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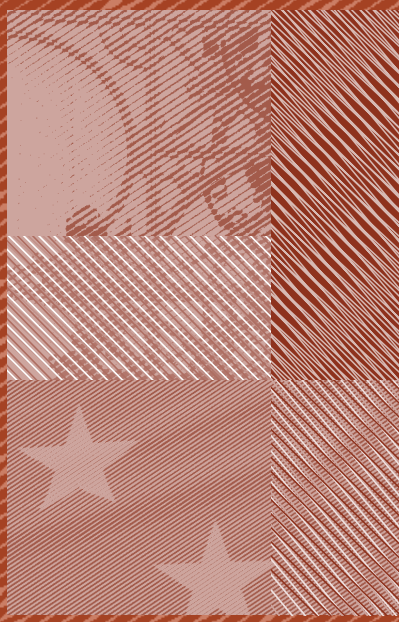

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BANCO DE ESPAÑA

(*) The opinion and analyses herein are the responsibility of the authors and, therefore, do not necessarily coincide with those of the Banco de España.

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Abstract

We have constructed a new database aimed at the study of the relation between firm demography and labour productivity, with a large number of Spanish firms from both industry and service sectors. This database allows us to analyze in detail the degree of dispersion and persistence of productivity levels, as well as the contribution of firm demography to productivity growth. This analysis has been done at different levels of sector aggregation. We have also studied explicitly the differential role of small and large firms.

JEL codes: D24, J24, L11, L25.

Keywords: Entry and exit, micro-data, labour productivity.

1 Introduction

The idea that the reallocation of resources across production units is important for economic performance is not new, dating at least from the ground-breaking work of Schumpeter [Schumpeter (1934)]. What is new is the availability of large longitudinal firm-level data sets which has prompted a growing literature aimed at analysing and measuring the connection between firm dynamics and productivity growth [see for example the literature reviews of Nelson (1981); Foster, Haltiwanger and Krizan (1998); Caves (1998); Haltiwanger (2000); Bartelsmann and Doms (2000), Ahn (2001)].

From a theoretical point of view, the connection between firm dynamics and productivity growth is supported by growth models emphasizing the role of creative destruction built upon the work of Schumpeter. For example, Aghion and Howitt (1992) propose a model of endogenous growth in which research and development activity results in innovations that grant monopoly rents to the innovator until the next innovation comes along. At that point the first innovation becomes obsolete. Hence aggregate productivity evolves with successive innovations via the reallocation of resources from less to more productive units. Alternative models of growth with creative destruction are vintage capital models [Caballero and Hammour (1994), Campbell (1997)]. In these models, new technology is embodied in new vintages of capital which are adopted by new establishments or by established firms after a process of internal reorganisation. Therefore growth occurs via entry and exit of establishments (external reallocation) as well as via internal reallocation.

The analysis of micro data at the firm level has uncovered an interesting set of empirical regularities. The first, and most startling, finding is the large scale of the reallocation process of inputs and outputs across production units, even within narrowly defined sectors. The exact magnitude of that contribution is quite sensitive to measurement issues [Foster et al. (1998)], the moment of the cycle[1] [Baily et al. (2001)] and the sector of analysis. Studies of firm dynamics in the manufacturing sector have found that established firms contribute the most to aggregate productivity growth (via productivity improvement within the firm and the reallocation of resources from less to more productive firms). The importance of net entry (entry and exit) for productivity growth, or in other words, the contribution of the fact that entrant (exiting) businesses are more (less) productive than incumbents, is estimated to be around 20%-30%, although it depends crucially on the time horizon over which the productivity growth is measured.[2] Given the numerous measurement difficulties encountered, it has not been until quite recently that micro data from the service sector has become available in some countries. Foster, Haltiwanger and Krizan (2002) for the US and Van der Wiel (1999) for the Netherlands are two of the very few service sector analyses so far. Interestingly, these preliminary studies have shown that net entry of firms plays a much more important role for productivity growth than in the manufacturing sector. Hence, we cannot assume that firm dynamics has the same impact on productivity growth

1. Baily et al. 2001 establish that the contribution of within-plant reallocation is more pro-cyclical than aggregate productivity growth reflecting the fact that the between-plant component (that is, the reallocation across existing establishments) is counter-cyclical because of the fall of the labour shares of less productive plants in recessions. On the other hand, the contribution of net entry to productivity growth increases during recessions because the exit of less productive units increases.

2. By construction, the share of activity accounted for by exits in the base year and entrants in the end year are increasing in the horizon over which the base and end year are measured. Moreover, the longer the horizon, the more time the new firms have to increase their productivity via learning and selection.

across all sectors of the economy. Furthermore, this finding has generated a good deal of policy interest since it has been conjectured that restrictive regulations in the service sector might be holding productivity back.

The second important stylized fact uncovered by the new wave of empirical studies using firm-level data is related to the existence of large differences —quite persistent along time— in the level and growth of productivity across production units. The fact that these productivity differences are observed even within narrowly defined economic sectors implies that they are due to firm-level factors [see for example Baily et al. (1992), Bartelsman and Doms (2000) and Haltiwanger (2000)].

Although these empirical regularities have been found mostly in studies using US data, there are studies in other countries [Oulton (1998) and Disney et al. (2000) for the UK and Barnes, Haskell and Malirata (2001) for a group of OECD countries[3]] that confirm roughly the facts. However, the analysis and understanding of productivity growth in Spain is still quite at its early stages, given the scarcity of good firm-level data. Earlier research on the issue has used the Industrial Survey of the National Statistics Institute (INE) to analyse the role of net entry in manufacturing productivity growth. Callejón and Segarra (1999), for example, find a significant effect of entry and exit of manufacturing firms on the Total Factor Productivity growth of several industries and regions, which they justify via vintage effects. Jaumandreu and Martín-Marcos (2004) use the same survey to analyse the contribution to manufacturing productivity growth of the increase in exports and the restructuring process that the Spanish industry undertook in the 80s, finding the displacement of inefficient firms to be crucial.

More recent studies use the "Encuesta sobre Estrategias Empresariales", a representative panel of manufacturing firms sponsored by the Ministry of Industry. In contrast with the earlier studies, covering a very dynamic economic period which could explain the important role played by net entry, the latter analyses find that established firms are the main contributor to productivity growth as in other developed countries. Fariñas and Ruano (2004), for example, use the ESEE for the period 1990-1997 to find that the distribution function of continuing firms dominates that of entering and exiting firms. They also test whether, according to Hopenhayn (1992) the productivity distribution function of surviving firms varies with the entry sunk costs of the industry. On the other hand, Huergo and Jaumandreu (2004) using the same survey between 1990 and 1998 find that new firms display higher productivity growth than average for some years. They attribute this finding to learning and vintage effects. Stucchi and Escribano (2007) use the same database to analyze whether there is convergence or not between the productivity of different firms, using concepts similar to those used in the literature about economic growth, and Stucchi (2007) relates this mobility to human capital and learning by doing. Finally, Jimeno and Sánchez (2006) calculate the contribution of internal and external reallocation to productivity growth in the 90s in the very recent monograph on productivity sponsored by the "Fundación Ramón Areces". They find very similar results as those found in other countries: established firms account in average for around 90% of total productivity growth whereas net entry contributes between something negative and 30%, the contribution being larger during expansions.

All of these studies concentrate in the manufacturing sector and refer, at the latest, to the 90s. On the other hand, none of the analyses has studied whether the contribution

3. Finland, France, Germany, Italy, Netherlands, Portugal, UK and USA.

of established firms and net entry varies with firm size, at least in some sectors. Given the fact that Spanish enterprises are in general smaller than in other developed countries[4], the study of the contribution of small (and very small) firms to aggregate productivity growth separately from that of the medium and large firms could be of some importance in Spain.

The main aim of this paper is to contribute to the understanding of the mechanisms behind the productivity growth in Spain by analysing firm-level micro data. We complement the findings of previous studies in several ways. Firstly, we study the period starting in the mid-90s, characterised by an important slowdown of the productivity growth in all Europe and, specially, in Spain. Secondly, we explore the connection between firm dynamics and productivity growth, as well as the dispersion and persistence of productivity, across all sectors of the economy, including some detailed analysis of the service industries, and of the construction sector. Thirdly, we study such connection also across firms of different sizes. Lastly, the availability of annual data on entry, exits and continuing firms permits an analysis of their contribution to the year-to-year productivity growth, as well as to productivity growth in longer periods, as it has been done traditionally in the literature.

