Dynamics in the Spanish Manufacturing Sector: Evidence from Aggregate and Firm-level Data*

PRELIMINARY VERSION

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Introduction

Usually economic growth is accompanied by large structural transformations inside the economic system. Spain has been characterized by a relatively high GDP growth in the last decade. The aim of this paper is to provide evidence on the structural changes, if any, occurred in the Spanish economy during the period 1995-2008. In particular, our motivation is to understand which sectors have been expanding and those that have been shrinking. Our attention will then shift to one of these sectors, the manufacturing industry, whose dynamics will be investigated using both aggregate industry data and firm-level data.

The first part of this article will provide a brief comparative analysis of the Spanish economy with respect to other 4 countries (UK, Germany, France and Italy) belonging to the European Union. We compare employment and productivity across the five countries using EUROSTAT data for the period 1995-2008. We will show that the large increases in GDP and employment in Spain have not been coupled with a similar increase in productivity. On the contrary, the productivity gap between Spain and the major European countries has widened, with Italy being the only exception.

We then take a closer look at the Spanish economy in order to understand whether the growth process of the last decade induced a process of structural transformation. To this aim, we use aggregate data on value added and employment in manufacturing, construction and services published by the Spanish Institute of Statistics, INE. At this level of aggregation the major change of the Spanish economy is represented by the increase in the relative contribution of the construction sector to total value added (from 7% in 1995 to 12% in 2007) at the expenses of the manufacturing sector (from 22% to 7% during the same period). Looking inside the manufacturing sector, we find no particular structural change among the different industries we analyse, both in term of value added and employment. Only the textile industry shrinks sensibly in term of value added during this period. Employment lost in the textile is absorbed by the metallic product industry.

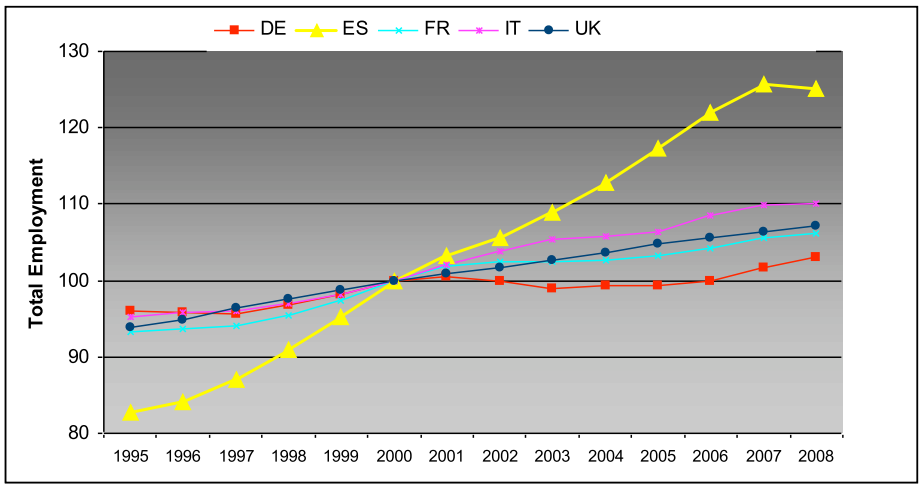
Finally, in order to better asses the dynamics of the manufacturing sector we use firm-level data retrieved from the ESEE dataset. We analyse exit, entry and growth in employment and productivity of the manufacturing sector during the period 1990-2006. Although the period covered by the ESEE does not include the recent economic recession, the analysis sheds some light on what characteristics make a Spanish firm more likely to survive and growth, or to shrink and exit. It also investigates whether firms that have been established are more productive than the firms that exit. The evidence is that there is a high persistence in productivity performance. More than half of high productive firms in the early 90s are still characterized by high productivity 15 years later. Newly established firms are usually characterized by low productivity, however those established between 1992 and 1998 have higher productivity in 2005 than those established after 1998. We find also that newly established firms are not better than the old ones in term of productivity even after ten years of their entrance in the market. The only dimension in which new firms do not differ from the old ones is profitability. We conjecture this is because new firms are mainly local business less exposed to competition.

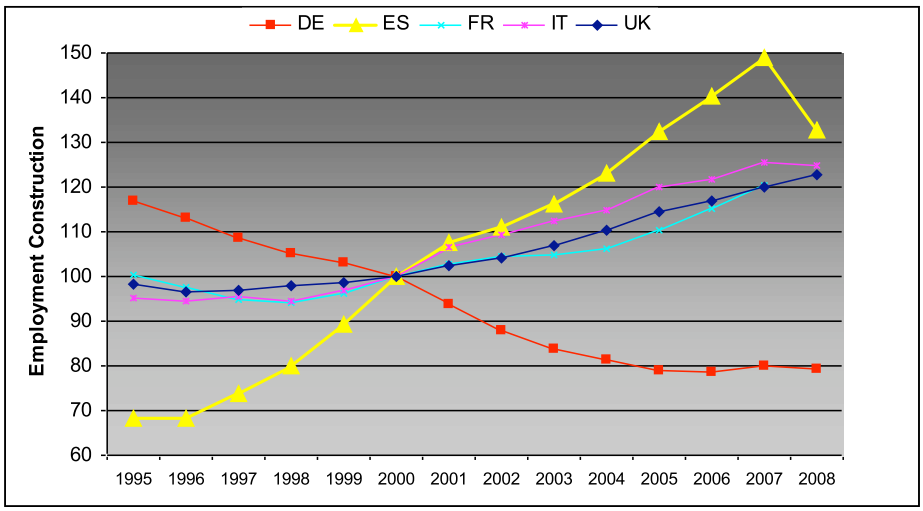
The paper is organized as follows. Section 1 compares the relative performance of the Spanish economy with respect the other European economies. Section 2 focuses on the Spanish economy to understand if any structural change occurred in the analyzed period. Section 3 presents the firm-level analysis of the manufacturing sector. Finally, Section 4 concludes.

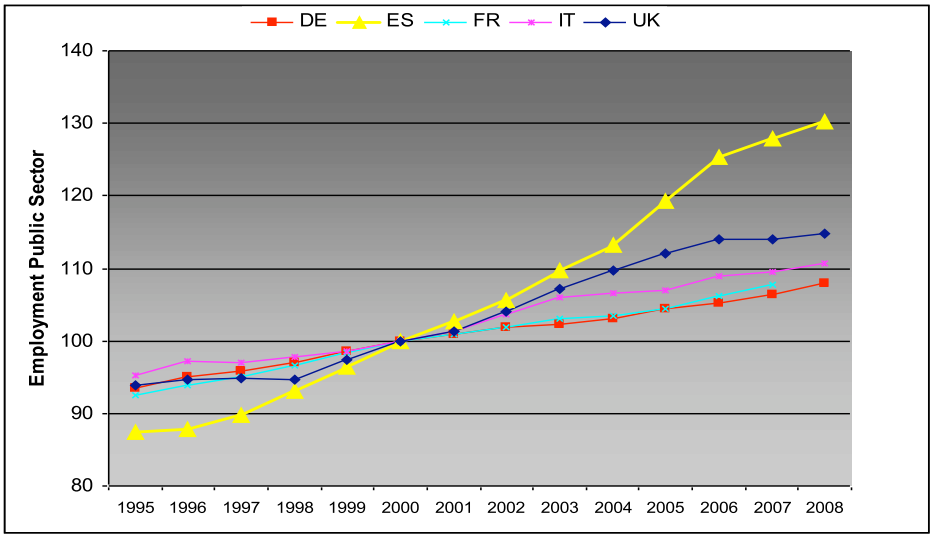
1. A comparison between Spain and the main European economies

The four graphs below show the evolution of employment in five EU countries: Germany (DE), Spain (ES), France (FR), Italy (IT) and Great Britain (UK) for the period 1995-2008. The first graph is for the total economy and the following two are for construction and public sectors. The employment in year 2000 is normalized to 100 (base year) for all the five countries.

