Industrial Employment Growth in Spanish Regions: the Role Played by Size, Innovation, and Spatial Aspects.

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Key words: Small firms; Innovation; Regional Growth; Gibrat´s Law

1. **Introduction**.

The role played by small and medium size firms in job creation and economic growth has developed an extensive international literature, specially after Birch' statement that "SMEs provide the highest share of economic employment"[1]. Many studies have tried to test the relationship between employment growth and firms' size from very different perspectives.

Probably, one of the most important regional economic analysis of the influence of firms' size on employment is Camagni & Capello (1999). Those authors test the assumption that regions with high share of small firms have a better behaviour than other regions in Italy.[2]

At the same time, and focusing on microdata level, one of the usual ways of studying this size-employment growth relationship is to test if Gibrat's law of "proportionate growth" is supported. Gibrat's hypothesis implies that "the probability of a given proportionate change in size during a specified period is the same for all firms in a given industry regardless of their size at the beginning of the period". Many authors have tested this law for different countries[3], and interesting surveys on this matter are found in Wagner (1992); Geroski (1995); Sutton (1997); or Caves(1998).

Parallel to this analysis, size influence has also been emphasized on the innovative process of firms and regions. Numerous empirical studies have emerged identifying small firms as the engines of technological change and innovative activity, at least in some industries and regions[4]. Camagni & Capello (1999) have also studied the role played by size on regional innovation systems, and following this relationship the relevance of innovation on regional economic development.

[1] Birch (1979).
[2] They state that "The good performance of regions (Italy) with a high share of small firms contrasted with the poor and decreasing rate of growth of the traditional large firms of the North-Western part of the country. The so called "Third Italy" phenomenon... a success which was explained by the high flexibility of small firms with respect to market volatility, their innovativeness in terms of costumised production, and the existence of district economies accompanying territorial specialisation" Camagni & Capello (1999).
[3] Calvo (2002, 2004) for the Spanish case.
[4] Audretsch & Vivarelli (1994); Pavitt et al (1987); Rothwell (1989). Fariñas et al. (1992), Calvo (1996, 2000a; 2000b)).

Studies about this relationship focusing on microdata have also developed an extensive literature[5], some of the articles using Spanish data. Fariñas et al (1992) or Calvo (2000a; 2000b), among others, have analysed, at firm level, the negative relationship between size and innovation effort, meanwhile Calvo (2003, 2004) have tested the positive interaction between innovation and firms behaviour, focusing on employment growth and export activity.

Two theoretical assumptions can be extracted from the literature mentioned, and be tested in this article: a) there is a negative relationship between firms' size and their growth, especially in employment terms. Or, *small firms grow faster than large ones*. This supposition has a direct translation to regional analysis: *regions with the highest share of small and medium size firms should be the ones with the highest growth*; and b) there should be a negative relationship between firms' size and innovation activity, and, following a) assumption, a positive interaction between innovation and the growth of firms. In other words, *small innovators grow faster*. The application of this assumption to regional economics is also clear: *Those regions with a higher innovative attitude should be the ones with a better economic evolution.*

The present article tests both theoretical conjetures from two complementary points of view: first of all, it studies the relationship, for seventeen Spanish regions, between industrial evolution and the share of small firms and the presence of high and medium-high technological industries; secondly, it introduces microdata in order to know if the assumptions made are true at microeconomic level. In this second stage, regional variables are also included in order to find if regional aspects play a role in the survival and growth of firms.

The article is structured as follows: its second section describes the relationship between the evolution of employment and productivity in Spanish regions and the industrial structure, focusing on the role played by small and medium size firms presence; the third section relates innovation, measured as the share of high and medium-high technological industries, and Spanish regional growth; the fourth section introduces microlevel data in order to estimate the significance of size and innovation in the employment growth of firms, also including regional variables for better explain the changes in employment. The estimation follows a

[5] Licht and Nerlinger (1998); Storey and Tether (1998); Almus and Nerlinger (1999, 2000); or Freel (2000).

