor in order to explain the differences in productivity among sectors. In those sectors classified as 'productive', which are essentially the manufacturing, labour constitutes a tool; while the sectors 'in stagnation', which are identified with the services, in general, usually involve an end. The quality of the service is often the relevant point and this does not allow substantial earnings from productivity per worker. Therefore, in an economy where the salaries are established in accordance with productivity growth (mainly the one in the manufacturing sector, which progresses more quickly), the costs in the sectors in stagnation tend to be and will be, in time, relatively higher due to the constant increase of labour employed and the evolution of salaries. These will not be far from those in the manufacturing sector and will often be higher. If demand in the sectors which are productively less dynamic lack elasticity, there will be a continual flow of labour towards these. Consequently, Baumol's 'cost disease' would consist of a trend to a slowdown of economic growth and of the overall productivity of the economy, while the prices of services increase.

If this dynamic persists in the long term, together with the growing weight of the services sector in the totality of economic activity, the growth in overall productivity of a country would fall. This would be due mainly to the slow growth of aggregated productivity in tertiary activities and its influence on the total productivity of the factors.

³ Other contributions can be quoted although they have had less impact, such as De Bandt (1991) or Nusbaumer (1987).

Figure 1: Relationship between service sector weight and productivity growth 1980-2003



Source: Based on GGDC

Figure 1 shows aggregated evidence in this issue for a wide group of OECD countries. It can be seen that there is a negative relationship between the overall productivity growth rate of the economy and the weight of the services sector, both in terms of production (left hand graph) and employment (right hand graph). Specifically, the correlation coefficient in the case of employment is -0.5969 , significant to 1% (p -value = 0.0055); while in the GVA this is -0.6338 , also significant to 1% (p -value = 0.0027). Some economies which have higher productivity growth are also those in which the services sector still occupies a lower percentage of the total, as occurs in the case of Korea. On the contrary, countries with a high percentage of services in total production and employment, such as the US, Canada, the Netherlands or France, register lower productivity growth rates. This same trend can be seen in a broad group of the more developed economies.

Naturally, this affirmation is based on the hypothesis of the low productivity growth of the of the services sector. However, as mentioned above, in recent years this hypothesis has been refuted in a substantial number of papers and by empirical evidence. Baumol (2002) rectified and made his position more precise by admitting that it is necessary to differentiate between types of services and stresses the role of innovation and technology in the evolution of services. Thus, only a third of the services sector could qualify as having 'slow productivity growth' activities, while the rest include branches of activity which have growth rates which are similar or even higher than those of the manufacturing sector. Other authors (Triplett and Bosworth, 2003) have also criticised 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 and Rubalcaba, 2007).

In the first place, it is necessary to take into account the indirect effects of the service activities on other sectors and the problems of the measurements (McLean, 1997; Ahmad et al., 2003) and indirect indicators of productivity in services (Rubalcaba, 1999; Wolff, 1999) as result of the conceptual and statistical debate generated over the last ten years. This debate started with the work of Gadrey (1996) and other French authors and continues with the latest developments in the OECD and the European Commission (2004). In addition, 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 wider. They take in a multitude of factors, such as those linked to the natures of the services, the organisation and segmentation of their markets, or the special substitution relationships between labour and capital (Kox, 2002).

Likewise, several authors have noted the need to limit the results of the theories of Baumol to the final consumer services and not those allocated to intermediate use. Although the service activities have low productivity, the movement of resources towards these must be interpreted as a result of an increase in their productivity (Oulton, 1999). The figures on productivity of some tertiary activities, such as the transport or financial services, can be undervalued as internal productivity should be added to the increased productivity which is generated by the companies which use these (Raa and Wolff, 1996; Fixler and Siegel, 1999).

Finally, several recent empirical approaches stress the role of the high productivity evident in some branches of services, especially those related to ICT in Europe (O'Mahony and van Ark, 2003; van Ark and Piatkowski, 2004) and in the US (Stiroh, 2001, Triplett and Bosworth, 2003). A possible explanation for this would be the presence of growing returns to scale in these activities, which would contradict the thesis of Baumol (Wölfl, 2003).

3. Sources and methodology

In order to explore the relationship between structural changes, the role of the services sector and the evolution of productivity in recent years, we have chosen to work with the “*Industry Growth Database*” of the Groningen Growth and Development Centre (GGDC), which provides standardised data on production, employment and productivity for the main OECD countries, with a breakdown into 60 sectors or branches of activity for the period which ranges from 1979 onwards. The sample of countries used in this paper was all of the EU-15, plus Japan, Korea, the US, Canada, Australia and Norway. Finally, depending on the disaggregation offered by this database, the breakdown by economic sectors chosen is as follows: Agriculture (01-05 ISIC), Manufacturing (10-39), Energy (40-41), Construction (45), Market Services (50-74), and Non-Market Services (75-99). As it constitutes the focus of our analysis, the services sector has been broken down into nine sub-sectors: Distribution services (50-52), Hotels and restaurants (55), Transport (60-63), Communications (64), Financial Services and Insurance (65-67), Real Estate Services (70), Business Services (71-74), Public Administrations (75), and Social and Personal Services (80-93).