We use a newly constructed database combining information from the Central Firm Registry and the Firm Central Directory (DIRCE) run by the National Statistics Institute. We have annual firm-level information on value added, employment, sector, legal form, some entries of the balance sheet as well as the moment of entry and exit (if in the period) for a set of 90,000-200,000 societies (Limited Liability Societies and Corporations) active each year between 1996 and 2003 across all sectors of the business economy, excluding the farming and financial sectors.

The next section of the paper describes in detail the data. Section 3 analyses the productivity dispersion within narrowly defined sectors. Furthermore, using transition matrixes that allow studying the productivity progression of firms along time we are able to study the persistence of such productivity dispersion. Section 4 studies the contribution of firm dynamics to productivity growth using an accounting decomposition methodology a la Foster et al. (1998). We perform the analysis for different periods, sectors and firm sizes. Finally, section 5 concludes.

4. See Núñez (2004).

2 The database

The Bank of Spain Firm Demography Database (BSFDD) contains information on sector of activity (at 4 digits), legal form, employment, labour productivity and some entries of the balance sheet at firm-level for about 90,000-200,000 Spanish Limited Liability Societies and Corporations with one or more employees, operating in all sectors of the business economy (but the agricultural and financial sectors) each year between 1996 and 2003. Data come from two sources: the "Directorio Central de Empresas" (DIRCE), managed by the National Institute of Statistics (INE), and the "Central de Balances del Banco de España" (CB), which processes data from the firm registries. DIRCE covers the whole population of Spanish firms (including self-employed) since 1994. It works mainly with tax and social security records and provides annual information on the total number of active firms, entries and exits, by sector, region and employment (but has no information on value added, production or sales). The CB receives sometime between August and December every year the financial statements deposited the previous year in the Firm Registries[5] by all societies (not self-employed) that have been active any moment during the previous year.

All societies are obliged by law since 1990 to deposit every year their financial accounts in the regional firm registries. Unfortunately, the fine for not doing so is quite low. Furthermore, the cost of processing electronically the statements is quite high which means that only the readable and quality-printed financial statements are processed electronically every year by the "Centro de Procesos Estadísticos", dependent on the regional firm registries". Both circumstances imply that "only" the financial statements of about 60% of all active firms every year are sent to the "Central de Balances del Banco de España" (CB). The CB does not incorporate about 10% of the firms received from the firm registries to its database because either they belong to the financial sector, not covered by the CB, or because the firms are already collaborating on voluntary grounds with the CB. Firms that are received and processed by the CB pass several logical and arithmetic filters to detect statements with severe incoherencies in their balance sheets and employment figures (total assets should be equal to total liabilities, for example, and the employment figure provided should be in concordance with the reported labour expenses). Surprisingly, only about half of the financial statements received pass those, truly not too demanding, tests. The next table shows the number of firms dropped at each stage of the process. We end up with about one-third of all active societies each year.

5. All regional firm registries send the statements to a central unit created in 1996 that processes electronically the information (the "Centro de Procesos Estadísticos" or CPE). It is the CPE who at the end of each year sends the electronic information to the CB.

	Limited liability and corporations active in the population	Statements received by the CB from the firm registries	Statements processed by the CB[1]	Statements with coherent accounts	Statements with coherent accounts and employment figures
1996		311,606	279,352	173,279	109,017
1997		389,403	350,964	223,123	145,107
1998		446,767	401,450	238,054	154,934
1999	684,810	433,500	352,834	211,604	141,592
2000	734,679	427,679	361,458	231,651	166,953
2001	787,227	445,871	367,290	245,620	192,578
2002	832,884	609,278	489,496	319,958	295,043
2003	886,787	658,813	537,653	374,874	308,997

[1] Excluding firms operating in the financial sector and firms already collaborating with the CB

Amongst the firms that do present coherent financial statements at least one year, we find that many "disappear" from the registry to appear year/s later. We checked whether firms with no data in one specific year in their history were systematically different from those providing information that year, given both groups of firms had the same age and belonged to the same sector, by comparing their average employment and productivity when the information was provided. We found no systematic differences. We also looked for differences between firms whose financial accounts were never, during the period of analysis, processed by the firm registries, and those that did, at least one year, in terms of sector and employment at constitution year (information provided by DIRCE). We found that the proportion of firms in the construction and hotels and restaurants sectors belonging to the first group —those that never deposited their accounts or were not processed by the firms registries— was clearly larger than the proportion of firms in those two sectors that collaborated with the firm registries. The proportion of firms with no employees at birth was also higher within the first group.

Given the fact that the firm registry information is fairly incomplete due to the numerous gaps found in the history of some firms, we were unable to deduct the date of entry and exit of the firms solely from the presence or absence of data in the registry, as it is done in other countries. For that reason we had to resort to a second source of data. The Bank of Spain made a special request to "Directorio Central de Empresas" (DIRCE), run by the National Statistics Institute to get, under strict confidentiality clauses, the fiscal identification numbers, employment, sector and region of all Limited Liability Societies and Corporations that entered or exited the market between 1996 and 2003. DIRCE is,

therefore, the main source of data to establish the demographic pattern of the firms in the sample, but, unfortunately, it cannot be used to compute firm-level productivity given the absence of information on value added, sales or production. For that reason we crossed the demographic information provided by DIRCE with the economic variables provided by the CB using the unique fiscal identification number of the societies. After crossing the two data sets we had access to firm-specific information on firm duration, sector (4 digits), employment, legal form, province of headquarters, and financial accounts.

We performed a very conservative treatment of missing data: for quantitative variables we interpolated any missing datum between two existing data (i.e. we interpolated the number for t only when we had information of the value of the variable for t–1 and t+1). In the case of categorical variables (like the province) we assumed the value in t was the same as the value in t–1 and t+1 only when those two values were the same.

To check whether the date of entry and exit provided by DIRCE were consistent with the date of first, or last, appearance of data in the firm registries was not easy due to the numerous gaps in the data, even after interpolation. What we could do was to make sure that prior to the date of entry provided by DIRCE there was no information in the firm registry for the firm and, similarly, that after the date of exit provided by DIRCE there was no sign of the firm in the CB. Entries provided by both sources were consistent for 97.3% of the cases. About half of the discrepancies were of one year, that is, there was a financial statement deposited in the firm registry one year prior the official date of entry provided by DIRCE for about 1.5% of the firms. The match of dates in the case of exit was also very large: in 96.2% of the cases they were consistent. However, in this case, the number of years of discrepancy (financial statement presented after the official year of exit provided by DIRCE) was larger: half of the cases were between 1 and 4 years and the other half between 5 and 9. We decided to drop all firms whose date of entry and exit were not consistent across both data sources.

To calculate labour productivity at the firm level we took the value added at factor cost calculated by the CB from the information provided by the firms in their financial statements. More concretely, value added is computed as the difference between the value of production —which roughly includes sales, inventory changes and subsidies—, and intermediary consumption —including purchases, changes in input stocks, insurance and renting expenses and taxes. The nominal value added was deflated using sector value added deflators at 2-digits detailed level from the National Accounts (that is, all firms operating in the same 2-digit sector are applied the same value added deflator). Lastly, firm level labour productivity was computed as the ratio of real value added at factor cost to total employment. Due to the fact that that for some firms either value added, or/and employment or/and sector were missing during the same year, we could not calculate their productivity level that year and had to drop them. Moreover, some of the firms reported very extreme levels and/or growth rates of labour productivity, indicating possible measurement errors, so we dropped the 5% extreme cases (top and bottom of the distribution) in each 2-digit sector. Finally, given that our database is not exhaustive for all the reasons exposed above, we cannot expect that labour productivity calculated with our data is exactly equal to the equivalent figure from national accounts. For this reason, we have

normalized each firm labour productivity in such a way that the aggregation from our database and national accounts are coherent each year and each sector analyzed.[6]

In summary, at the end of the process of dataset construction we ended up each year with about one-quarter of the total number of reported active firms and could not assume that what was left was representative of the population. For that reason we computed sampling weights for each firm in the data set according to its 2-digit sector, employment and status (continuing firm, entry or exit), using as the population benchmark the aggregate data from DIRCE.