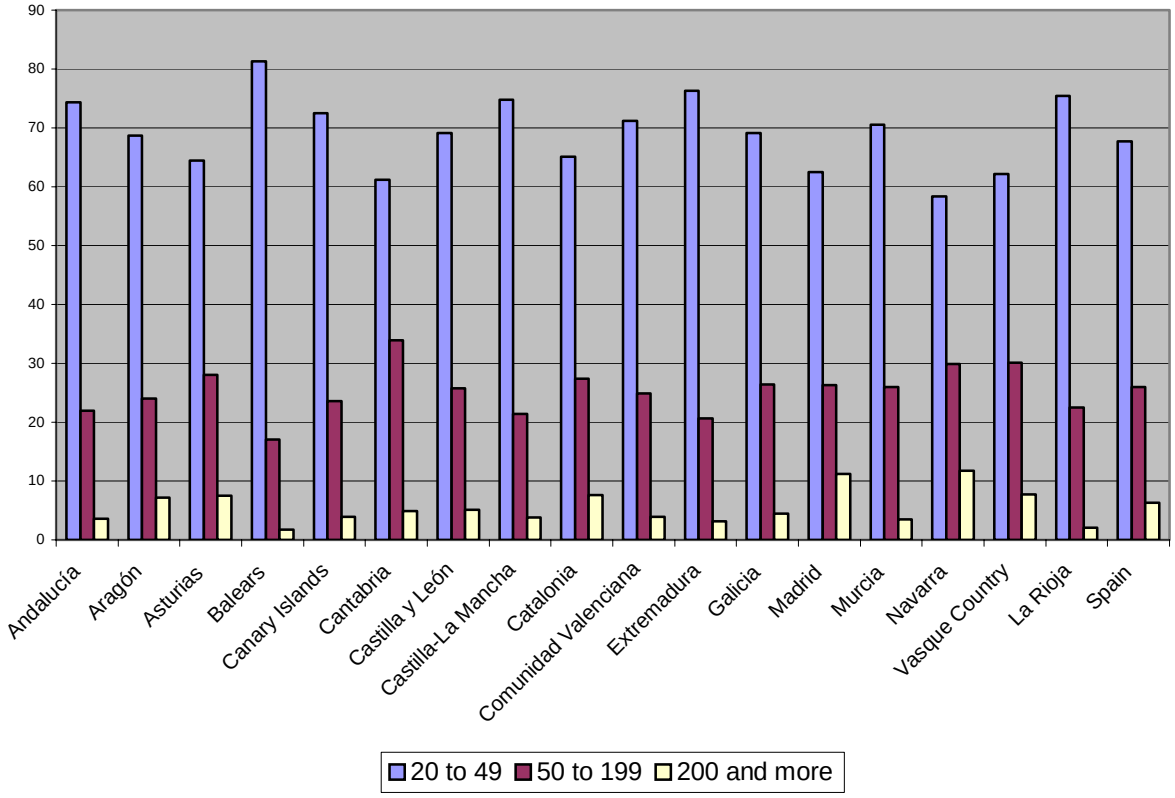
Heckman's model where survival and employment growth are estimated together by Maximum Likelihood methods; finally, the fifth section concludes the study.

2. **Spanish Regions' Growth and Industrial Structure.**

1.1. *Regional Industrial Structure*.

The Structure of Spanish Industry has been classified in this article following two different criteria: first of all, Figure 1 reports the distribution of industrial firms by size and region in 2002[67]; secondly, Figure 2 shows the relevance of the industrial sector in regional employment.

Figure 1.- Distribution of Industrial Firms by Size. 2002.