The analysis itself is organised as follows. As was stated at the beginning, section 4 includes a study of the effects of structural changes and the within-sector productivity on the growth of labour productivity. For this purpose, the indicator of added value per hour worked has been chosen as this indicator takes into account the changes in the full-time – part-time relation of the workers (which is not registered by the indicator based on the number of workers) and the changes in the average number of hours effectively worked (OECD, 2001). It should be pointed out that the calculations presented here have been repeated in the case of production per person employed and the conclusions are essentially the same.

After a first theoretical survey on the relationship between the structural changes, the growth of the services sector and productivity, point 4.1 gives a combined analysis of the evolution of productivity in time and the two variables which determine this (production and employment), in the branches of services for the European average case (figure 2). To achieve this, the methodology 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.

Then, in point 4.2, a shift-share analysis is made. It breaks down overall productivity growth into two effects: structural changes and the within-sector productivity growth ones. Using the notation traditionally employed (Peneder, 2003; van Ark, 1995; Fagerberg, 2000; Timmer y Szirmai, 2000; and Havlik, 2005), the overall growth of labour productivity can be broken down into three differentiated effects:

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

where: π is the labour productivity (and its derivative is approximated by the logarithm); $t-n$ is the initial year; t is the final year; T is the set of sectors; i and s are the percentages of the sector i as regards the total employment.

The first component of the above equation is the *static or net effect*. This is calculated as the sum of the changes in the weight of each sector as regards the total employment between the final and initial years, weighted by the value of the labour productivity of the sector in the initial year. It will be positive (negative) when the sectors with high productivity levels attract more (less) labour and consequently increase (reduce) their weight in total employment. The traditional hypothesis (*structural bonus*), which postulates a positive relationship between structural change and economic growth⁴, would correspond to an expected positive contribution of this static effect to overall productivity growth:

$$\sum_{i=1}^n \pi_{i,t-n} (S_{i,t} - S_{i,t-n}) \geq 0 \quad (2)$$

The second component is the *dynamic or interaction effect*. This is calculated as the sum of the interactions between the changes in the weight of employment and the

⁴ For a discussion on this hypothesis, see Timmer and Szirmai (2000).

changes in the labour productivity of each branch of activity. The more displacements which take place towards highly productive sectors, the greater will this effect be. This effect can be used to check the hypothesis of the *structural burden* proposed by Baumol (1967). For this hypothesis to be valid, the value of this effect would be negative as there is a displacement of labour from manufacturing to services (with less productivity) at macroeconomic level.

$$\sum_{i=1}^n (\pi_{i,t} - \pi_{i,t-n})(S_{i,t} - S_{i,t-n}) \leq 0 \quad (3)$$

Finally, the third component is the *within-sector or internal effect*. This corresponds to the productivity growth in the case of the non-existence of labour changes.

Finally, in section 5 an econometric analysis is made of the relationship between the increase in the weight of the services sector in the advanced economies and the overall productivity growth. To achieve this, a panel data model was used to relate the productivity growth to the change in the weight of service activities. Two explanatory variables are included: the initial level of productivity (introduced to achieve *catching-up* or technological convergence) and the initial weight of the services sector. The analysis also includes other auxiliary variables, such as the level of human capital (approximated through the percentage of employees with higher education), the investment (measured as a percentage of the GDP) and a demographic variable (relationship between population and employment). As will be seen in the tables in section 5, these auxiliary items were included in the model in order to analyse how some variables, which traditionally appeared in papers on growth and productivity, influence the relationship between tertiarization and productivity growth.

In the light of the above, the final specification of the panel data model to be used is the following:

$$\pi_{i,t} - \pi_{i,t-L} = \alpha + \beta\pi_{i,t-L} + \gamma(x_{i,t} - x_{i,t-L}) + \delta x_{i,t-L} + \phi Z_{i,t} + \nu_i + \varepsilon_{i,t} \quad (4)$$

Where $i = 1, 2, \dots, N$ are the countries in the sample (with $N = 21$), L is the length of the period considered (with maximum $L = 25$), x_i is the weight of the services sector (in the total employment) in the country i , and π_i the logarithm of the GVA over employment, or labour productivity growth rate. Z_i is the matrix of auxiliary variables, which includes

the growth of the level of human capital, the weight of investment as regards the GDP and the demographic variable. Finally, ν_i is the random effects component⁵, and ε_{it} the residue of the model.

4. The effect of structural changes on productivity growth

In this section, the aim is to relate the structural changes in the more developed economies, particularly the services sector growth, with the performance of these countries with regard to productivity. To do so, in point 4.1 the contributions and theoretical ideas on this relationship are summed up, while the following point gives an empirical analysis carried out through techniques to decompose the overall productivity growth.

4.1. Structural changes, the services sector and productivity.

The relationship between the economic structure of a country and its overall productivity growth has been one of the main focuses of political-economic attention in recent decades. Many theoretical models have arisen within this stream of thought, for example, that those economies which are more specialised in highly technological or progressive activities will have higher productivity growth rates (Lucas, 1988, 1993; Grossman and Helpman, 1991), while those which are specialised in activities which are not particularly dynamic should expect relatively slower productivity growth. However, despite the growing interest in this topic and the originality of some models recently presented, 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 subject⁶ (see, for example, Salter, 1960; Denison, 1967) were followed by those focused on the manufacturing sector (Young, 1995; Fagerberg, 2000; Carree, 2003). Despite this progress, the services sector has not been analysed empirically as much as would have been expected given its dominant role in advanced economies at the present time.