6. Concretely, this normalization consists on multiplying the productivity of each firm in a given sector and year by the ratio (productivity from National Accounts)/(average productivity in the sample in the correspondent sector and year). It does not affect the comparison of the contribution of different types of firms to productivity growth (entering, exiting, big, small,…) because all productivities of the firms in the comparison are multiplied by the same factor.

3 Heterogeneity and persistence of productivity in Spain

One of the most striking stylized fact uncovered by the recent empirical work performed with firm-level micro data sets is the dispersion of productivity levels across firms belonging to the same, narrowly defined, sector of activity. For example, Haltiwanger (2000) reports for plants within the US manufacturing industries an average ratio of the TFP level for the plant at the 75th percentile to the plant at the 5th percentile of 2.4 (average across industries). The equivalent ratio for labour productivity is 3.5. Bartelsman and Doms (2000) report a ratio using the Longitudinal Research Database covering US manufacturing plants of the average TFP for plants in the 9th decile of the productivity distribution to the average in the 2nd decile of about 2 in 1972 and 2.75 in 1988. Dunne et al. (2002) also report a large and slightly increasing dispersion of the labour productivity levels within the US manufacturing industries: the 90-10 differential is computed to be 1.71 in 1977 and 1.88 in 1992. The large dispersion is not exclusive of the manufacturing sector or of the USA economy. Foster et al. (2002) analyse the US retail sector and find the standard deviation and interquantile range of the labour productivity distribution to be 0.54 and 0.57 respectively. On the other hand, Disney et al. (2000) study the UK manufacturing sector and find that establishments at the top decile are 150% more productive than those at the first decile.

The BSFDD information shows a large dispersion of the labour productivity levels also in Spain. Figure 1 displays the evolution of two dispersion measures between 1996 and 2003 for the whole business economy (excluding the agricultural and financial sectors) and three main sectors. For business economy, the interquartile range, standardized by the absolute value of the first quartile[7], remained close to 1.2 along this period (left panel of figure 1). It means that the productivity of any firm in the top quartile of the distribution is more than twice the productivity of any firm amongst the 25% of the least productive firms. Dispersion is slightly higher in services, with an interquartile range fluctuating around 1.3 along the period, and lower in manufacturing and construction (around 0.9 and 0.8, respectively). The standardized interdecile range (right panel) provides the same relative order, but with a larger (in relative terms) and growing dispersion in the services sector, which increased from 4.0 in 1996 to 5.8 in 2003.

This large dispersion remains with narrower defined sectors. Figure 2 reports both dispersion measures as averages over the period 1996-2003 for 24 sectors of activity (from the CB classification into *main sectors).* The average standardized interquartile range amounted about one in the majority of sectors[8] and the average standardized interdecile range oscillated between 1.9 and 3.8 for that majority of sectors, above the aforementioned calculations for the USA and the UK economies.

Macroeconomic or sector effects cannot explain this dispersion, because they affect all firms in the same sector and period in the same way. Consequently, a number of studies[9]

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7. The interquartile range is defined as the difference between the productivity of the firm which is more productive than 75% of the firms (third quartile) and the productivity of the firm which is more productive than 25% of the firms (first quartile). Therefore it provides an absolute measure of dispersion, not affected by the very extreme values of the distribution. Being rescaled by the absolute value of the first quartile, a relative dispersion measure is obtained.

8. The exceptions are the sectors "Mining and Quarrying" (sectors 10 to 14 from NACE-93), "Coke, refined petroleum and nuclear fuel" (sector 23), "Electricity, gas and water supply" (sectors 40 and 41) and "Real estate, renting and business activities" (sectors 70 to 74), with an average standardized interquartile range of 2, 4, 7 and 2, respectively.

9. See Baily et al. (1992), Bartelsman and Doms (2000), and Haltiwanger (2000) for excellent surveys

have tried to explain the firm-level factors behind this empirical finding. What follows is a non-exhaustive attempt to list those idiosyncratic factors found in the literature to explain, at least partially, the large dispersion of productivity levels across firms in the same industry.

First of all, there is **uncertainty** around the development, distribution and regulation of new products and production techniques. This uncertainty leads to experimentation which in turn generates different outcomes across firms; which are those outcomes depends crucially on the **managerial ability** of the entrepreneurs. In the model by Jovanovic (1982) there is a given underlying distribution of managerial abilities. Entrepreneurs do not know their particular ability so they start small and learn about their ability over time through the realisation of profits. Based on this observation, managers decide to expand, contract or exit. In Ericson and Pakes (1995) the managerial ability of entrepreneurs is not given but rather it can be improved via the firm's investment.

The **ability of the workforce** could also be a factor behind firm-level productivity differences. Doms, Dunne and Troske (1997), for example, find that firms with more human capital are more likely to adopt the latest technologies and, therefore, to be more productive. Hopenhayn (1992), on the other hand, constructs a theoretical model where firms have to incur in a sunk cost in order to enter the market, which depends on the **firm-specific location and shocks** such as differences in energy and other factor costs. Sunk costs are in this model an important source of productivity heterogeneity because they influence the distribution of productivity levels across incumbent firms as well as the productivity threshold below which firms decide endogenously to exit the market. Bernard and Jensen (1995) find strong links between the **exporting activity** of firms and their productivity. The relation might be explained by self-selection, that is, only the more productive firms decide to go outside, or by a learning argument —firms that export are able to learn about new technologies and processes outside which explains their larger productivity. A firm that exports could also enjoy economies of scale. The fact that different firms enjoy differently from the possibility of exploiting **economies of scale, utilise the factors differently or install different vintages of capital** could also explain the observed productivity differences. Lastly, other factors such as the firm's **ownership structure** could be important. Lichtenberg (1992) has explored the link between mergers and productivity and has found that establishments enjoy several years of higher productivity growth after a merger due, mainly, to a reduction in corporate overhead. Finally, there may be different efficient production processes, even for a given sector, with different capital and labour intensities, which would imply different levels of labour productivity.

Most studies also report a large degree of persistence of the productivity levels: That is, a firm in a given quintile one year is very likely to stay in the same quintile five years later. The instrument to study such persistence is the transition matrix. Table 1 reports the transition matrix for the whole Spanish business economy between 1997 and 2002. It shows information about three different statistical distributions of firms. First of all, the distributions of surviving firms according to labour productivity quintiles[10] in 2002, conditional on the quintile they belonged to in 1997 are presented in the inner part of the table. The high values in the main diagonal show that firms in a particular quintile in 1997 tended to remain in that same quintile five years later. The persistence is especially strong in the top quintile (the most productive), with 54.8% of the firms which remained alive going on that quintile. About 25% of the firms which remained operative moved up into the next

10. All quintiles are calculated at a two digit aggregation level.

productivity quintile, while the percentage of transitions to higher quintiles reduces substantially. In the other side, the percentages reflecting downward movements have the same pattern, but they are slightly smaller.

Secondly, the percentage of firms that left the market between 1998 and 2002, by productivity quintiles in 1997, is reported in the last column of Table 1. The higher the firm productivity in 1997, the higher the firm survival rate in 2002. For instance, 70.2% of firms belonging to the bottom quintile (the less productive) in 1997 disappeared between 1998 and 2002. This percentage drops to 29.3% in the case of the firms included in the top quintile in 1997.

Finally, the last row of Table 1 shows the percentage of firms being operative in 2002 that were created between 1997 and 2001, by productivity quintiles in 2002. Young firms tend to concentrate in the least productive quintiles. However, this evidence is less sharp than in the exits' case.

Concerning differences between sectors, Table 2 displays the transition matrixes for the three main sectors. Taking services as a reference, all quintiles in manufacturing and the least productive quintile in construction show a higher degree of persistence of productivity levels, reaching a persistence of 60% in the top quintile in manufacturing. On the other hand, even though both exits and, especially, entries concentrate on the least productive quintiles, like in the aggregate, all percentages are lower in the manufacturing sector. The largest difference with respect to services appears in the creation of firms in the top quintile, which is more than 20 percentage points lower in manufacturing. Regarding the comparison of construction and services, all entry and exit percentages are very similar, maybe with the exception of the bottom quintile, in which the two percentages are slightly lower in construction.