Picture 1 – Employment Index in five EU countries







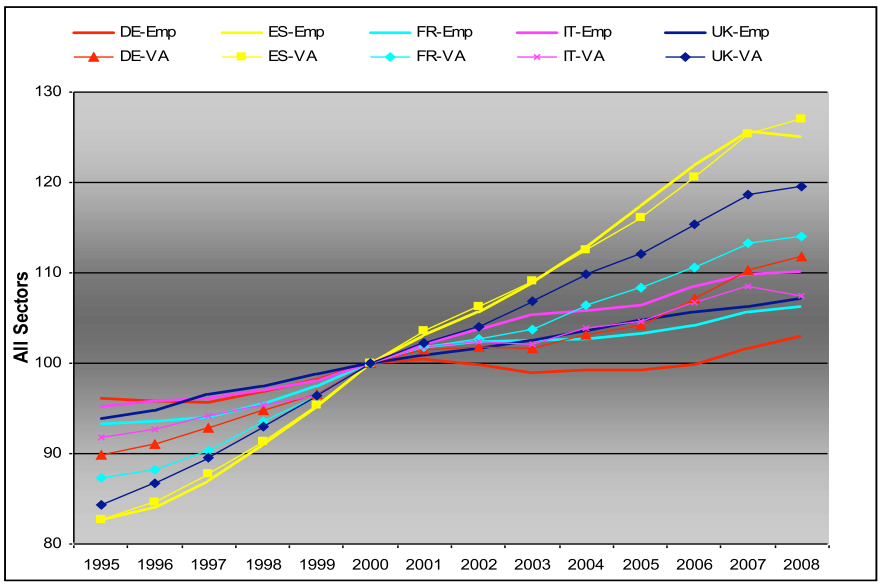
Total employment in the Spanish economy has grown more than all other European countries considered. Employment has been growing at particularly fast paste in construction while the public sector employment has grown at the same pace of the overall economy.

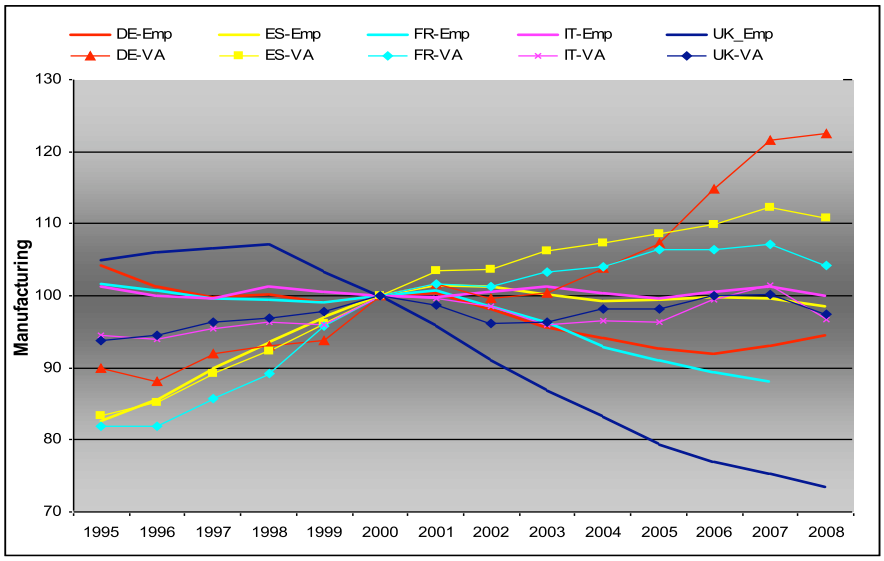
Picture 2 reports changes in both employment and value added (VA) for the overall economy (top chart) and the manufacturing sector (bottom chart). Value added is expressed in year 2000 prices using the chain-link volume methodology[1].

In the first graph the line of employment (Emp) and value added (VA) for Spain are almost aligned, thus suggesting that there are no relevant changes in value added per employee. Other countries (with the exception of Italy) experience a larger growth of value added than employment (i.e., larger increase in labour productivity). The second graph shows that labour productivity of Spanish manufacturing firms has increased more than other sectors of the Spanish economy but it still lacks behind the gains obtained by the other EU countries (with the exception of Italy). It is interesting to see that the number of people working in the manufacturing industry has decreased in both France and Germany, with the United Kingdom experiencing the most dramatic reduction of all.

Picture 2 – Employment and Value Added in five EU countries

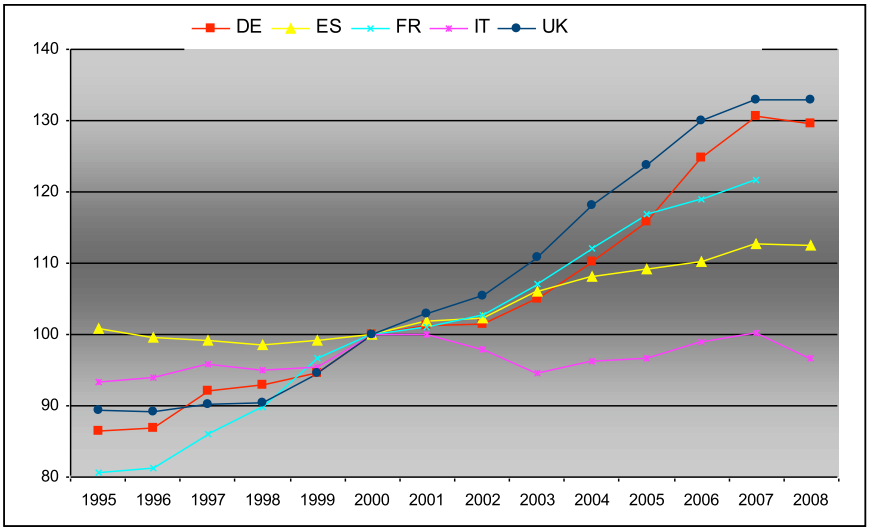
[1] This methodology allows to measure the growth of quantity produced in volume, removing the effects of price changes. See "Introduction of chain-linked volume measures in the Quarterly Spanish National Accounts", available at http://www.ine.es/en/daco/daco42/cne00/medic_vol_encad_b2000_en.pdf, for further details.





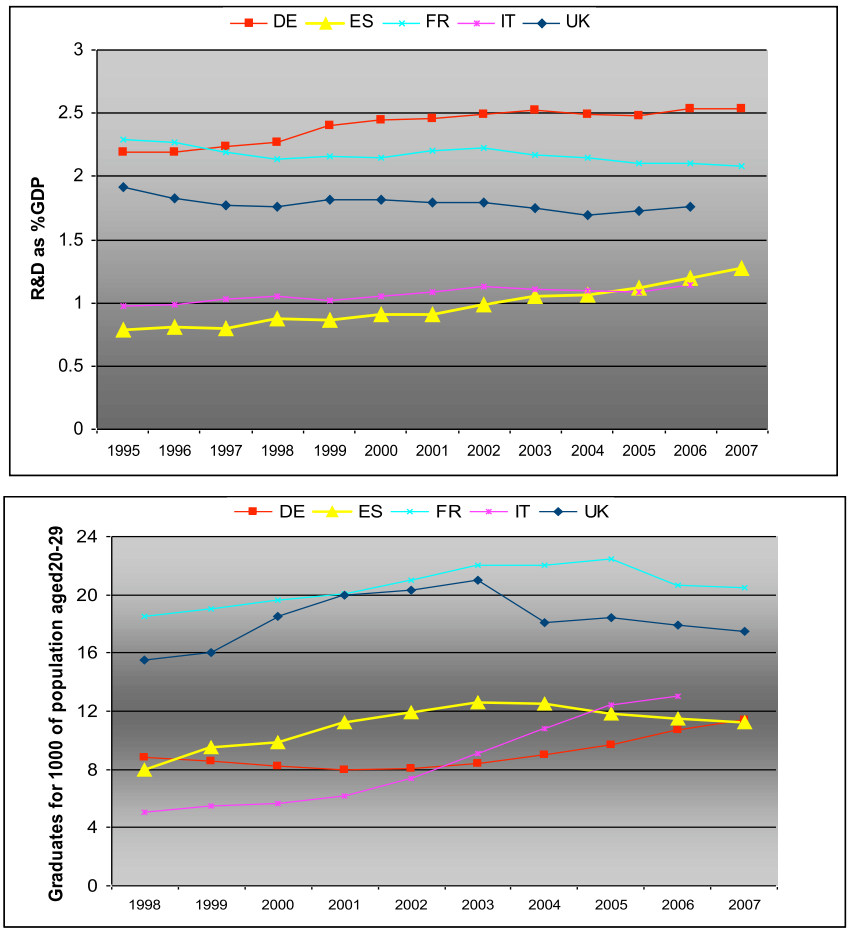
By taking the ratio of VA and Emp reported in the bottom graph of Picture 2, it is possible to have an immediate perception of how labour productivity in the manufacturing sector of the five EU countries has changed over the period considered. The ratio VA/Emp is reported in Picture 3. The graph points clearly to a loss of competitiveness of the Spanish manufacturing sector with respect to Germany, France and UK. Particularly dramatic is the situation of the Italian manufacturing sector with a labour productivity that has been stagnant over the last decade.