⁵ 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 services sector or the initial productivity level in our analysis.

⁶ For a collection of these, see Fagerberg (1994).

Within the structural changes, one of the most controversial aspects since the Second World War has been, precisely, the extraordinary increase in the weight of the services sector in the overall activity of the advanced economies and its implications. In fact, this sector has become the most important one in all the developed countries, both in terms of production and in volume of employment. It has also notably increased its weight since the 70s. to reach 65 to 75 per cent of the total in these economies at the present time. This factor has been extensively demonstrated, both at the level of international comparisons and in time series (Feldstein, 1999). From a political-economic point of view, an important question is whether this greater weight of the services sector and the structural changes which have accompanied this tertiarization process affect the performance of the overall productivity or not. This factor has not been dealt with empirically in the depth required, except for some papers such as those of Dutt and Lee (1993) and Wilber (2002).

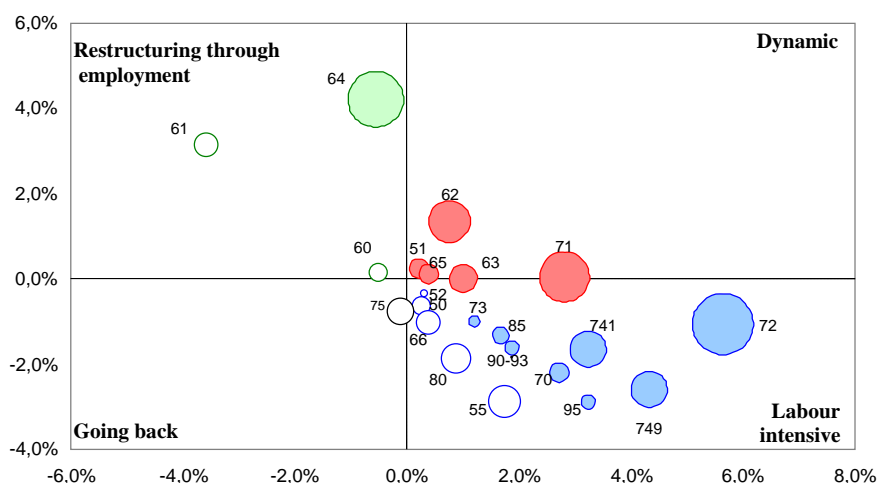
The traditional hypothesis of the literature on growth is that structural change is an important factor in the improvement of economic growth and overall productivity. This idea is always based on the existence of surplus labour in some less productive sectors (originally agriculture), thus, transfers can be generated towards the more productive sectors (manufacturing), which boosts the growth of the overall productivity of the economy. This fact also occurs within each economic sector, and encourages the growth of their respective internal productivity. However, it is evident that the structural changes could also slow down the productivity growth if the reallocation of resources is directed towards those branches in which the productivity growth is low or null – a hypothesis historically quoted in order to label the services as the causes of the low overall productivity in developed countries.

However, the affirmation that services contribute to the stagnation of overall productivity growth in the long term can now be questioned. The data at international level shows that the strong productivity growth in some sub-sectors of services, and those related to the ICTs, in countries such as the US or Australia since the 80s, and particularly during the 90s, has revisited the traditional theories on the low productivity of the services (Bosworth and Triplett, 2007). One of the possible reasons is the presence of increasing returns to scale in these activities (Baily and Gordon, 1988; Fixler and Siegel, 1999).

The data makes it possible to observe that there are cases characterised by strong productivity growth, especially in the sub-sectors of communications and financial intermediation, whose growth rates are, on average, approximately 4.5% in financial services, and 10% in communications. Moreover, these strong growths have been continuous over the last twenty years, which suggests that these activities 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 of significant potential improvement for the future. In addition, relatively strong productivity growth rates can also be observed in the distribution services, as well as in transport and storage services, where the average growth rate is situated at approximately 2.5%.

Additionally, the data at international level show that in some countries, such as the US, Sweden, Finland, Germany, the United Kingdom and Japan, the contribution of the services to the overall productivity growth has increased in recent years (Wölfl, 2003). However, it is the activities outside the services sector – fundamentally the manufacturing activities – which account for a substantial part of the overall productivity growth productivity in the majority of the advanced countries.

Figure 2. Typology of European services growth, 1980-2003
(Axis X: Employment; Axis Y: Productivity; Size: GVA)



Note: Following the maximum disaggregation of the base GGDC possible: 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: Own elaboration based on GGDC

In support of this stream of thought observed at international level, the empirical evidence shows that the productivity growth in relation to the evolution of employment and production, as observed in figure 2 for the European case is not the same in all the activities of services. Some of these, such as part of the transport services, the financial activities, wholesale trade and renting services, are characterised by an intensive use of factors boosting productivity, such as innovation or human capital. This makes the productivity growth rates in these activities similar, or even higher than those of the most dynamic manufacturing industries, while they show positive growth in employment. In addition, communications and other branches of transport also present high productivity growth rates although, in this case, at the cost of strong employment reduction processes.