According to the firm size, two additional transition matrixes (for firms with 20 or less employees and with more than 20 employees) are reported in Table 3. The degree of productivity persistence is substantially higher in large firms, reaching 74% in the top quintile, versus 50.2% in the small firms. Concerning moving firms, it appears that movements towards more productive quintiles are more common among large firms.

All these results point to a situation in which movements between productivity quintiles are less frequent in manufacturing, suggesting that the learning process in this sector could be slower. Also, upward movements are more frequent among large firms, which suggest a correlation between firm size and productivity growth. There is more evidence on this relationship later on.

The previous results offer a static description of persistence in productivity levels. Concerning dynamics, figure 3 represents, for the business economy, by main sectors and by sizes, the evolution of the percentage of firms remaining in the same productivity quintile than in the previous year, by quintile. In general, this evolution is slightly hump-shaped, except for some quintiles in manufacturing and large firms. The percentages peak in 2000 or 2001 and finish in 2003 somewhat above than in 1997, except for the top quintile. The aforementioned differences between sectors and sizes are present in all years.

4 Labour productivity growth decompositions

The microeconomic characteristics of firms could have very important effects in the process of productivity growth. From a firm demographic point of view, it is interesting to assess whether productivity growth in one sector is driven by growth within established firms, or is driven by new, more productive firms, replacing old ones. This assessment could be different for different sectors, depending on factors like sunk costs, the extent to which technology is embodied in capital, the level of competence, etc. In addition, the Spanish economy is characterized by a reduced firm size in all sectors.[11] Consequently, it is very important to assess also the differential role played by small and large firms in the process of productivity growth.

Established firms could contribute to aggregate labour productivity growth either having a high productivity *growth*, or reallocating labour to more productive firms. Concerning entries, they will have a positive (negative) contribution if new firms have a higher (lower) productivity *level* than the average. Finally, exiting firms will contribute positively (negatively) if their productivity *level* is lower (higher) than the average.

With these motivations in mind, we have conducted a productivity growth decomposition exercise, following the methodology described in Foster et al. (1998), and extended it to identify the specific role of small and large firms. This methodology could be subdivided into two similar, but different, decompositions. The first one (which is going to be referred as method 1) is the following:

$$\Delta p_{it} = \sum_{e \in C} s_{et-1} \Delta p_{et} + \sum_{e \in C} \left(p_{et-1} - p_{it-1} \right) \Delta s_{et} + \sum_{e \in C} \Delta p_{et} \Delta s_{et} + \\ + \sum_{e \in N} s_{et} \left(p_{et} - p_{it-1} \right) + \sum_{e \in X} s_{et-1} \left(p_{et-1} - p_{it-1} \right)$$

Where p_{it} denotes productivity in sector i and period t, p_{et} denotes productivity of firm e in period t, s_{et} denotes the employment weight of firm e in its sector, C denotes the set of continuing firms, N denotes the set of entering firms and X denotes the set of exiting firms.

The second one (method 2) is:

$$\Delta p_{it} = \sum_{e \in C} \overline{s}_e \Delta p_{et} + \sum_{e \in C} \left(\overline{p}_e - \overline{p}_i \right) \Delta s_{et} + \\ + \sum_{e \in N} s_{et} \left(p_{et} - \overline{p}_i \right) + \sum_{e \in X} s_{et-1} \left(p_{et-1} - \overline{p}_i \right)$$

11. See Nuñez (2004).

The difference between both methods is that some variables are calculated as an average over initial and ending period. An advantage of method 1 is that it includes a covariance term between weight changes and productivity growth that cannot be identified in method 2, because it is split among other components. On the other hand, method 2 is less sensitive to measurement errors.[12] Instead of choosing one of them, we are going to provide both decompositions in each case.

As stated above, it is very important for the Spanish economy to analyze separately the contribution of small and large firms. For this purpose, we have extended the previous methodology in the following way:

— Method 1:

$$\Delta p_{it} = \sum_{e\in C} s_{et-1}\Delta p_{et} z_e + \sum_{e\in C} s_{et-1}\Delta p_{et}(1-z_e) + \sum_{e\in C}(p_{et-1} - p_{it-1})\Delta s_{et} + \sum_{e\in C}\Delta p_{et}\Delta s_{et} +$$
$$+ \sum_{e\in N} s_{et}(p_{et} - p_{it-1})z_e + \sum_{e\in N} s_{et}(p_{et} - p_{it-1})(1-z_e) +$$
$$+ \sum_{e\in X} s_{et-1}(p_{et-1} - p_{it-1})z_e + \sum_{e\in X} s_{et-1}(p_{et-1} - p_{it-1})(1-z_e)$$

— Method 2:

$$\Delta p_{it} = \sum_{e\in C} \bar{s}_e\Delta p_{et} z_e + \sum_{e\in C} \bar{s}_e\Delta p_{et}(1-z_e) + \sum_{e\in C}(\bar{p}_e - \bar{p}_i)\Delta s_{et} +$$
$$+ \sum_{e\in N} s_{et}(p_{et} - \bar{p}_i)z_e + \sum_{e\in N} s_{et}(p_{et} - \bar{p}_i)(1-z_e) +$$
$$+ \sum_{e\in X} s_{et-1}(p_{et-1} - \bar{p}_i)z_e + \sum_{e\in X} s_{et-1}(p_{et-1} - \bar{p}_i)(1-z_e)$$

Where z_e is a variable that takes the value 0 if the firm has more than 20 employees and 1 otherwise.[13]

Tables 4 and 5 present the decomposition of labour productivity growth for the business economy and for the three main sectors, under both methods. The first thing to notice is that average growth between 1996 and 2003 was negative for the business economy, and was positive only for the manufacturing sector. This is due to the growth pattern in Spain in these years, characterized by strong increments in employment. When looking at the decomposition itself, what turns out is that this negative growth is a combination of a positive contribution of established firms, compensated by a negative

12. Suppose that for some observation we have a negative measurement error in labour. Then the weight of this observation is artificially decreasing, whereas labour productivity is artificially increasing, because the denominator is decreasing. This produces an artificial negative correlation between changes in weights and labour productivity growth. Consequently, the covariance term is going to be affected by these measurement errors, whereas in method two this effect is mitigated because weights are calculated with both initial and final employment. An implication is that a small covariance term in method 1 suggests small measurement errors.

13. The input for this variable is the average employment between initial and end year for continuing firms, and employment in final and initial year, respectively, for entries and exits.

contribution of entries, and also a negative contribution of exits. The first two are coherent with the interpretation given in Jovanovic (1982) and in Ericson and Pakes (1995), with firms entering the market with a low productive level and, as time goes by, learning or improving their productivity and hence contributing positively once established.[14] However, the third one is very difficult to interpret form a theoretical point of view. It should be expected that exiting firms are the least productive ones, but the negative contribution found means the contrary. There are two possible explanations for this fact. First, merges and spin-offs are not detected in our database. This could be important if, for example, productive firms are being absorbed. A second explanation is that firms that know that with a high probability they are going to exit could have fewer incentives to report their financial statements, which could produce a bias in our database towards more productive exiting firms. Both arguments should be kept in mind when interpreting the results concerning exits.[15]

Tables 4 and 5 also show that there are sector differences beyond overall growth. First of all, the strong contribution of established firms vanishes when looking only at construction. It is much smaller in it than in the other two main sectors, and it is even negative in method 2. Concerning entry contribution, the special sector is manufacturing, where the important negative contribution found in the aggregate becomes almost zero under both methods. Exit contribution is very heterogeneous, being strongly negative in manufacturing, slightly negative in services, and positive in construction. Finally, the reallocation component in method 2 is negative, albeit small, for all sectors, suggesting that there is a reallocation of resources towards more labour intensive activities, operating at an aggregation level lower than three main sectors. However, this component becomes positive for all sectors but manufacturing, when using method 1 while, at the same time, the new covariance term is negative. This implies that we cannot assess whether the negative reallocation contribution found in method 2 is due to the previous argument or to measurement errors. In any case, the covariance term is not very large, which suggest that, if there are measurement errors, they are not very influential.