Picture 3 – Labour Productivity Index in Manufacturing across EU countries



Finally, the first graph of Picture 4 shows how R&D expenditure (as percentage of GDP) in Spain is structurally lower than the R&D expenditure in Germany, UK and France. In the last 12 years, Spain overcame Italy. The second graph reports the number of persons with bachelor degree in technology and science (out of 1000 persons). Spain has a comparable amount of Italy and Germany, but much lower than UK and France.

Picture 4 – R&D Expenditure and Tertiary Education in science and technology



The overall picture that emerges from the data above is that the dramatic increase of GDP and employment in Spain has not been coupled with major advances in productivity. On the

contrary, the productivity gap between Spain and other major European countries seems to have widened, with the only exception of Italy.

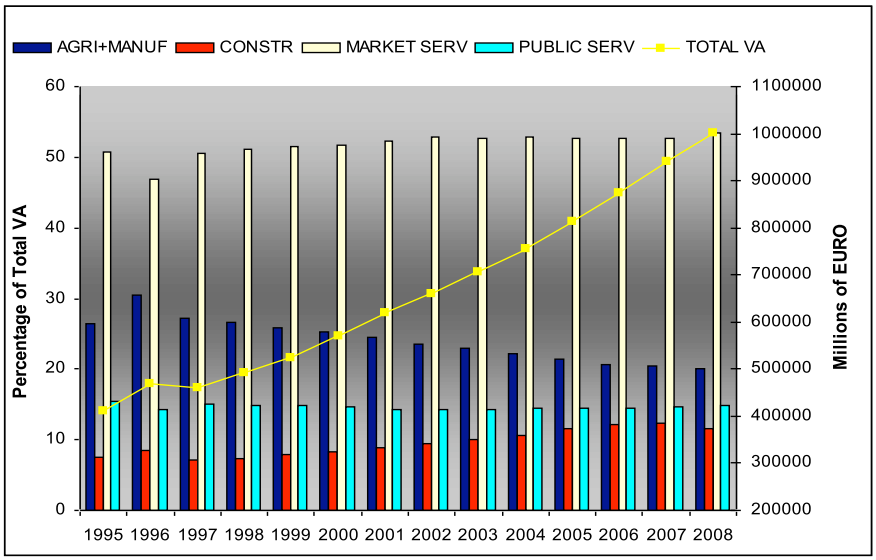
2. The Spanish Economy

This section will investigate whether the impressive growth documented in Section 1 has lead to major structural changes in the Spanish economy. To this aim, we will first analyse whether the relative contribution of agriculture, manufacturing, construction and services to total production and employment has changed. The second part of this Section will take a closer look at the dynamic of the Spanish manufacturing industry.

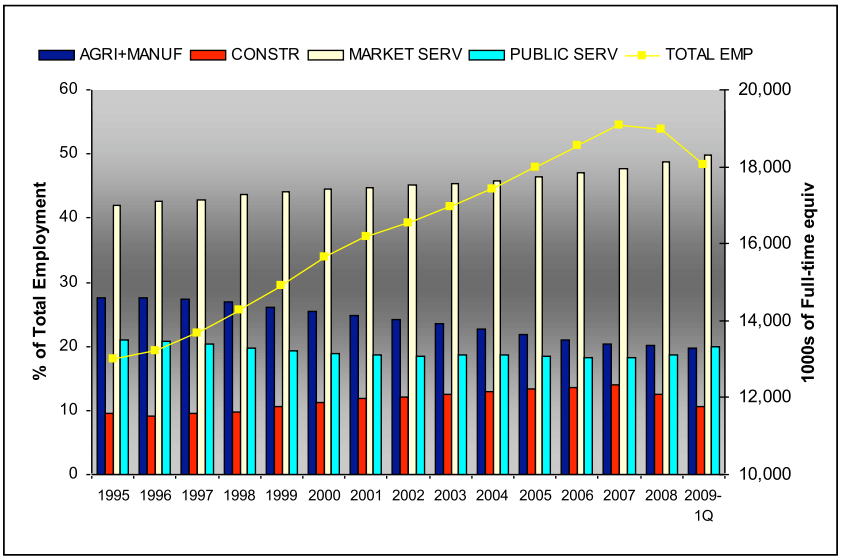
Picture 5A shows that value added at market prices (scale on the right) more than doubled between 1995 and 2008. The Picture also shows the division of value added (VA) between industry (including agriculture), construction, market services and public sector (scale on the left) in each year. The contribution of market services and public sector to total VA is pretty much constant over this period, around 50% and 15%, respectively. The contribution of manufacturing and agriculture to total VA is decreasing: It accounted for 27% in year 1995 and for 20% in year 2008. At the same time there has been a symmetric expansion of the construction sector which accounted for 7% of total VA in year 1995 and for 12% in year 2008.

Qualitative similar results are obtained when drawing the relative contribution of these sectors to total employment, as we have done in Picture 5B. It is interesting to note that, while the proportion of VA accounted by market services has been constant at 50%, the number of people working in this sector has increase from 42% to 50% over the period considered. The expansion of construction has been more pronounced in terms of VA than in terms of employment.

Picture 5A – Total VA and its distribution across different Sectors

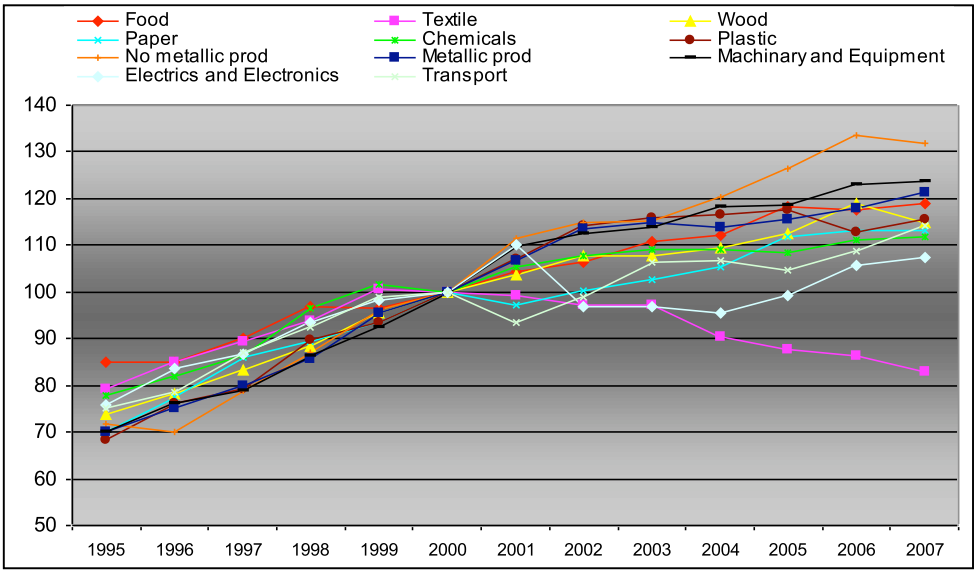


Picture 5B – Total Employment and its distribution across different Sectors



The two Pictures above show that the contribution of manufacturing to total VA and employment has decreased during the last decade. We now take a closer look at this sector by analysing the dynamics of eleven different manufacturing industries. The analysis is performed using the data of the *Encuesta Industrial* (EI). This survey, published by the Spanish National Institute of Statistics (INE), contains, among others, information on gross production, consumption of intermediary goods, number of people employed and cost of labour for the period 1995-2007. One of the advantages of using these data is that industry classification used by the INE has not changed for the period covered by the survey. Changes in the industry classification used by the INE has made difficult to construct consistent series of VA and employment for the period considered in this study using other sources.