4.2. Breakdown of the overall productivity growth: effect of the structural and within productivity changes.

In order to deep more into the effect of the structural change on the performance of productivity, as stated in section 3, a *shift-share analysis* was made for the large economic sectors of the EU-15 and the US economies (table 1). The services sector was then disaggregated (table 2) in order to analyse how the productivity growth was broken down during the reference time period, 1980-2003.

In accordance with the equation on the breakdown of the overall productivity (section 2), the sum of the static and dynamic effects, as well as the within-sector growth, would be equal to the average growth rate of labour productivity (first cell in each sub-table). Vertically, for each of the three components, all the contributions of each sector would also give this average productivity growth rate through the aggregate sum of the three effects. As a complement, the average productivity growth rates of each individual sector are also provided in parenthesis.

Table 1. **Shift-share analysis of productivity growth, 1980-2003**

| | Labour productivity growth | Net or static effect | Interaction or dynamic effect | Within effect |
|--------------------------|----------------------------|----------------------|-------------------------------|---------------|
| EUROPEAN UNION 15 | | | | |
| TOTAL | 1,62 = | 0,28 | -0,68 | 2,02 |
| | | = | = | = |
| Manufacturing | (5,84) | + 0,01 | - 0,08 | + 0,30 |
| Services | (0,84) | + 0,00 | - 0,01 | + 0,00 |
| Rest | (3,26) | + 0,27 | - 0,59 | + 1,72 |
| UNITED STATES | | | | |
| TOTAL | 0,87 = | -0,01 | -0,67 | 1,55 |
| | | = | = | = |
| Manufacturing | (7,55) | + 0,01 | - 0,82 | + 1,25 |
| Services | (1,18) | + 0,00 | + 0,00 | + 0,05 |
| Rest | (2,49) | - 0,02 | + 0,15 | + 0,25 |

Source: Based on GGDC.

In table 1, the first result to highlight is that, following the line of the results obtained by some authors for other economic areas⁷, the structural components are generally dominated by the within-sector effects of the productivity growth (last columns in both tables). This means that, in aggregated terms, the reallocation of labour among those sectors with low and high productivity only has a weak net effect on overall growth. This factor is even more notable as from the 90s, a period in which the productivity growth rates of the European countries in relation to the US began to fall notably. In the second place, it can be appreciated that the European performance differs slightly from the case of the US. While in the EU-15 the static component has a positive and significantly important effect, this does not occur in the US, where this effect is practically inappreciable. Another aspect to highlight is that the dynamic or interaction component makes a negative contribution. Finally, if we analyse 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, the activities external to this sector are those which still provide the major contribution to the growth of the overall productivity of the advanced economies (Wölfl, 2003; Maroto and Rubalcaba, 2007).

The results for the period analysed here are similar to those obtained by other authors for previous periods (van Ark, 1995). Thus, it is possible to speak about a robust factor in time. In contrast with periods previous to the economic crises of the 70s, the results

⁷ See, for example, Peneder (2001) for 28 countries of the OECD; Havlik (2005) for the new countries of Eastern Europe belonging to the EU; Fagerberg (2000) for the manufacturing sectors in 39 countries based on the UNIDO; and van Ark (1995) for a group of 8 countries of the EU and the USA.

during the period analysed here show that the structural changes do not notably boost productivity growth, which confirms the results of other papers, such as those of Dollar and Wolff (1988), and Timmer and Szirmai (2000).

However, it could be put forward that this aggregated view could conceal important structural aspects in each individual sector. This is particularly interesting in the case of the services sector, where the overall contribution to productivity is divided practically between two of the components analysed here: the within-sector growth and the static effect. In other words, in the European countries and in the developed countries in general (Peneder, 2003), the services sector contributes to the per capita GDP through two channels. Firstly, through the growth of the GDP per worker within the sector. However, and this is a factor exclusive to the 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-elasticity⁸.

If the services sector in particular is analysed (table 2), the data show, firstly, that, throughout the 1980-2003 period, the productivity growth of the services sector in the European average (0.84) is distant from the growth in the US (1.18). If we go more deeply into the branches of services, there are several of these, specifically transport, communications and financial services, which, in the two cases analysed show high within-sector growth (last column), comparable to those sectors with higher productivity levels. Therefore, the traditional scarcely productive vision of the aggregated sector is refuted when certain tertiary sub-sectors are studied, as demonstrated by many of the more recent empirical studies. Again the case of the US differs notably from the European case. On the one hand, very dynamic performance of its commercial sector has been observed, and, on the other hand, there are within-sector decreases in the non-market services.

⁸ The first author to introduce this theory was Fourastie (1949). Some empirical applications on this hypothesis are: Guo and Planting (2000) and Peneder et al. (2003).