There are also important differences between the behaviour of small and large firms. They can be summarized in two. First, there are large differences between small and large firms in the contribution of established firms. Both in the aggregate and in the three main sectors, the contribution of large established firms is much more important, being this difference larger in manufacturing and smaller in construction.[16] Second, both for entries and exits, the productivity level of large firms is higher. This means that most of the negative contribution of entries could be attributed to small firms. Indeed, large manufacturing entrants have a positive contribution that is compensating for the negative contribution of smaller firms. Conversely, the negative contribution of exits in manufacturing and services is due exclusively to the exit of large productive firms. The role of merging firms can probably explain partially this result, as explained before.

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14. It should be noted that data in tables 4 and 5 are averages across annual decompositions. This contrasts to other decompositions in the literature, which are calculated over a longer time span and, consequently, some new firms had time to increase their productivity. In other words, if the time span used in the decomposition is longer, then the contribution of entry is mixing the pure effect of entry with some growth of established firms.

15. There are other explanations that, however, are ruled out by our methodology. One example is a continuation in sales but not in production in an exiting firm. This situation will imply high productivity among exiting firms under productivity measures based on sales, whereas value added based measures are not going to be affected by this fact. Also, a composition effect of exiting firms in sectors with different productivity, if it exists, it should operate at an aggregation level lower than the nine sectors reported in table 7.

16. In our methodology, a large contribution of large firms could be due to a better growth pattern of these firms, but also to a larger share of big firms. We guess that the first effect is more important, given the fact that Spanish firms tend to be small.

All these differences between sectors and sizes allow us to extract some implications. The first one is that the learning process of established firms appears to be more important in manufacturing and services, because this component is much smaller in construction, where the closure of unproductive firms appears to be more important. Second, the contribution of small established firms is reduced in all sectors, when compared to the outcome of large ones. The combination of this fact, the distribution of Spanish firms, concentrated in small ones, and the comparison reported in footnote 17, suggests that the higher growth rate of small firms and their amount cannot overcome the high influence of big firms on aggregate productivity caused by their size. Finally, initial investments appear to be more important in manufacturing, where entrants have a productivity level similar to incumbents.

We have repeated the decomposition exercise for a lower aggregation level, to see if the analysis of the three main sectors is hiding important differences between their subsectors. The results under both methods are presented in tables 6 and 7. Without entering into the details, four facts in these tables deserve special mention. First, the positive contribution of established firms found in services is mainly due to the performance of two subsectors: transport and telecommunications. In the remaining service subsectors, the contribution of established firms is much smaller. Second, the different performance of small and large firms in services appears to be explained also by the transport and telecommunications sectors. In the remaining service subsectors, the contributions of small and large firms are very similar. Third, the reallocation component is now positive for almost all subsectors, which suggests that the reallocation of resources between sectors is not operating at lower levels of aggregation. Fourth, the positive contribution of large entrant firms found in manufacturing appears to be caused exclusively by large firms in utilities, being slightly negative almost all the remaining entry contributions in the sector. Given that the number of observations in this subsector is reduced, this result should be interpreted with caution.

Figures 4 and 5 present the time pattern of productivity decompositions for the aggregate and for the three main sectors. It is very difficult to extract conclusions from these graphs, because productivity growth rates in this period remained very stable, except for construction. In this sector, there was a recovery of productivity growth, from negative values in the late nineties, to almost zero in the last years considered. According tothe figures, entry and exit contribution remained more or less stable over the period, whereas within firms growth steadily increased. Therefore, it seems that the recovery in construction was driven by the performance of established firms.

5 Conclusions

The relationship between productivity growth and firm dynamics in Spain and in the services sector has been studied only to a limited extent. Also, there is a lack of papers analyzing the differential contribution of small and large firms in the process of productivity growth. To fill these three gaps, we have constructed a new database, with sufficient information to develop an analysis for the problem at hand.

We have studied the degree of productive dispersion and persistence. The main result concerning the former is that there is a large, somewhat increasing, degree of productivity dispersion even within narrowly defined sectors. There are some sectors in which this dispersion is especially high. Regarding persistence, we found that most firms remain in the same productivity quintile from year to year, being this persistence higher in manufacturing and in large firms.

We have also developed a productivity growth decomposition exercise, with the following results. The main engine of productivity growth in most sectors is the productivity improvement of established firms. In some sectors, like manufacturing, transport and telecommunications, most of this contribution can be attributed to large firms. Concerning entry and exit, both contributions are in general negative, and large entering and exiting firms have higher productivity levels than smaller ones. Finally, the analysis of the reallocation term suggests the possibility of a reallocation of resources towards more labour intensive activities, but at an aggregation level not lower than the nine wide sectors considered.

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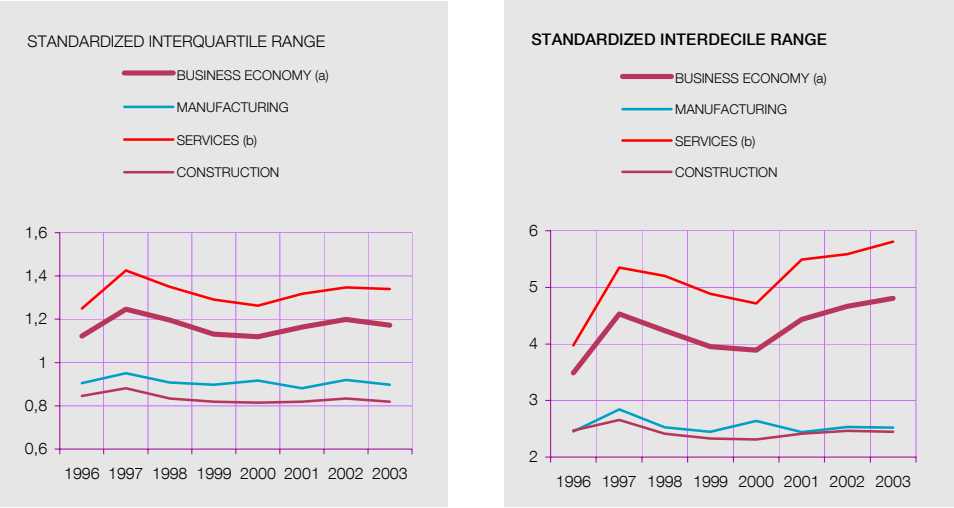
LABOR PRODUCTIVITY DISPERSION ACROSS FIRMS

FIGURE 1



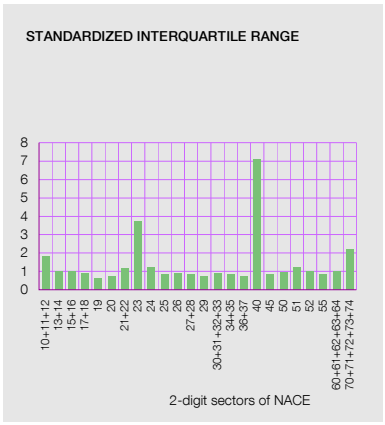
Sources: Bank of Spain Firm Demography Database .

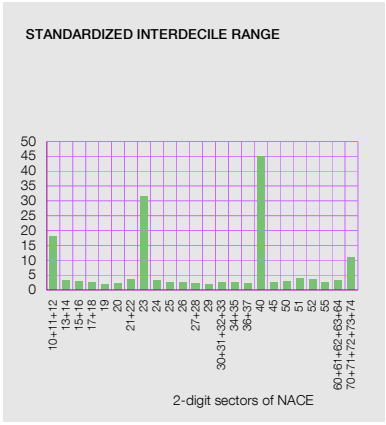
a. Excludes agriculture and financial intermediation and non market services.
b. Excludes financial intermediation and non market services.

LABOR PRODUCTIVITY DISPERSION ACROSS FIRMS

FIGURE 2

1996-2003 Average





Sources: Bank of Spain Firm Demography Database .