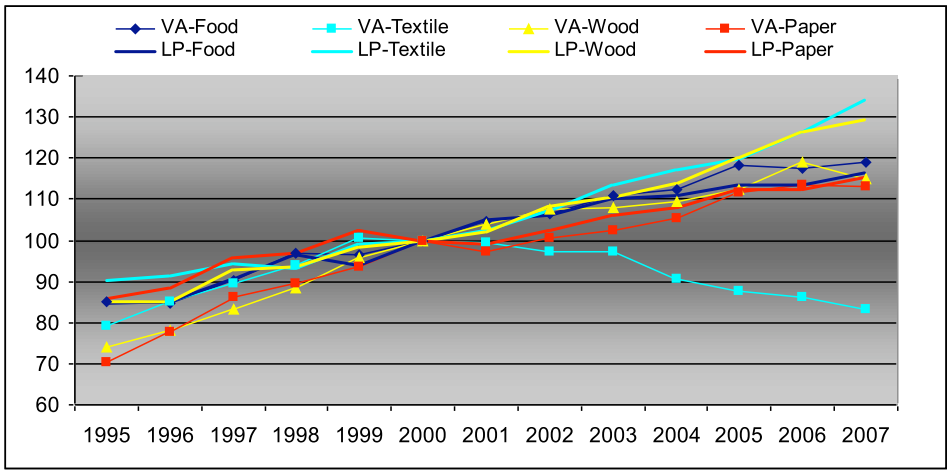
Picture 6 – VA from Encuesta Industrial

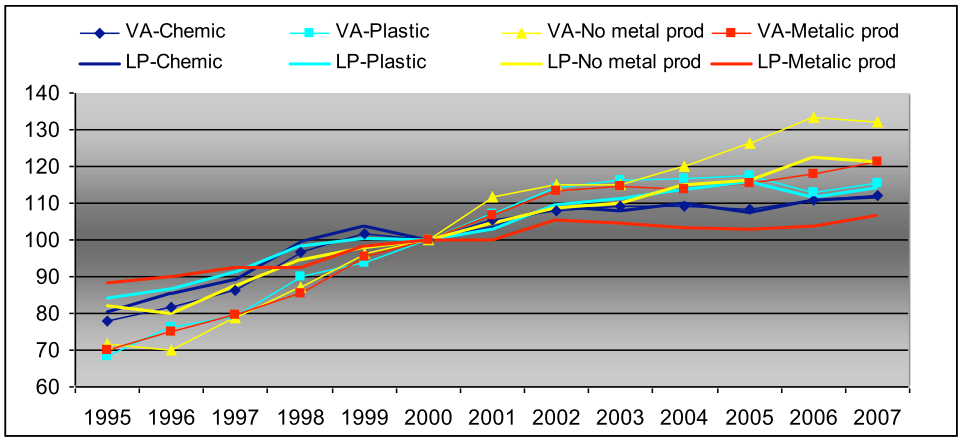


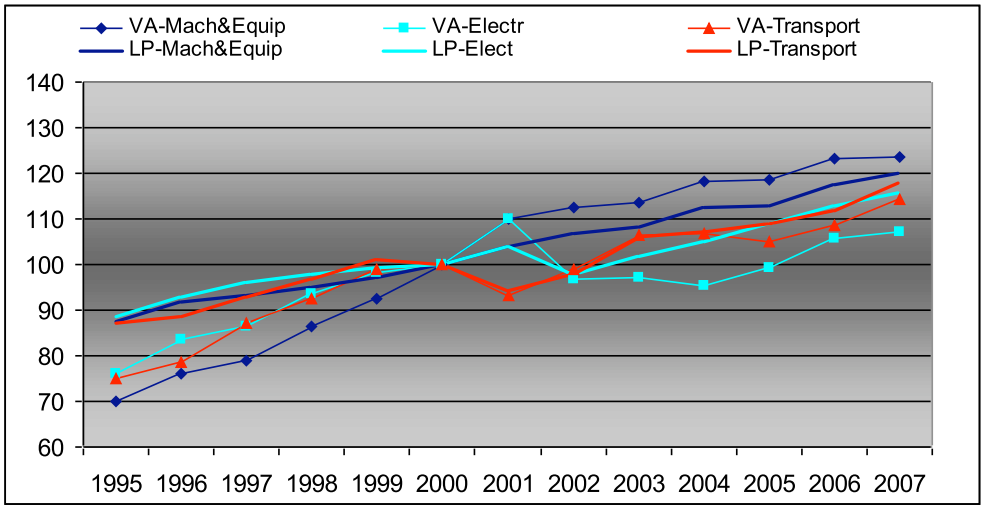
Picture 6 shows the VA at year 2000 prices computed using the chain-link method. As for the other graphs, we have normalized the value of VA for year 2000 at 100. The picture above suggests that most of the industries have seen a continuous and steady growth of VA between 1995 and 2007. “No metallic product”, “Metallic product” and “Machinery and Equipments” are the three sectors that have experienced the largest increase. We speculate that part of this expansion might be linked to the boom of the construction. In fact, “No metallic product” includes concrete, stone and ceramic while “Metallic product” includes, among others, the production of doors, frames and heating equipments. The only industry that has suffered a contraction in the quantity produced since the beginning of the new millennium is “Textile”. This is not surprising given most of fabrics and cloths are now produced in the Far East.

The evolution of VA shown in Picture 6 is reported in the three graphs of Picture 7 together with the labour productivity, measured as deflated VA for the total number of hours worked. Notice that the information provided by the EI is not rich enough to construct an alternative and reliable measure of productivity like TFP. Picture 7A-7C show that VA and LP seem to follow the same pattern over the period considered for all the industries with the exception of textiles: a steady expansion in production coupled with a constant increase in productivity.

Picture 7: VA and Labour Productivity in Manufacturing Industries







The impression one gets from the Picture above is that most of the industries have been characterized by a constant and steady increase in production and productivity. These dynamics are further explored in Table 1. The Table shows the distribution of employment and deflated VA (expressed in thousands of EURO in year 2000 prices) in 1995 and in 2007 across the same eleven manufacturing industries together with their growth over these twelve years. The first interesting result that emerges from this table is the contribution of most of the industries to total employment and production is largely unchanged. The relative weight of "Wood", "Paper", "Chemicals", "Plastic" and "Transport" in employment and/or VA differs less than 1% point. As said above, the most remarkable exceptions to this stillness are "Textile", where almost a third of the jobs have been destroyed over the period considered, and "No Metallic Product", "Metallic Product" and "Machinery and Equipment", which have grown at a faster pace than the other sectors.

Even more astonishing is the similarity in labour productivity growth that these sectors have experienced. Seven out of the eleven industries have seen an increase of labour productivity between 0.33 and 0.37. Interesting but not surprising is the fact that "Textile" is the sector with the second highest increase in productivity: only the most efficient textile firms have stood the competition of the Far East. "Metallic Product" is the sector with the smallest increase in Labour Productivity. In fact, while the increase in the number of people working in this industry has been more than three times the manufacturing average, the increase in VA has been only one and half the industry average.