Table 2. Shift-share analysis. Service industries, 1980-2003

| | Labour productivity growth | Net or static effect | Interaction or dynamic effect | Within effect |
|------------------------------|----------------------------|----------------------|-------------------------------|---------------|
| EUROPEAN UNION 15 | | | | |
| SERVICES | 0.84 = | + 0.57 | - 0.04 | + 0.31 |
| | | = | = | = |
| Distribution | (1.46) | - 0.02 | - 0.01 | + 0.02 |
| Hotels and restaurants | (-1.27) | + 0.47 | - 0.11 | + 0.06 |
| Transport | (1.99) | + 0.01 | + 0.02 | + 0.05 |
| Communications | (5.67) | + 0.03 | + 0.08 | + 0.14 |
| Financing | (1.22) | - 0.03 | - 0.01 | + 0.02 |
| Real state | (-0.59) | + 0.07 | - 0.01 | + 0.00 |
| Business services | (-0.12) | + 0.01 | + 0.00 | + 0.00 |
| Public administration | (0.87) | + 0.01 | + 0.00 | + 0.02 |
| Social and personal services | (-0.29) | + 0.02 | + 0.00 | + 0.00 |
| UNITED STATES | | | | |
| SERVICES | 1.18 = | + 0.32 | + 0.04 | + 0.82 |
| | | = | = | = |
| Distribution | (2.89) | - 0.01 | + 0.00 | + 0.51 |
| Hotels and restaurants | (-0.06) | + 0.00 | 0.00 | + 0.00 |
| Transport | (2.76) | - 0.02 | + 0.00 | + 0.47 |
| Communications | (2.50) | - 0.04 | - 0.01 | + 0.59 |
| Financing | (3.66) | + 0.02 | + 0.02 | + 0.29 |
| Real state | (0.65) | + 0.01 | + 0.00 | + 0.05 |
| Business services | (0.14) | + 0.01 | + 0.00 | + 0.00 |
| Public administration | (1.46) | + 0.32 | + 0.03 | - 1.06 |
| Social and personal services | (0.27) | + 0.03 | + 0.00 | - 0.03 |

Source: Based on GGDC.

Secondly, a detailed analysis of these data show the simultaneous functioning of the opposing mechanisms obtained by the static and dynamic effects (second and third columns respectively)⁹. The traditional hypothesis on the reallocation of resources far from the highly productive sectors (*structural burden*) seems to be robust in the European case. The dynamic effect is negative, both as regards the aggregated data and, generally, as regards the data broken down by sectors. Consequently, this hypothesis is confirmed for the services sector in Europe, although this is not so in the case of the US (where the effect is slightly positive). The hypothesis of the *structural bonus*, which entails the reallocation of resources to the activities with higher productivity levels, can also be observed with the help of the previous table. Its data shows that the static effect for the two economic areas analysed is positive for the global effect for the period, and with a weight higher than within-sector growth in the European case. However, if other periods of reference or economic areas are taken into account, the empirical evidence regarding this factor is weaker as regards the effects of interaction than in the case analysed above.

⁹ This combined effect of the static and dynamic components is termed the "*structural effect*" or simply the "*effect of structural change*" by some authors (Maddison, 1996), and analysed together although the analysis is deeper if both effects are distinguished.

Concluding, in line with other authors, the *shift-share* analysis implemented here confirms that, in general terms, the structural change has a positive effect, although this is relatively weak, on the growth of the overall productivity. 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. In the following section, an attempt will be made to empirically analyse this relationship between productivity and structural changes through linear models. Specifically, the processes of tertiarization, which has been observed in the countries in the sample studied here over the last few years will be researched.

5. The impact of service industries growth on overall productivity: A comparative econometric analysis

The results obtained in the previous section should not be taken as an implication that the structural changes do not play an important role in the evolution of overall productivity. Neither should they be used in order to affirm that the services sector is not important in the conduct of overall productivity. What they do show is that the structural changes, on average, do not involve notable growth in that. Nevertheless, determined structural changes, such as the so-called '*electronic revolution*' (see, for example, Bernstein, 1997; Raa and Wolff, 1996; and Fagerberg, 2000) occurring in some countries have relevant economic importance. The activities of services, which were traditionally considered not to be very productive or stagnant, have gone to the top of the list of studies on productivity in recent years. This is due to their strategic role and quantitative weight in the advanced economies and the empirical evidence that some of the branches register productivity growth comparable to the manufacturing sector.

Therefore, in this section an attempt will be made to explore to what extent the growth of the weight (in terms of employment) of the activities of services observed in the advanced economies in recent decades is important for the overall productivity growth of a country. From a merely accounting point of view (as in the previous section), this is what it should be observed. Nevertheless, the methodology developed previously

does not obtain the indirect effects which the tertiarization of the economies have on other sectors (outsourcing, off-shoring, etc.), and maintains the problems of definition and measurement intrinsic to the services sector.

5.1. Tertiarization and overall productivity growth.

In order to empirically analyse this fact, we have carried out regressions of the overall productivity growth over the change in the percentage of the services sector in total employment. The weight of the services sector at the beginning of the period to be analysed is also included in order to distinguish between those economies which, while undergoing equal growth in the percentages of employment, differ significantly in their levels or weight. That is to say, how it affects the fact that an economy is initially more or less tertiarized. However, 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. All these variables refer to the aggregated level of each country and include the initial productivity level in order to try to obtain the existence and size of convergence processes; the growth of human capital, measured through employees with higher studies; investment (in percentage of the GDP); and a demographic variable (which relates employment to population). The main results are summarized in table 3. The following are then added to the simple model which relates the growth of overall productivity only to the growth of services (column 3.1): firstly, the initial level of productivity (3.2), the initial level of tertiarization (3.3), and, finally, the matrix of auxiliary variables.