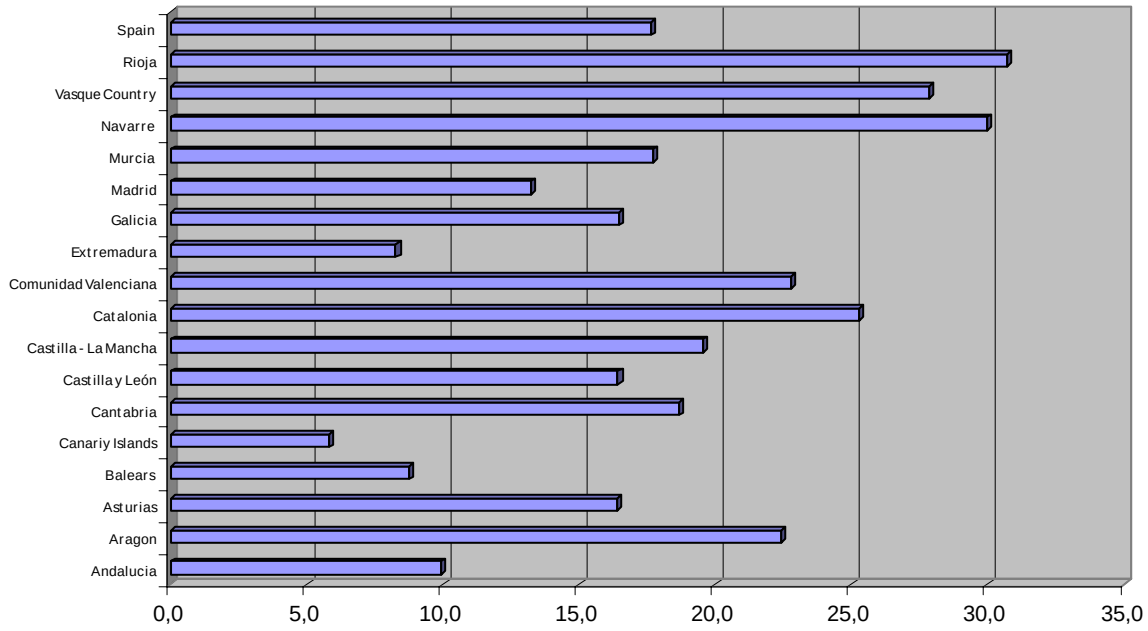


[6] The distribution of Spanish regions is not homogeneous. This means that we find big regions in terms of population and employment, such as Andalucia, Aragon, Catalonia, Comunidad Valenciana or Madrid, together with very small regions such as Asturias, Cantabria, la Rioja or Murcia. This classification depends on political criteria, since the data are classified by "Autonomous Communitties".

[7] Following Camagni & Capello (1999) methodology, we consider small firms those with employment between 20 and 49 employees.

Small firms represent two thirds of Spanish industrial employment, and very important shares in all regions. But distributional differences are also significant. Three of the most industrialised regions, as we will see in next Figures, Catalonia, the Vasque Country and Navarre, along with Madrid, Asturias and Cantabria, have shares of small firms participation below the national mean; on the contrary, the less industrialised regions, Andalucia, Castilla-La Mancha, and, above all, Extremadura, joined by an industralised region, La Rioja, show very high small firms percentages.

Figure 2.- Share of Industrial Employment. 2002.