Table 1: VA and Employment: Distribution across Industries and Growth

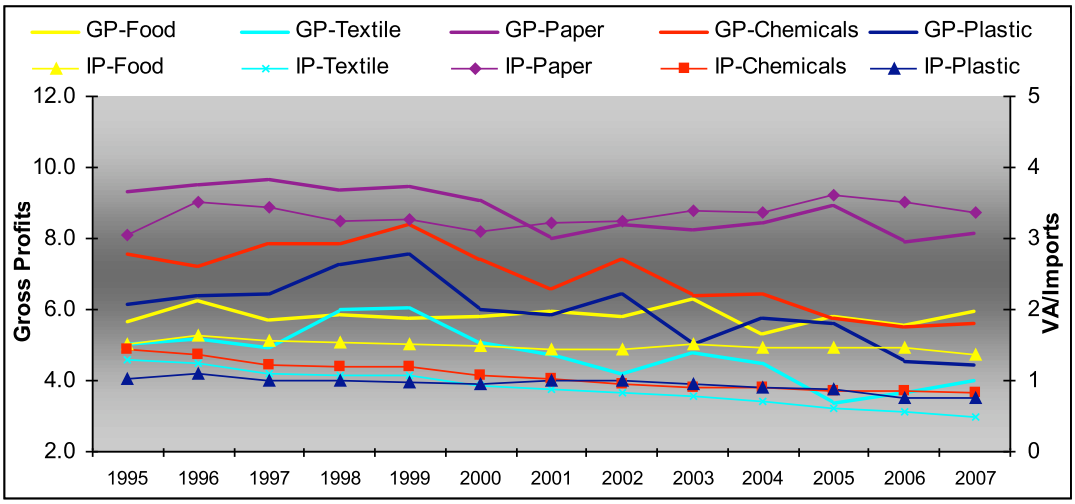
Variable	Employment 1995		Employment 2007		Employment Growth 1995/2007	VA 1995		VA 2007		VA Growth 1995/2007	Lab Prod. Growth 1995/2007
Industry	Number	%	Number	%		Value (def)	%	Value (def)	%		
Food	372925	18.1	381681	16.6	2.3	19974176	19.1	27970017	17.5	40.0	0.37
Textile	277013	13.5	197214	8.6	-28.8	7448236	7.1	7806215	4.9	4.8	0.47
Wood	89911	4.4	92835	4.0	3.3	2441059	2.3	3799686	2.4	55.7	0.51
Paper	162347	7.9	196772	8.5	21.2	9388229	9.0	15139587	9.5	61.3	0.33
Chemicals	130027	6.3	136979	5.9	5.3	12455146	11.9	17915494	11.2	43.8	0.37
Plastic	95614	4.6	118207	5.1	23.6	4711620	4.5	7941991	5.0	68.6	0.36
No metallic Product	156436	7.6	196634	8.5	25.7	8742998	8.4	16077680	10.0	83.9	0.46
Metallic Product	305370	14.8	439736	19.1	44.0	13909554	13.3	24051033	15.0	72.9	0.20
Machinery and Equipment	142556	6.9	185281	8.0	30.0	6375626	6.1	11263444	7.0	76.7	0.36
Electrics and Electronics	135718	6.6	147692	6.4	8.8	7313282	7.0	10330849	6.5	41.3	0.30
Transport	190037	9.2	211888	9.2	11.5	11678785	11.2	17775913	11.1	52.2	0.37
TOTAL	**2057954**	**100.0**	**2304919**	**100.0**	**12.0**	**104438715**	**100.0**	**160071914**	**100.0**	**53.3**	**0.37**

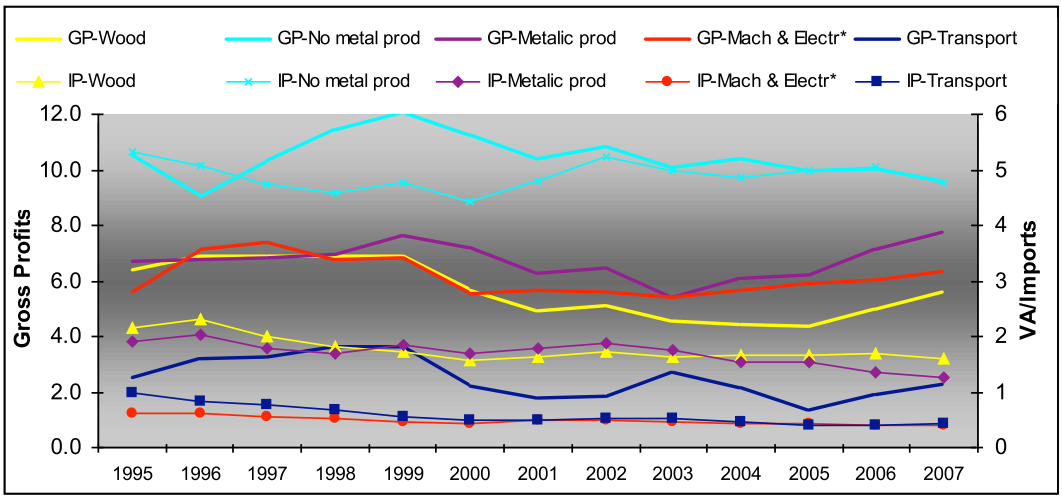
Picture 3 above shows that the productivity gains of the Spanish manufacturing segment have been lower than those of other European Countries. It is then interesting to explore to what extent this apparent loss of competitiveness has affected both profits and the trade balance of the different industries we are considering.

We compute gross margins by subtracting the cost of good sold (intermediary inputs and cost of labour) from total revenues (that is, gross margins do not include amortization and depreciation, R&D expenditure and other general expenses). Retrieving imports and exports data from the INE, we have also computed an "inverse" index of *imports penetration* defined as VA/ Imports. A decrease of the import penetration index implies a larger penetration of foreign products in the Spanish market, which is expected to determine a reduction in gross profits. Pictures 8 confirms this hypothesis. Quite remarkable are the cases of "Paper" and "No metallic products": these are the industries with the lowest import penetration and the highest profitability. In general, the correlation between profits and our import index is above 80% in any of the years considered.

An interesting finding is that import penetration is substantially flat for most of the industries. This suggests that the lower productivity of Spanish manufacturing documented in Section 1 has not lead to an invasion of foreign goods into the Spanish market.

Picture 8: Gross Profits and "Inverse" Import Penetration (VA/Imports)





In order to investigate the dynamic effect of import penetration on profits, we estimate a basic "growth" regression of profits, Π, on import penetration (Imp) - defined as imports/VA -, controlling also for labour productivity (LP) and time dummies. This regression gives the following result:

$$\Delta\Pi = -1.13\Delta Imp + 0.08\Delta LP + TimeDummies \quad N = 120$$
$$\quad (0.03) \qquad (0.01) \qquad\qquad R\text{-squared} = 0.45$$

A one standard deviation of ΔImp (equal to 2.83) determines a decrease in profits of 3.1%. A one standard deviation in ΔLP (equal to 0.12) implies an increase of only 0.01%.

A largely constant import penetration suggests that imports have increased at the same pace of the economy but it does not reveal whether Spanish firms have been able to stand the competition of international markets. To this aim, we compare the ratio of exports and imports measured in monetary values and in quantities (that is, removing the effects of changes in the price). Table 2 reports the average ratio for the period 1995-2007 and its growth between these twelve years. Values of column (1) and (2) below 1 indicate that exports are lower than imports in values and quantities, respectively. Positive values in column (3) and (4) suggest that the balance trade is improving. By comparing the first two columns, we can investigate the relative "quality" of the export-import flows: values of column (1) higher (respectively, lower) than column (2) indicate that the average price of exports is greater (smaller) than imports, thus suggesting that Spanish industries tend to specialize in "high" ("low") quality products. Similarly, a growth in (3) higher (respectively, lower) than in (4) suggest that the specialization in "high" quality products tend to increase (decrease) over time.