PERSISTENCE OF THE PRODUCTIVITY LEVELS: BUSINESS ECONOMY (a)
1997-2002 transition matrix (b)

TABLE 1

%

		PRODUCTIVITY QUINTILES IN 2002					
		1	2	3	4	5	Exits (c)
PRODUCTIVITY QUINTILES IN 1997	1	36,5	27,6	15,7	12,3	7,8	70,2
	2	18,6	33,1	25,9	14,9	7,5	45,6
	3	9,2	22,3	31,5	24,6	12,4	38,7
	4	4,8	11,8	22,2	35,3	25,9	35,4
	5	5,0	6,8	10,7	22,6	54,8	29,3
	Entries (d)	80,1	68,7	64,1	60,7	58,5	

Sources: Bank of Spain Firm Demography Database .

a. Excludes agriculture and financial intermediation and non market services.
b. Percentage distribution according productivity quintiles in 2002 of the number of firms in a particular quintile in 1997, conditional on the firm remained alive in 2002.
c. Percentage of firms in a particular quintile in 1997, disappeared between 1998 and 2002.
d. Percentage of firms in a particular quintile in 2002, created between 1997 and 2001.

PERSISTENCE OF THE PRODUCTIVITY LEVELS BY SECTOR
1997-2002 transition matrix (a)

TABLE 2

MANUFACTURING

%		PRODUCTIVITY QUINTILES IN 2002					
		1	2	3	4	5	Exits (b)
PRODUCTIVITY QUINTILES IN 1997	1	39,9	28,6	14,7	11,2	5,6	60,0
	2	19,1	34,9	26,7	13,6	5,7	35,6
	3	8,6	23,6	33,4	23,9	10,5	28,5
	4	4,9	9,5	23,1	37,0	25,6	25,1
	5	1,8	4,2	8,0	25,2	60,8	22,7
	Entries (c)	70,2	53,2	46,5	41,3	39,7	

SERVICES (d)

%		PRODUCTIVITY QUINTILES IN 2002					
		1	2	3	4	5	Exits (b)
PRODUCTIVITY QUINTILES IN 1997	1	34,3	27,6	16,2	13,3	8,6	73,7
	2	17,6	33,0	26,5	15,3	7,6	47,9
	3	9,2	21,9	31,2	24,9	12,8	41,3
	4	4,6	12,7	21,5	35,3	25,9	37,1
	5	6,0	6,9	11,8	22,0	53,2	30,1
	Entries (c)	82,5	71,5	66,9	63,7	61,8	

CONSTRUCTION

%		PRODUCTIVITY QUINTILES IN 2002					
		1	2	3	4	5	Exits (b)
PRODUCTIVITY QUINTILES IN 1997	1	40,5	26,6	15,7	11,0	6,3	67,7
	2	21,9	31,1	22,4	15,1	9,6	47,6
	3	9,4	22,6	30,5	24,2	13,2	39,6
	4	5,6	11,5	23,5	33,1	26,3	39,2
	5	4,9	9,5	9,5	21,6	54,4	33,4
	Entries (c)	78,6	69,8	67,5	64,7	60,9	

Sources: Bank of Spain Firm Demography Database .

a. Percentage distribution according productivity quintiles in 2002 of the number of firms in a particular quintile in 1997, conditional on the firm remained alive in 2002.
b. Percentage of firms in a particular quintile in 1997, disappeared between 1998 and 2002.
c. Percentage of firms in a particular quintile in 2002, created between 1997 and 2001.
d. Excludes financial intermediation and non market services.

PERSISTENCE OF THE PRODUCTIVITY LEVELS BY FIRM SIZE
1997-2002 transition matrix for no financial firms of business economy (a)

TABLE 3

FIRMS WITH 20 EMPLOYEES OR LESS

%		PRODUCTIVITY QUINTILES IN 2002				
		1	2	3	4	5
PRODUCTIVITY QUINTILES IN 1997	1	36,3	27,4	15,9	12,5	8,0
	2	19,0	32,6	25,7	15,0	7,7
	3	9,8	22,8	30,6	24,0	12,7
	4	5,4	13,1	22,8	33,4	25,4
	5	6,2	8,1	12,4	23,2	50,2

FIRMS WITH MORE THAN 20 EMPLOYEES

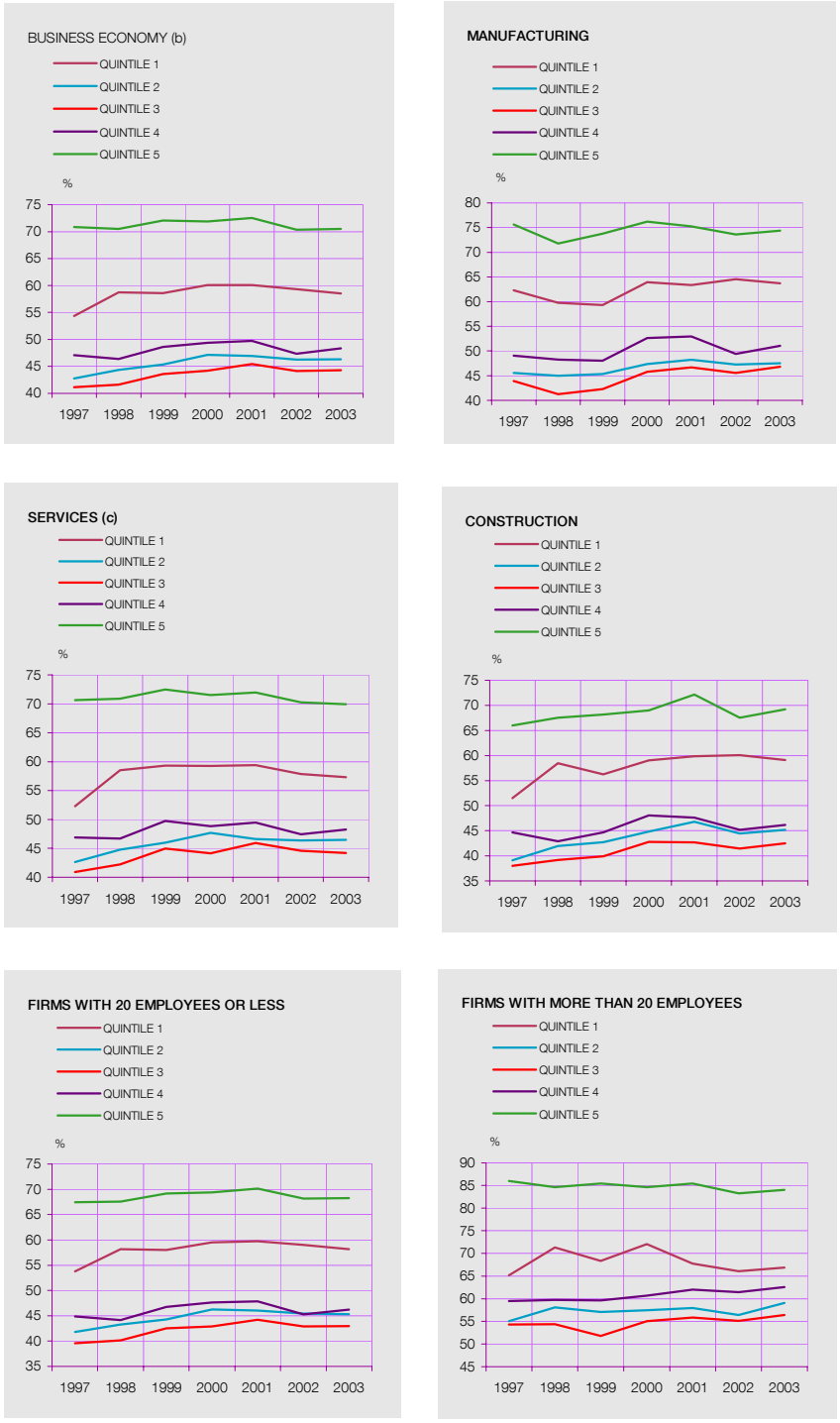
%		PRODUCTIVITY QUINTILES IN 2002				
		1	2	3	4	5
PRODUCTIVITY QUINTILES IN 1997	1	40,9	31,6	13,3	9,9	4,3
	2	13,5	39,1	29,0	13,5	4,9
	3	3,8	18,2	39,1	29,5	9,4
	4	1,6	5,4	19,0	45,4	28,6
	5	0,4	1,4	3,9	20,3	74,0

Sources: Bank of Spain Firm Demography Database .

a. Percentage distribution according productivity quintiles in 2002 of the number of firms in a particular quintile in 1997, conditional on the firm remained alive in 2002.