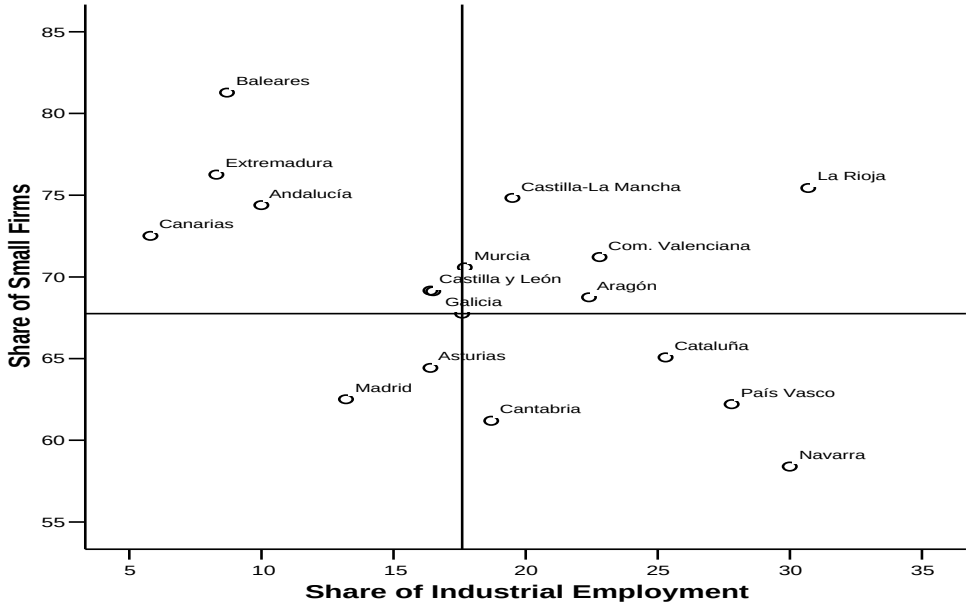
Spanish regions could be divided into three groups depending on the relevance of industry on their employment structure: Group I could be called “industrialised regions”, where more than twenty per cent of the employees of the region worked in 2002 on the industrial sector: La Rioja, Navarre, the Vasque Country, Catalonia, Aragon, and Comunidad Valenciana belong to this group. Group II, called “semindustrialised regions”, would be integrated by those regions where the industrial employment is around the national mean (17.6%): Castilla-La Mancha, Cantabria, Castilla y León, Murcia, Galicia, and Asturias, conform this group. Finally, Group III, the “less industrialised regions”, is composed by those regions where the industrial employment is around 10 % of total employment of the region: Andalucia and Extremadura. Three communitties present special characteristics in order to be classiffied:

Madrid, where a big share of Spanish public services is concentrated; and Balearic Islands and Canary Islands, which most important industry is tourism[8].

Now, we can cross both clasiffications and obtain a characterisation of Spanish regions dividing them in four groups:

a. *Less industrialised regions supported by small firms*. Composed by those regions where the share of small firms is higher than average but industrial employment is lower.
b. *Industrialised regions based on small firms*. Regions with higher than average share on small firms and industrial employment.
c. *Less industrialised regions based on large firms*. Regions with lower than average share on small firms and industrial employment.
d. *Industrialised regions based on large firms.* Regions with lower than average share of small firms but higher industrial employment.

Figure 3.- *Classification of Spanish regions depending on the share of industrial small firms and the share of industrial employment.*



[8] Nevertheless, Balearic Islands and Madrid are in the group of the highest income per head in Spain, well above national mean and over European Union (15 members) standard. Canary Islands belong to the opposite group, with an income per head below the national mean and far away from European average.

According to Figure 3, six regions can be classified as Group I, *less developed regions supported by small firms*: Balearic Islands, Canary Islands, Extremadura, Andalucia, Castilla y León and Galicia, the last two very close to national average. Four regions belong to Group IV, *industrialised regions based on large firms*: Catalonia, Vasque Country, Navarre, and Cantabria. Group II, *industrialised regions based on small firms* is composed by five regions: Murcia, Aragon, Comunidad Valenciana, Castilla-La Mancha and La Rioja. Finally, Madrid and Asturias belong to Group III, *less industrialised regions based on large firms*, but Madrid's special characteristics advice us to give it a different treatment.

If the first hypothesis assumed in the introduction is true, then the regions with the highest growth should be those classified in Groups I and, above all, Group II: industrialised regions with an important presence of small firms in their industrial structure.

1.2. *Spanish Regional Growth.*

The growth of Spanish regions during the period 1998 to 2002 is analysed taking into account three variables: Employment; and Productivity, measured as Gross Added Value at constant prices by employee. Table 1 presents the results for both variables:

Table 1.- *Growth of Employment and Productivity. 1998-2002.*

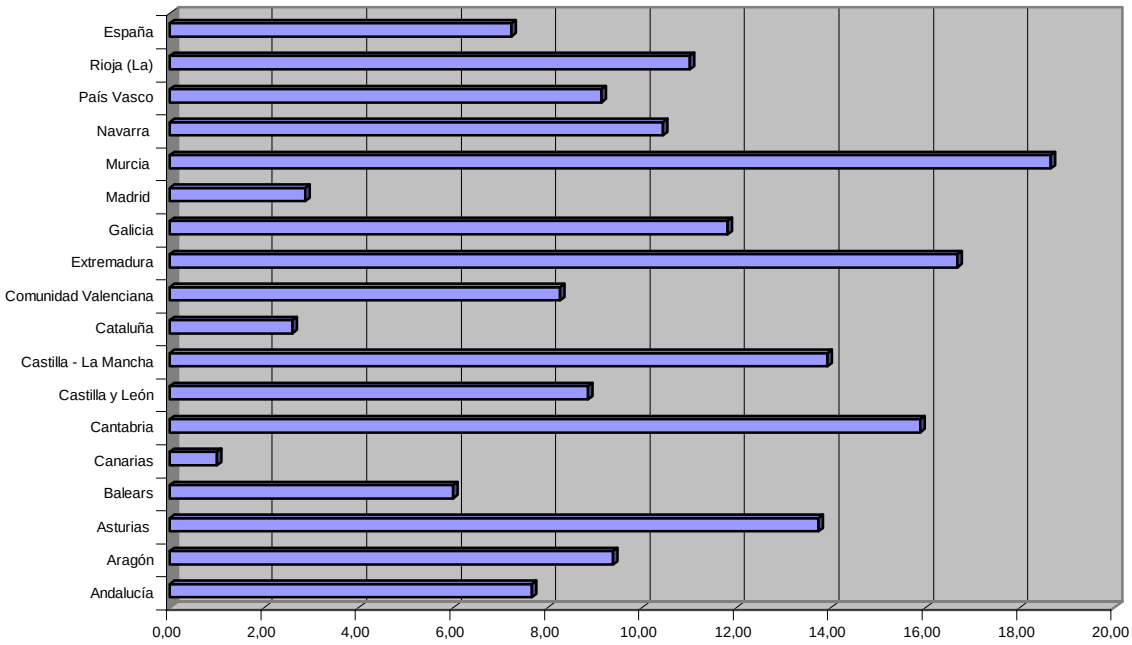
	Employment	**Productivity**
Andalucia	7,67	2,22
Aragon	9,38	-2,43
Asturias	13,74	-2,07
Balearic Islands	6,00	3,80
Canary Islands	1,00	9,91
Cantabria	15,88	-1,98
Castilla y León	8,85	2,19
Castilla - La Mancha	13,92	3,17
Catalonia	2,60	6,18
Comunidad Valenciana	8,26	-0,11
Extremadura	16,67	6,73
Galicia	11,81	5,19

Madrid	2,87	5,52
Murcia	18,65	3,83
Navarre	10,43	5,31
Vasque Country	9,14	5,96
Rioja (La)	11,01	0,63
Spain	7,23	3,54

(*) Rate of Growth measured as the value at 2002 minus the value at 1998, divided by the value at 1998.

1998 to 2002 was a good period for industrial employment in Spain, increasing 7.2 points during those 5 years. The number of people employed in the industrial sector grew in every Spanish region, but the differences were very significant: Two very important regions, Madrid and Catalonia, had rates which were less than half of the national mean; at the same time, some less industrialised regions grew at very high rates: Extremadura increased its industrial employment by 16.7%; Murcia by 18.7%; Castilla-La Mancha by 13.9%; and Asturias by 13.7%. Figure 4 graphs the results for all the Spanish regions.

Figure 4.- Rate of Industrial Employment Growth.
1998-2002



The second variable considered in the analysis of Spanish regional growth during the period is Productivity, measured as the Gross Added Value at constant prices by Employee. Its results are shown in Figure 5.