Despite the loss of competitiveness of the Spanish manufacturing sector documented in Section 1, the figures in Table 2 suggest that there has been only a moderate worsening of the balance of trade. This result might be due to two alternative (and not necessarily exclusive) reasons: i) exporters are more efficient than local firms (see Melizt, 2003); ii) Spanish firms specialize in products that do not compete with those produced by other (more efficient) European countries (see Cuadras, Puig and Xifre, 2008). This result is in line with the figures published by the World Trade Organization, according to which Spanish export quota in world trade is small but stable around 1.6% – 1.8% from 1990s to present. This is remarkable given the important reduction that US, France, Italy, UK and have suffered (though their absolute levels were much larger) at the expense of the emerging economies.

Similarly, Table 2 shows that Spain exports products that are on average more expensive than those that are imported, although this alleged specialization in "high" quality products seems to decrease over the period considered. The study by Cuadras, Puig, Xifre (2009) compares the relative quality of Spanish exports with their main competitors in the main destinations and finds a relatively stable "quality" index, between .93-.97 (where 1 would mean a similar quality to those of main exporters) without a clear temporal trend.

The findings presented in this section suggest that the Spanish economic is relatively static: the dramatic growth that the country has experience over the last decade has not been accompanied by a process of deep structural transformation. There has been only a minor change in the importance of manufacturing and construction, with the former losing ground in favour of the latter. Similarly, most of the Spanish manufacturing industries have not been shaken by major transformation, with the exception of textile. Despite the loss of competitiveness of Spanish

manufacturing firms in international markets, there have not been major changes in the import penetration or remarkable deterioration of the export\import ratio.[2]

Table 2: Export/Import Ratio over 1995-2007

Industry	Yearly Average Value (1)	Yearly Average Quantity (2)	Growth 1995-2007 Value (3)	Growth 1995-2007 Quantity (4)
Food	1.06	0.67	0.14	0.22
Textile	0.82	0.54	-0.32	-0.35
Wood	0.51	0.28	-0.07	0.24
Paper	0.84	0.62	0.20	0.22
Chemicals	0.60	0.77	0.35	0.14
Plastic	0.82	0.80	0.15	0.05
No metallic Product	1.60	3.85	-0.27	-0.49
Metallic Product	0.77	0.44	-0.18	-0.23
Machinery and Equipment	0.52	0.73	-0.15	-0.18
Electrics and Electronics	1.13	1.30	-0.41	-0.38
Transport	1.06	0.67	0.14	0.22
TOTAL	0.80	0.70	-0.14	-0.02

3. Manufacturing Sector: Firm-level analysis

This section investigates the dynamics of the manufacturing sector using firm-level data retrieved from the Encuesta Sobre Estrategias Empresariales (ESEE), an unbalanced panel of Spanish manufacturing firms observed for the period 1990-2006.[3]

[2] The study by Gordo, Gil and Perez (2003) suggests that none of the major Western European economies has experience major shifts in their production structure since the late eighties.

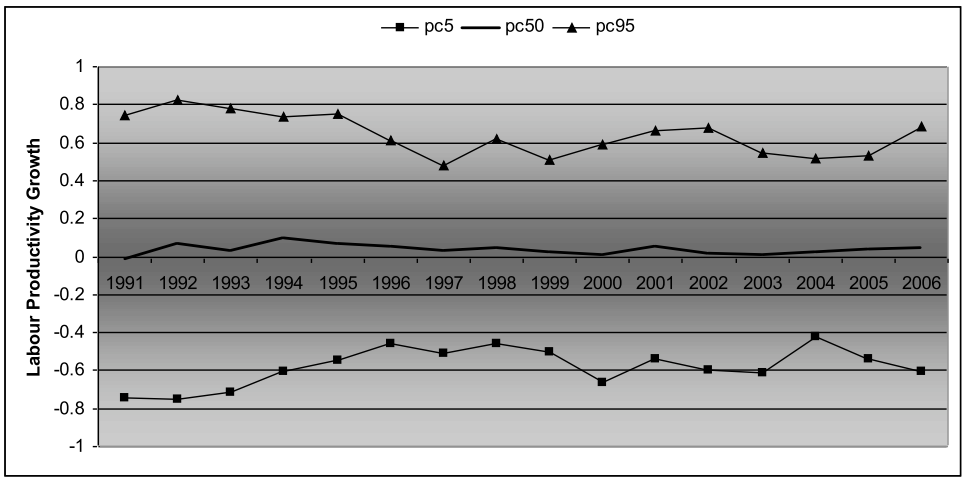
[3] The survey has been sponsored by the Ministry of Industry and it is published by the Fundacion Empresa Publica. In the first year of the survey, 5 percent of all manufacturing firms with between 10 and 200 employees were randomly selected by industry and size strata. At the same time, all firms with more than 200 workers were asked to participate, and 70 percent of these firms decided to respond to the questionnaire. See Castiglionesi and Ornaghi, 2009, for further details.

Data presented in Section 2 suggest that there is not a large dispersion in "aggregate" productivity growth of manufacturing industries over the period considered. Picture 9 plots the distribution of labour productivity growth constructed with the ESEE. The picture shows that there is a large heterogeneity in productivity growth, which does not seem to narrow over time.

The distribution of productivity growth in Picture 9 might arise from two different types of firm-level dynamics. First, it might be the case that all the firms in the industry tend to growth at similar pace over a long period of time. Firms that look more productive in a given year will revert to an "average" productivity value as time passes. In other words, firms that are high in the productivity distribution in year *t* can be in any point of the distribution in year *t+1*. The fact that the productivity growth will be uncorrelated form period to period would suggest that productivity changes are "exogenous" and/or that there are large technological spillovers in the economy.

Second, it might be the case that differences in productivity growth and, consequently in productivity levels, tend to be persistent over time. Firms are more efficient in a given year will show high productivity also in the following years. This particular dynamics is likely to arise if productivity is embodied in new capital goods or in human capital.[4]

Picture 9: Dispersion of Labour Productivity Growth at Firm-level



The first part of this section will explore how labour productivity and firm size has changed over the period 1990-2006. The analysis will try to uncover if productivity differences are persistent over time and whether small/medium size firms at the beginning of the nineties have growth into larger business over the following decade. In the second part of the section, we will use the survey at hand to address the following three questions. i) What are the main determinants of productivity growth? ii) What are the characteristics of firms that exit the market? iii) Are newly born firm more productive than existing ones?

3.1 Productivity and Size of firms that stay, exit and enter the industry

[4] Castiglionesi and Ornaghi (2009) show that the relevant explanation is the second one. Moreover, they explain why a firm-level analysis is able to uncover such result while an aggregate analysis cannot.

Tables 3A and 3B report a transition matrix among productivity classes as in the paper by Baily, Hulten and Campbell (1992). This matrix is constructed by classifying the manufacturing firms by quintiles according to their level of labour productivity (at industry level) in two different years. The initial year is 1991 for both tables.

Tables 3A and 3B show where these firms are in 1998 and in 2005, respectively. The first quintile contains firms with the lowest productivity levels in their industry while those firms in quintile 5 have the highest productivity in their industry. The column OUT refers to the firms alive in 1991 that have closed down between 1992 and 1998 or between 1999 and 2005. The row IN refers to the quintile position in 2005 of the firms established between 1992/1998 or between 1999/2005. Consider, for instance, the first row of Table 3A. In 1998, 33 percent of the lowest productivity firms are still in the first quintile and 36 percent of them disappear. Only 5 percent of them are able to move up to the fifth quintile. For the firms established after 1991, we report their quintile in 1998. For example, 32 percent of these new companies are in the first quintile in 1998. From Tables 3A and 3B we observe a high persistency in productivity differences: 51% of the most productive firms in 1991 are still in the top quintile fifteen years after. This strong persistence of differences in productivity levels seems at odds with theoretical models where technological progress is freely available (Solow, 1956), possibly as a result of large spillovers. If this were the case, the dispersion of productivity should be random and firms at the top of the distribution in period *t* should not be there fifteen years after.