PERSISTENCE OF THE PRODUCTIVITY LEVELS
1997-2003 annual evolution (a)

FIGURE 3



Sources: Bank of Spain Firm Demography Database .

a. Percentage of firms remaining in the same productivity quintile as in the previous year, by productivity quintile.
b. Excludes agriculture and financial intermediation and non market services.
c. Excludes financial intermediation and non market services.

DECOMPOSITION OF THE LABOR PRODUCTIVITY GROWTH: METHOD 1 TABLE 4
Annual changes, in thousand of euro (2000 base). Average 1996-2003

	Total economy (a)	Manufacturing	Services (g)	Construction
Overall growth	-0,14	0,53	-0,24	-0,64
Due to:				
Within firms' growth (b)	1,63	1,76	1,50	0,27
With 20 employees or less	0,41	0,28	0,57	0,06
With more than 20 employees	1,22	1,48	0,93	0,20
Reallocation of weights between firms (c)	0,06	-0,23	0,36	0,26
Covariance term (d)	-0,67	-0,21	-1,00	-0,57
Entrant firms' contribution (e)	-0,77	-0,03	-0,91	-0,99
With 20 employees or less	-0,65	-0,43	-0,62	-0,60
With more than 20 employees	-0,12	0,40	-0,29	-0,39
Exiting firms' contribution (f)	-0,39	-0,77	-0,18	0,40
With 20 employees or less	0,28	0,20	0,28	0,27
With more than 20 employees	-0,67	-0,98	-0,47	0,13

Sources: Bank of Spain Firm Demography Database .

a. Excludes agriculture and financial intermediation and non market services.
b. The contribution is positive when the firms increase their own productivity level.
c. The contribution is positive when there is a reallocation of resources to more productive than average firms.
d. The contribution is positive when there is a positive correlation between the changes in the weight and the productivity level of the firms.
e. The contribution is positive when the entrant firms are more productive than incumbents.
f. The contribution is positive when the exiting firms are less productive than incumbents.
g. Excludes financial intermediation and non market services.

DECOMPOSITION OF THE LABOR PRODUCTIVITY GROWTH: METHOD 2 TABLE 5
Annual changes, in thousand of euro (2000 base). Average 1996-2003

	Total economy (a)	Manufacturing	Services (f)	Construction
Overall growth	-0,14	0,53	-0,24	-0,64
Due to:				
Within firms' growth (b)	1,29	1,66	1,00	-0,02
With 20 employees or less	0,20	0,19	0,25	-0,11
With more than 20 employees	1,09	1,47	0,75	0,09
Reallocation of weights between firms (c)	-0,28	-0,33	-0,15	-0,05
Entrant firms' contribution (d)	-0,76	-0,04	-0,90	-0,95
With 20 employees or less	-0,65	-0,44	-0,62	-0,57
With more than 20 employees	-0,12	0,40	-0,28	-0,38
Exiting firms' contribution (e)	-0,40	-0,76	-0,19	0,39
With 20 employees or less	0,28	0,21	0,28	0,26
With more than 20 employees	-0,67	-0,97	-0,47	0,12

Sources: Bank of Spain Firm Demography Database .

a. Excludes agriculture and financial intermediation and non market services.
b. The contribution is positive when the firms increase their own productivity level.
c. The contribution is positive when there is a reallocation of resources to more productive than average firms.
d. The contribution is positive when the entrant firms are more productive than incumbents.
e. The contribution is positive when the exiting firms are less productive than incumbents.
f. Excludes financial intermediation and non market services.

DECOMPOSITION OF THE LABOR PRODUCTIVITY GROWTH: METHOD 1 TABLE 6
Annual changes, in thousand of euro (2000 base). Average 1996-2003. Nine wide sectors

	Mining and quarrying (a)	Manuf. (b)	Electricity, gas and water supply	Construct.	Wholesale and retail trade	Hotels and rest.	Transport and storage	Post and telecom.	Real estate, renting and business activities
Overall growth	4,2	0,5	6,3	-0,6	0,0	-0,9	-0,1	-0,3	-1,9
Due to:									
Within firms' growth (c)	-0,6	1,7	2,6	0,3	0,5	0,5	2,3	9,9	1,4
With 20 employees or less	0,4	0,3	0,2	0,1	0,2	0,2	0,6	2,3	0,7
With more than 20 employees	-1,0	1,4	2,4	0,2	0,3	0,3	1,7	7,6	0,7
Reallocation of weights between firms (d)	1,3	0,1	-6,6	0,3	0,3	0,4	-0,1	3,3	0,5
Covariance term (e)	-1,5	-0,3	5,8	-0,6	-0,4	-0,7	-0,4	-6,1	-2,5
Entrant firms' contribution (f)	-0,5	-0,4	9,5	-1,0	-0,5	-1,2	-0,5	-1,8	-1,5
With 20 employees or less	-0,8	-0,4	-0,6	-0,6	-0,5	-1,0	-0,4	-0,8	-0,5
With more than 20 employees	0,3	-0,1	10,1	-0,4	0,0	-0,2	0,0	-1,0	-1,0
Exiting firms' contribution (g)	5,5	-0,6	-5,0	0,4	0,2	0,2	-1,5	-5,6	0,3
With 20 employees or less	0,1	0,2	0,1	0,3	0,2	0,5	0,2	0,6	0,1
With more than 20 employees	5,3	-0,8	-5,0	0,1	-0,1	-0,2	-1,7	-6,2	0,1

Sources: Bank of Spain Firm Demography Database .

a. Includes coke, refined petroleum and nuclear fuel.
b. Excludes mining and quarrying; coke, refined petroleum and nuclear fuel and electricity, gas and water supply.
c. The contribution is positive when the firms increase their own productivity level.
d. The contribution is positive when there is a reallocation of resources to more productive than average firms.
e. The contribution is positive when there is a positive correlation between the changes in the weight and the productivity level of the firms.
f. The contribution is positive when the entrant firms are more productive than incumbents.
g. The contribution is positive when the exiting firms are less productive than incumbents.

DECOMPOSITION OF THE LABOR PRODUCTIVITY GROWTH: METHOD 2 TABLE 7
Annual changes, in thousand of euro (2000 base). Average 1996-2003. Nine wide sectors

	Mining and quarrying (a)	Manuf. (b)	Electricity, gas and water supply	Construct.	Wholesale and retail trade	Hotels and rest.	Transport and storage	Post and telecom.	Real estate, renting and business activities
Overall growth	4,2	0,5	6,5	-0,6	0,0	-0,9	-0,1	-0,3	-1,9
Due to:									
Within firms' growth (c)	-1,4	1,6	5,5	0,0	0,3	0,1	2,2	6,8	0,1
With 20 employees or less	0,2	0,2	0,1	-0,1	0,1	0,0	0,5	0,7	-0,1
With more than 20 employees	-1,6	1,3	5,4	0,1	0,2	0,1	1,6	6,1	0,3
Reallocation of weights between firms (d)	0,6	0,0	-3,7	-0,1	0,0	0,0	-0,3	0,7	-0,8
Entrant firms' contribution (e)	-0,5	-0,4	9,1	-0,9	-0,5	-1,2	-0,5	-2,2	-1,4
With 20 employees or less	-0,8	-0,4	-0,7	-0,6	-0,5	-1,0	-0,4	-0,9	-0,5
With more than 20 employees	0,3	-0,1	9,8	-0,4	0,0	-0,2	0,0	-1,3	-0,9
Exiting firms' contribution (f)	5,4	-0,6	-4,3	0,4	0,2	0,2	-1,5	-5,6	0,2
With 20 employees or less	0,1	0,2	0,1	0,3	0,2	0,5	0,2	0,7	0,1
With more than 20 employees	5,3	-0,8	-4,4	0,1	-0,1	-0,3	-1,7	-6,2	0,1