Table 3. Structural change and productivity growth^a

| | 3.1 | 3.2 | 3.3 | 3.4 |
|-----------------------------------|----------------------|--------------------------------------|--------------------------------------|-------------------------------------|
| Service sector growth | 2,9095*** (48,78) | 2,9040*** (48,41) | 2,9112*** (48,76) | 2,3942*** (13,09) |
| Initial productivity level | | -3,33e ⁻⁰⁶ *** (-1,65) | -8,79e ⁻⁰⁶ *** (-2,97) | 1,13e ⁻⁰⁵ *** (-2,97) |
| Initial services weight | | | 0,7748** (2,53) | 1,0921*** (2,77) |
| Inversion | | | | 0,8919*** (4,50) |
| Human capital | | | | 0,1185*** (4,69) |
| Demographic effect | | | | -0,5972 (-0,77) |
| R² | 0,60 | 0,64 | 0,69 | 0,80 |
| N | 485 | 485 | 485 | 248 |

^a Data panel estimation, random effects.

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

Source: Own elaboration

The main result shown by this table is that the increase of the weight of the services sector observed in the countries in the sample during the 1979-2003 period has a positive effect on the overall productivity growth although its impact is limited. An absolute increase of 1% in the weight of the services sector as regards total employment during these years was associated to an increase of 2.9 points in the rate of absolute overall productivity growth. The estimations are highly significant (at 1%) and stable throughout the different specifications of the model. The explanatory capacity of the model, through its R-squared, is also relatively respectable.

Among the rest of the variables, the convergence or catching-up effect (approximate for the level of productivity per hour worked in 1979) is statistically significant, with a negative coefficient, as predicted by the traditional theories, although relatively low. Those countries which started with higher productivity levels have seen how their overall productivity growth rates were less than those which started with lower levels. The weight of the services sector at the beginning of the period is also statistically significant, with a positive impact. This fact suggests the idea that those countries which were more tertiarized from the beginning had more dynamic overall productivity growth rates than those which started from a lower weight of the services sector at the beginning of the period analysed.

Among the auxiliary variables, and taking into account their incorporation into the model as a complement to the central analysis, both investment and human capital are statistically significant and have a positive coefficient. At the same time, the demographic component is not significant. Both investment, measured in this analysis as flow, and growth of the level of human capital, in line with all the papers which stress the role of these two factors in economic growth and in the positive performance of the productivity variable, have a positive impact on the growth of overall productivity. This is greater in the case of investment. Those countries where a greater increase in the level of the working population with higher studies and higher levels of investment have been observed to present more dynamic productivity. This places these aspects, together with other commonly accepted factors, as spheres of action when implementing policies intended to improve productivity.

5.2. Differential aspects of market and non-market services by countries.

One of the features which more clearly characterises the services sector is the high degree of heterogeneity it has, as well as its atomisation and diversification of supply since market activities and other non-market services coexist in this sector. Consequently, it is reasonable to suppose that the impact on the growth of overall productivity differs depending on the different activities involved. When the within-sector performance of productivity was analysed, the following features were observed: i) a number of services with weak capacity to increase productivity; ii) activities capable of moderate productivity growth; and iii) others, such as telecommunications, some transport and finance activities, capable of registering growth rates similar or higher than ones in the most dynamic manufacturing branches. It should also be remembered (see section 2) how difficult it is to define and then quantify the activity of many services, especially in the case of those out of the markets, and, due to this, the difficulty to calculate the evolution of the productivity variable.

In order to differentiate the results obtained in the previous point depending on whether the services are market services or not, table 4 shows the results of the model described above, but distinguishes between market services (codes 50-74 ISIC) and non-market services (75-95). The results make it possible to observe that, in accordance with the logic stated above, the market services have a statistically significant coefficient higher than the one observed in the case of the aggregated sector, while, in the non-market services, the contrary is true. Thus, an increase of 1% in the weight of the market services as regards the total employment supposes an increase in the absolute overall productivity growth amounting to 3.23 (2.91 for the aggregated sector); while the same increase in those services outside the market involves a relatively lower change amounting to 2.4 points. Table 4 also shows that the performance of the other variables included in the model follows the same patterns of performance as for the analysis of the services sector as an aggregate.

Table 4. Structural change and productivity growth ^a:Market services versus non market services

| | 4.1 | 4.2 | 4.3 | 4.5 |
|---|----------------------|-----------------------------------|-------------------------------------|------------------------------------|
| Market services | 3.2342*** (25.81) | 3.2367*** (25.80) | 3.2250*** (25.80) | 2.7856*** (12.97) |
| Non market services | 2.3964*** (13.01) | 2.3755*** (12.90) | 2.4164*** (13.13) | 1.4277*** (4.17) |
| Initial productivity level | | -3.36e ⁻⁶ * (-1.77) | -8.93e ⁻⁶ *** (-3.05) | -1.1e ⁻⁵ *** (-2.70) |
| Initial market services weight | | | 1.0925** (2.38) | 0.8692 (1.35) |
| Initial non market services weight | | | 0.5018 (1.29) | 1.0337* (1.90) |
| Inversion | | | | 0.7860*** (3.99) |
| Human capital | | | | 0.1276*** (5.14) |
| Demographic effect | | | | -0.1222 (-1.56) |
| R² | 0.61 | 0.65 | 0.71 | 0.65 |
| N | 485 | 485 | 485 | 248 |

^a Data panel estimation, random effects.