Exit rates, reported in Column OUT (92/98), are decreasing as we move from the first to the fifth quintile. This result is stronger than what Baily et al (1992) report for the US firms. On the contrary, exit rates after 1999, reported in Column OUT (99/05) in Table 3B, are almost the same across different quintiles. This suggests that the selection of most productive firms has been rather fast. We also observe that exit rates for new firms are suspiciously low. We believe this is likely due to the poor monitoring of firms exiting the survey (i.e., true exit and attrition are not well defined). Finally, the last two rows of Table 3B suggest that newly established firms are more likely to be found in the lowest quintiles of the distribution in both periods. However, the productivity in 2005 of firms entering the market in the period 1992-1998 is better than firms born in the period 1999-2005.

Table 3A: Quintiles of Labour Productivity (1991-1998)

QUINTILE	QUINTILE IN 1998					OUT
in 1991:	Q1	Q2	Q3	Q4	Q5	(92/98)
Q1	33	22	10	5	5	36
Q2	16	22	23	12	7	28
Q3	6	15	24	24	13	28
Q4	4	9	20	32	27	12
Q5	4	2	8	22	56	12
IN(92/98)	32	25	19	12	7	7

Table 3B: Quintiles of Labour Productivity (1991-2005)

QUINTILE	QUINTILE IN 2005					OUT	
in 1991:	Q1	Q2	Q3	Q4	Q5	(92/98)	(99/05)
Q1	21	12	8	10	7	36	8

Q2	14	16	17	10	8	28	7
Q3	14	16	17	10	8	28	7
Q4	5	9	12	25	31	12	6
Q5	5	2	5	17	51	12	8
IN(92/98)	25	21	19	12	9	7	7
IN(99/05)	35	28	23	9	4	.	2

Table 3C reports a similar transition matrix considering however changes in firm size. The size classification is based on thresholds, similar to those often used to classify small, medium and large firms. More precisely, we divide firms in six groups: firms with less than 20 employees, firms with 20-40 employees, firms with 41-100 employees, firms with 101-250 employees, firms with 251-500 employees and more than 500 employees. This table is useful to understand whether a reasonable number of small and medium firms grow into large firms. We find that very few firms are characterized by large increase in size. More worryingly, there are more cases of firms with 41-100 employees and with 251-500 employees in 1991 that have moved to a lower size class than moved up. Finally, there are few instances of newly established large firms (i.e., with more than 500 employees). Firms established between 1992 and 1998 are characterized by larger size in 2005 than those firms established after 1999.

Table 3C: Size of Firms (1991-2005)

EMPLOYEES In 1991:	EMPLOYEES in 2005						OUT	
	<20	20-40	41-100	101-250	251-500	>500	(92/98)	(99/05)
<20	34	20	2	0	0	0	36	8
21-40	17	24	19	2	0	0	29	8
41-100	3	19	35	10	0	1	23	10
101-250	1	0	7	37	17	3	24	11
251-500	0	0	1	26	32	9	22	11
>500	0	0	0	6	12	46	15	20
IN(92/98)	31	24	15	8	6	2	7	7
IN(99/05)	50	18	9	12	8	1	.	2

The analysis above suggests that differences in efficiency tend to be rather persistent over time. Similarly, there are no many instances of small and medium firms that have grown into larger companies. These two findings might be related to the extent that small firms are characterized by permanent lower productivity, thus struggling to increase their sizes. Even at firm-level, the picture that emerges is that there is a large inertia in the relative efficiency and competitiveness of manufacturing companies.

3.2. Determinants of Firms Productivity

We try now to shed some light on what firms' characteristics can explain productivity changes. We estimate a model where the dependent variable is growth in labour productivity and the explanatory variables include R&D intensity, innovation, labor skills, six size dummies (one

for each of the group size used in Table 3C) and geographic markets dummies (i.e. local, national and international markets). In order to minimize problems of reverse causality (e.g. more efficient firms decide to hire people with a degree), we include one-year lag of the explanatory variables wage, labor skill and R&D intensity.

We report the results in Table 4. They confirm the positive effect of innovation and labour quality on productivity changes. Most of the explanatory variables have a stronger effect in the period 1990-1998 than for the following period. The overall fit of the model is also higher for the first period. This could be consistent with the figures reported in the Columns OUT in Table 3B: Less productive firms (usually small firms) have already been thrown out of the market by the late nineties and there are not strong shake out after 1999. Size dummies show that labor productivity of large firms (group size 3, 4 and 6) increases at a faster pace than small firms (note that the reference group is firms with less than 20 employees). This result is not confirmed in the second column. Productivity changes of local firms (dm_loc = 1) and international fims (dm_int = 1) are respectively lower and higher than those of the firms that operate at national level (reference group).

Overall, these findings are consistent with the view that productivity growth is the result of firm-level investments in research and human capital. Firms exposed to tougher competition needs to run faster than local small business.

Table 4: Labour Productivity Changes (p-values in parenthesis)

Dep Vbl: Δlab_pr Variable:	1990-1998 (1)	1998-2006 (2)
lab_pr (lag)	-0.273	-0.181
	(0.000)	(0.000)
rd_int (lag)	0.256	0.131
	(0.361)	(0.585)
dm_inno	0.036	0.012
	(0.000)	(0.214)
wage (lag)	0.151	0.074
	(0.000)	(0.000)
skill (lag)	0.218	0.136
	(0.000)	(0.006)
group_size_2	0.002	-0.001
	(0.879)	(0.936)
group_size_3	0.024	-0.001
	(0.158)	(0.923)
group_size_4	0.033	0.019
	(0.059)	(0.185)

group_size_5	0.050	0.002
	(0.009)	(0.892)
group_size_6	0.036	-0.002
	(0.102)	(0.927)
dm_loc	-0.031	-0.007
	(0.011)	(0.501)
dm_int	0.032	0.045
	(0.003)	(0.000)
Ind. Dummies	Incl.	Incl.
Time dummies	Incl.	Incl.
N. obs.	10,833	11,299
R^2	0.12	0.08

3.3. Characteristics of Firms that exit

To get a better understanding of what characteristics make a firm more successful, we now complement the analysis above with the study the probability of death. We divide firms according to two groups: the firms that exit and those who stay. Exit firms are those firms that leave the market in the next three years (i.e., there are up to three observations for each exit firm). Firms that stay are those firms who never exit the ESEE (not even for attrition). We have decided not to include firms that exit the survey in the control group as it is possible that some of those actually close down. Table 5 compares several characteristics of the two groups (labour force, productivity and innovation) using a test of difference in means and the U-test[5]. The null hypothesis that the firms that stay and the exit firms do not differ can be rejected for all the variables considered.

Table 6 reports the estimated coefficients of a logit model aimed at assessing the relative importance of (some of) the variables reported in Table 5 in explaining the probability of exiting an industry. The three columns refer to the period 1990-1998, 1998-2006 and 1990-2006, respectively. Exit in period *t* is predicted using the variables in *t-1*: this allows minimizing problems of reverse causality. The Partial Effect at the Average (PAE) reported below the table shows the change in probability of exiting the market for a standard deviation of each continuous variable (or a change from 0 to 1 for a dummy variable), keeping all the other variables fixed at their averages.

Table 5 Characteristics of Exiting Firms (* p-values)

Variable Description	Variable	Observ. Stayers (1)	Observ. Exiters (2)	Mean of (1) (3)	Mean of (2) (4)	Test diff means* (5)	U-test* (6)
Gross Profits	gross_π	14327	1402	9.969	1.804	0.00	0.00
Ln of Employees	ln_emp	14387	1440	4.169	3.529	0.00	0.00
Growth of Employees	gr_emp	12577	1176	0.009	-0.087	0.00	0.00

[5] The U-test, also known as the Mann-Whitney-Wilcoxon test, is a non parametric test for assessing whether two independent samples of observations come from the same distribution.