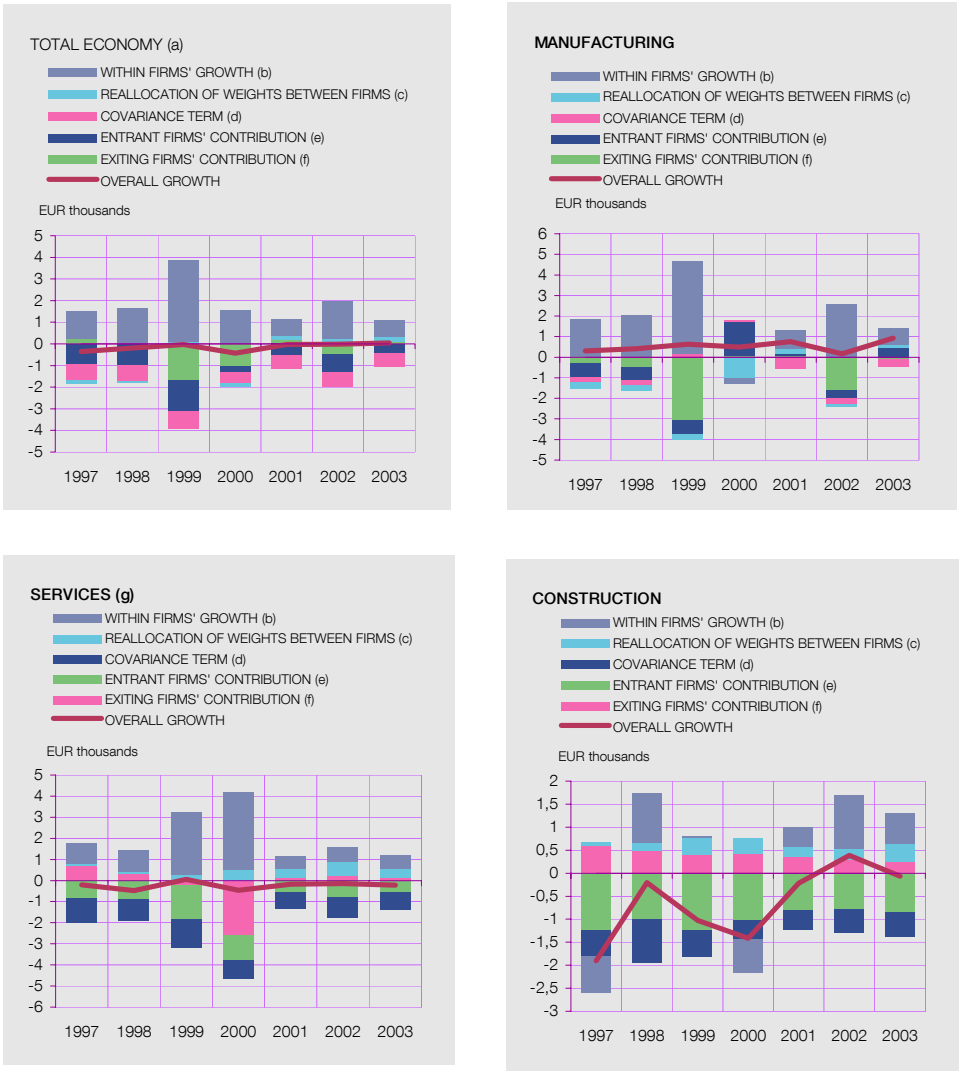
Sources: Bank of Spain Firm Demography Database .

a. Includes coke, refined petroleum and nuclear fuel.
b. Excludes mining and quarrying; coke, refined petroleum and nuclear fuel and electricity, gas and water supply.
c. The contribution is positive when the firms increase their own productivity level.
d. The contribution is positive when there is a reallocation of resources to more productive than average firms.
e. The contribution is positive when the entrant firms are more productive than incumbents.
f. The contribution is positive when the exiting firms are less productive than incumbents.

DECOMPOSITION OF THE LABOR PRODUCTIVITY GROWTH: METHOD 1

FIGURE 4

Annual changes, in thousand of euro (2000 base)



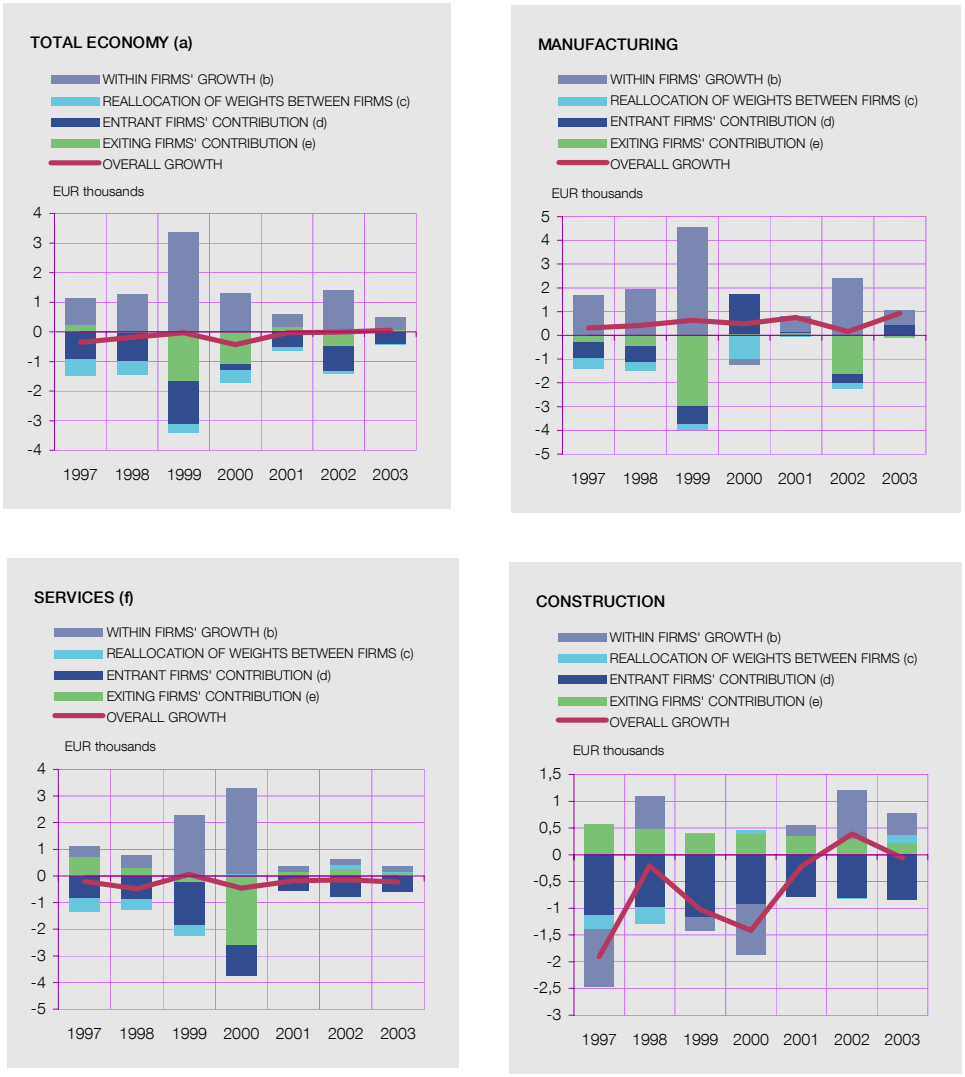
Sources: Bank of Spain Firm Demography Database .

a. Excludes agriculture and financial intermediation and non market services.
b. The contribution is positive when the firms increase their own productivity level.
c. The contribution is positive when there is a reallocation of resources to more productive than average firms.
d. The contribution is positive when there is a positive correlation between the changes in the weight and the productivity level of the firms.
e. The contribution is positive when the entrant firms are more productive than incumbents.
f. The contribution is positive when the exiting firms are less productive than incumbents.
g. Excludes financial intermediation and non market services.

DECOMPOSITION OF THE LABOR PRODUCTIVITY GROWTH: METHOD 2

FIGURE 5

Annual changes, in thousand of euro (2000 base)



Sources: Bank of Spain Firm Demography Database .

a. Excludes agriculture and financial intermediation and non market services.
b. The contribution is positive when the firms increase their own productivity level.
c. The contribution is positive when there is a reallocation of resources to more productive than average firms.
d. The contribution is positive when the entrant firms are more productive than incumbents.
e. The contribution is positive when the exiting firms are less productive than incumbents.
f. Excludes financial intermediation and non market services.

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