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

Source: Own elaboration

Finally, the general results obtained for the model of panel data can hide some specific behaviours which differ among the countries which make up the sample. Thus, table 5 shows the results of the relationship between the growth of the services sector and the overall productivity by countries. If the services sector is analysed as a whole, the US, the majority of the Scandinavian countries (Norway, Denmark and Sweden), Korea and Ireland are the countries where a more positive impact of the growth of the sector is observed as regards the overall productivity growth. These last two countries also have the peculiarity that they were observed to be the two economies in which there was the most substantial process of tertiarization during the period analysed, especially in market services. The others are those which have had less growth in the services sector as concerns the total labour. In the other extreme, countries such as Germany, Greece and the Netherlands show an impact which is distinctly below the general level. This is particularly notable in the case of the first two due to the strong process of tertiarization which both economies underwent during those years. As concerns the market services, again Sweden and Ireland are the countries whose greater impact has meant their overall productivity growth, while the opposite was observed in Germany, Spain, Portugal and, particularly, in Japan (the only country in the sample which has a negative coefficient, although this is not very significant). As concerns non-market services, where a process of stabilisation of their weight in the

advanced economies in recent years was observed, only Japan has a coefficient which is notably above the rest; while Luxembourg is in the opposite position.

Table 5. Relationship between services growth and productivity, 1980-2003

| COUNTRIES | Regression coefficient* | | | Weight growth (L) (absolute, in %) | | |
|---------------------|-------------------------|--------------------|---------------------|---------------------------------------|-----------------|---------------------|
| | SERVICES | Market services | Non market services | SERVICES | Market services | Non market services |
| Germany | 1.46 | 1.22 | 1.93 | 18.56 | 11.34 | 7.22 |
| Australia | 3.07 | 2.79 | 3.60 | 13.00 | 7.77 | 5.23 |
| Austria | 2.78 | 3.93 | 1.10 ¹ | 16.21 | 9.51 | 6.70 |
| Belgium | 2.97 | 3.99 | 1.08 | 13.81 | 7.18 | 6.63 |
| Canada | 3.18 | 4.06 | 0.42 ³ | 9.67 | 7.95 | 1.72 |
| Denmark | 4.07 | 4.88 | 2.93 | 11.71 | 5.30 | 6.41 |
| Spain | 2.38 | 1.18 | 3.27 | 17.25 | 7.64 | 9.60 |
| Finland | 3.72 | 4.71 | 3.22 | 15.51 | 5.78 | 9.73 |
| France | 2.22 | 2.76 | 1.72 | 17.01 | 8.66 | 8.34 |
| Greece | 1.36 | 2.39 | 0.02 ³ | 20.23 | 10.97 | 9.26 |
| Netherlands | 1.81 | 1.79 | 0.82 | 13.91 | 9.61 | 4.30 |
| Ireland | 5.18 | 5.49 | 4.32 | 17.49 | 11.49 | 6.00 |
| Italy | 1.97 | 1.55 | 2.52 | 18.38 | 11.64 | 6.74 |
| Japan | 3.25 | -2.08 ² | 11.90 | 13.16 | 7.99 | 5.17 |
| Korea | 4.01 | 2.42 | 0.14 | 28.95 | 20.75 | 8.20 |
| Luxembourg | 1.89 | 2.06 | -2.16 ³ | 14.01 | 13.52 | 0.49 |
| Norway | 4.06 | 4.52 | 3.91 | 12.85 | 4.33 | 8.52 |
| Portugal | 2.13 | 0.97 ³ | 3.34 | 18.82 | 8.82 | 10.00 |
| Sweden | 4.38 | 5.20 | 0.44 ³ | 10.72 | 7.44 | 3.28 |
| United Kingdom | 2.97 | 3.45 | 2.04 ² | 17.36 | 10.99 | 6.37 |
| US | 4.00 | 4.12 | 3.74 | 10.54 | 7.06 | 3.47 |
| Total sample | 2.91 | 3.23 | 2.40 | 15.67 | 9.32 | 6.35 |

* MLS coefficient. Statistically significant at 1%, except 1 (5%), 2 (10%) or 3 (not significant) marked cases.

Blue (red) marked those countries above (below) $[\mu \pm 2\sigma]$ interval, being μ the simple coefficient and σ the sample deviation.