Labour productivity Ln(VA/Hours)	lab_prod	13475	1187	9.843	9.341	0.00	0.00
Temporary worker	lab_temp	14379	1440	3.38	7.06	0.00	0.05
Ln of wages	ln_wage	13961	1282	9.470	9.226	0.00	0.00
R&D intensity	rd_int	14336	1445	0.715	0.545	0.02	0.00
R&D activity dummy	dm_rd	14360	1455	0.357	0.194	0.00	0.00
Innovation dummy	dm_inno	14433	1464	0.426	0.226	0.00	0.00
Percentage of employees with a degree	Skill	14309	1456	10.2	8	0.00	0.00

Table 6. Probability of Exit – Logit Regression (p-values in parenthesis)

Variable	1990-1998 (1)	1998-2006 (2)	1990-2006 (3)
Gross_π	-0.032	-0.037	-0.036
	(0.000)	(0.000)	(0.000)
Ln_emp	-0.260	-0.098	-0.188
	(0.000)	(0.231)	(0.002)
gr_emp	-1.830	-1.998	-1.711
	(0.000)	(0.000)	(0.000)
lab_prod	-0.447	-0.099	-0.194
	(0.001)	(0.451)	(0.076)
lab_temp	1.764	2.603	2.068
	(0.002)	(0.000)	(0.000)
Ln_wage	0.312	0.456	0.272
	(0.269)	(0.122)	(0.231)
dm_inno	-0.731	-0.861	-0.757
	(0.000)	(0.000)	(0.000)
dm_loc	0.088	0.028	0.081
	(0.598)	(0.887)	(0.561)
dm_new	0.769	0.293	0.591
	(0.000)	(0.246)	(0.000)
Ind. Dummies	Inc.	Inc.	Inc.
Time dummies	Inc.	Inc.	Inc.
N.obs	5,046	8,651	12,880
Pseudo-R^2	0.22	0.18	0.21

Partial Effect at the Average (PEA) for column (3)

Variable	gross_π	ln_emp	gr_emp	lab_prod	lab_temp	ln_wage	dm_inno	dm_loc	dm_new
PEA	-2.50%	-1.60%	-1.80%	-0.90%	1%	0.70%	-4%	0.50%	3.40%

From the previous Tables we can infer that less productive and less profitable firms are more likely to exit the market. Even if this is somehow tautological, still Baily et al (1992) find that "*a surprising number of high-productivity plants also exit the industry*". Our results suggest that selection is mainly on profitability than productivity. The coefficient of lab_prod is not statistically significant in the period 1998-2006. Introducing a process or a product innovation is the single most important factor in explaining exit/survival: introduction of an innovation in period *t-1* reduces the probability of exit in period *t* by 4%. Firms with a higher percentage of temporary workers are more likely to exit the market.[6] Firms that serve local markets or newly born firms are more likely to exit (some of these effects are not statistically significant). These results are the in line with those reported in Table 4.

3.4. Characteristics of New Entrant

Tables 3 and 4 show that newly born firms have lower productivity levels than other firms in the market. Quite astonishing is the fact that these lower performances are still found many years after being established. Baily et al (1992) find that newly born firms enter with rather low productivity but that they gradually caught up to the average level before they are 10 years old. This section tries to give some more evidence of this issue. Tables 7A and 7B are computed dividing firms into two groups: firms born 5 years ago vs. a control group of firms established more than 5 years ago (Table 7A) and firms established 10 years ago vs. a control group of firms that are more than 10 years old (Table 7B). This implies that more than one observation is used for those firms that enter the control group in each table (in fact, a firm can be 5 years old only once but it will be more than 5 years any year after that). Given that firms will be 5 years old in different point in time (e.g. two firm established in year 1990 and 1998 will be 5 years old in 1995 and 2003, respectively), we have then normalized the continuous variable (but not the dummies) by the yearly industry mean to reduce cyclical effects. This explains why the average values of the first six variables for the control group (column (1) in Table 7A and 7B) are very close to one.

Table 7A – Firms born 5 years ago vs firms born more than 5 years ago

Variable Description	Vbl. Name	More 5yr old (1)	5 yr old (2)	Mean of (1) (3)	Mean of (2) (4)	Test dif means* (5)	U-test* (6)
Gross Profits	gross_π	25502	1063	1.001	1.008	0.82	0.53
Labour productivity	lab_prod	22828	936	1.007	0.785	0.00	0.00
Temporary worker	lab_temp	25363	1056	0.995	1.220	0.00	0.08
Wages	ln_wage	24264	981	0.989	0.830	0.00	0.00
R&D intensity	rd_int	25224	1065	1.021	0.608	0.00	0.00
Percentage of employees with degree	Skill	25600	1087	0.975	0.871	0.01	0.00
Innovation dummy	dm_prod	25781	1090	0.424	0.368	0.00	0.00
Local firms	dm_loc	25782	1089	0.280	0.385	0.00	0.00

[6] This result is in line with Dolado and Stucchi (2007) who find that high shares of temporary contracts decrease firms' productivity.

International firms	dm_int	25782	1089	0.292	0.199	0.00	0.00

Table 7B – Firms born 10 years ago vs firms born more than 10 years ago

Variable Description	Vbl. Name	More 10yr old (1)	10yr old (2)	Mean of (1) (3)	Mean of (2) (4)	Test diff means* (5)	U-test* (6)
Gross Profits	gross_π	20603	903	1.002	0.996	0.85	0.57
Labour productivity	lab_prod	18461	812	1.005	0.845	0.00	0.00
Temporary worker	lab_temp	20491	891	0.999	1.131	0.05	0.01
Wages	ln_wage	19666	853	0.992	0.824	0.00	0.00
R&D intensity	rd_int	20380	893	1.015	0.775	0.01	0.00
Percentage of employees with degree	Skill	20660	920	0.978	0.930	0.22	0.00
Innovation dummy	dm_prod	20806	916	0.441	0.365	0.00	0.00
Local firms	dm_loc	20809	916	0.256	0.402	0.00	0.00
International firms	dm_int	20809	916	0.313	0.207	0.00	0.00

The main finding is that new firms are less productive and innovative than other firms even 10 years entering the market. Comparing columns (4) of the two tables, we see that there is a certain convergence between new and old firms but the pace is slow. For instance, the productivity of firms established 5 and 10 years ago is 78.5% and 84.5% of the old firms, respectively. The only dimension in which new firms do not differ from the old ones is profitability. This is probably due to the fact that new firms are mainly local business less exposed to competition (see dummy local). Overall, new firms either drop out or, if they survive, they are no any better than the old one. Only with respect to profitability the new firms are similar to the old ones.

4. Conclusion

This paper analyses employment and productivity dynamics of the Spanish economy during the period 1995-2008. We first show that the aggregate productivity in Spain did not growth as much as the major EU countries (with the only exception of Italy). We also document that the Spanish economy witnessed only a minor structural change in this period, with the manufacturing sector shrinking in favour of the construction sector.

We then took a closer look at the manufacturing sector. We observed how the manufacturing industries that present the higher growth rates are those connected with the construction sector. Interesting, those industries presents also the lowest productivity growth rates. These results seem to sustain the idea that the Spanish economy is biased towards low tech production, both of goods and services, compared with the economies of reference (see Castany and Xifré, 2009). However, there is not much dispersion in productivity growth among different industries (with the exception of textile).

When we turn our analysis to firm-level data, we do uncover a lot of dispersion in productivity among different manufacturing firms. Moreover, these differences are persistent over time. We exploit this dispersion to find that productivity growth is the result of firm-level investment in research and human capital, and exposition to tough competition. Moreover, we find that new firms are less efficient and innovative than older firms even after 10 years since their establishment.

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