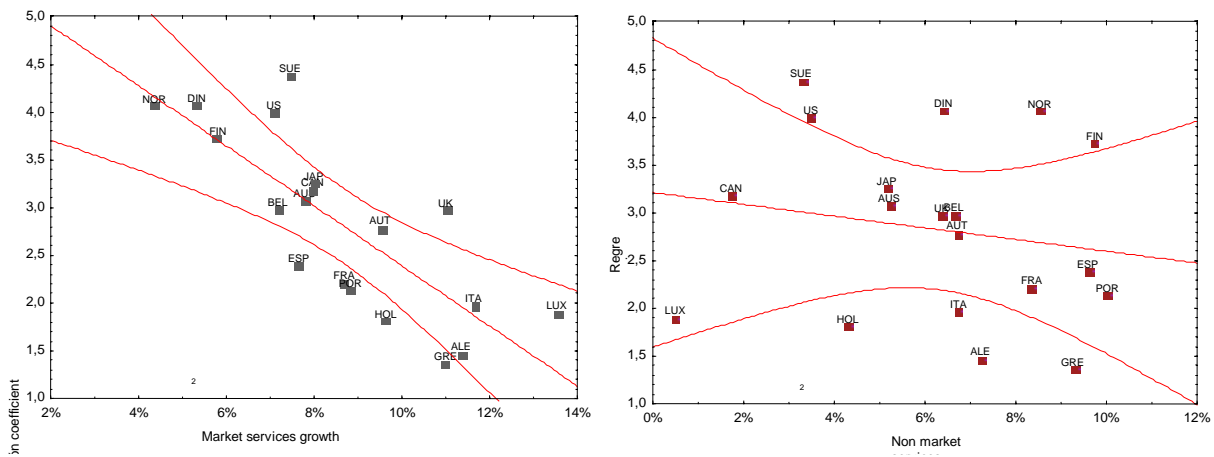
Source: Own elaboration

In order to conclude this section, we should draw attention to an interesting fact which again contrasts the differences between the service activities. Figure 3 shows the relation existing between absolute growth of the weight of each group of services (market and non-market) in terms of the total employment and the regression coefficient¹⁰ for the countries analysed. In the case of market services, the existing relation between both variables is clearly negative (-0.79, significant to 1%), while the pattern for the public, social and personal services is not so clear (-0.17, although not significant). This means that, in those countries where the growth of the role of market services has been greater, the positive impact of the increase in the weight of the

¹⁰ Linear regression which relates the growth of overall productivity (variable dependent) with the growth of the weight of the services as a whole (variable independent). This involves correlating the first column of table 4 with columns 5 and 6.

services in overall productivity has been distinctly lower. Instead of relating the growth of each sub-aggregate to the coefficient of all the services, if a similar exercise is carried out with the coefficient for each sub-group, this factor is stressed even more as the negative relation in the case of market services (-0.47, significant to 5%) is opposed to the positive relation of non-market services (0.45, significant to 5%). In economies where the market services have had greater growth, the impact of these on overall productivity has been lower; while in the economies where the non-market services have gained more weight in the labour structure, the impact of this amount on the overall productivity has been higher.

Figure 3. Services weight growth and regression coefficient, 1980-2003



Source: Own elaboration

6. Final remarks

The core thesis of this paper is that, although the conventional theories on the relationship between the services sector and productivity continue to have some validity at a highly aggregated level, they may clearly be questioned at disaggregated level by taking into account some recent contributions and the empirical evidence presented. Services are not unproductive, as such. Several branches show productivity growth rates comparable or greater than those registered by the manufacturing sector, on average, and those of its most dynamic sub-sectors. Of course, some services, especially those engaged in the final consumer demand and most of the non-market services, show very low productivity growth rates yet. However, the performance of others is very different, with high productivity growth

rates (part of transports; communications; some business services; financial intermediation), and even create employment at the same time.

The *shift-share* analysis made for the European and US economies confirms the findings of other similar papers. Structural changes generally had a positive effect on labour productivity during the period studied, although this may be relatively weak. Most productivity growth is due to the increase in productivity in each sector and in each activity, not to the reallocation of resources from some branches to others. Furthermore, the dynamic component is negative in most of the cases analysed, which bolsters the idea of the existence of the so-called structural frontier. In our analysis, the relation between productivity growth and employment is positive and significant, although it is not as strong as in previous decades.

The econometric analysis of the previous section shows the relationship between the productivity growth and the main structural change in recent decades: the expansion of the services sector. It can be seen that the relationship between these two factors is positive and statistically significant, although the impact of tertiarization on the evolution of productivity is limited. Moreover, the reaffirmation of two processes of economic interest has been observed. In the first place, a process of convergence and the reduction of differences in terms of productivity between the economies which started off with a better situation as regards productivity levels and those which started off from a more lagging position. Secondly, the fact that the countries which were initially more tertiarized are those which demonstrate more positive dynamics in their productivity growth. Among the explanatory variables in the model is the fact that human capital has a significantly positive effect on the productivity growth, and the investment in real capital.

Finally, as was pointed out above, the performance of service branches as regards productivity is very heterogeneous. This is reproduced in the analysis carried out, distinguishing market and non-market services, where it can be seen that the impact of the former is significantly greater than the average of the aggregated sector, while, in the case of the services which act outside the market, the result is the contrary. In addition, significant differences have been observed in the impact of tertiarization on aggregate productivity growth by countries, especially when the market services are analysed in comparison with non-market services.

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