Figure 5.- Rate of Industrial Productivity Growth.
1998-2002

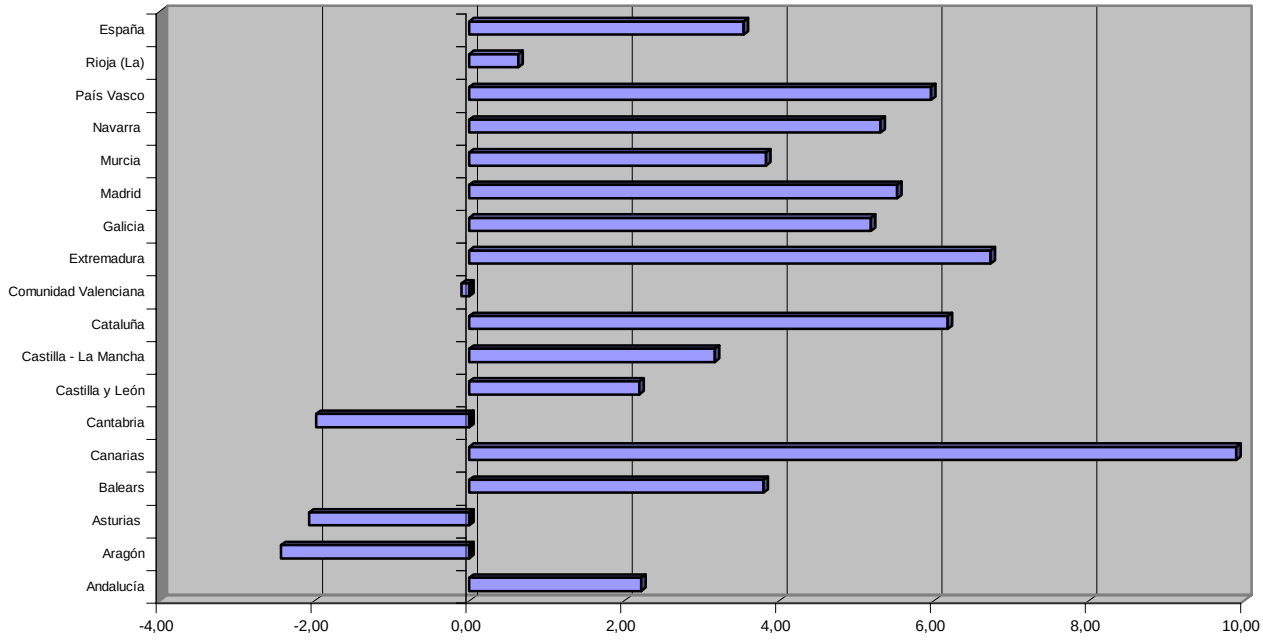


Figure 5 shows significant changes related to those obtained when we considered Employment. Three regions experience decreases in productivity: Aragon (-2,4%); Asturias (-2,07); and Cantabria (-1,98), meanwhile other regions reach high rates of growth, specially Canary Islands. At the same time, Madrid and Catalonia, two regions whose evolution in terms of employment was not very positive, increased their productivity well above national average.

As Camagni & Capello (1999) suggest "...good productivity performance may be achieved through different processes. It may take place through a restructuring process, when higher productivity growth is the result of severe employment cuts; or it may be the result of a real "virtuous cycle", where higher than average productivity growth generates good performance in both employment and output". Therefore "…regional development "patterns" need to be identified according to the trends of two indicators: employment growth (and in particular

relative employment growth) and productivity growth, the former representing a social problem and the latter explaining its causes and the future prospects of the local economy".

Following their methodological approach, we define relative employment growth (REG) of region *r* as:

$$REG_r = \frac{E_r^{02} / E_r^{98}}{E_n^{02} / E_n^{98}}$$

And, in the same way, relative productivity growth (RPG):

$$RPG_r = \frac{P_r^{02} / P_r^{98}}{P_n^{02} / P_n^{98}}$$

Where n denotes national average variable, and E and P are employment and productivity, respectively.

Adapting Camagni & Capello (1999) methodology to the Spanish case for the period we are considering, four possible patterns of regional evolution emerge from the combination of REG and RPG[9]:

a. *Virtuous cycle*, when a higher than average productivity growth generates good performance in both employment and output;
b. *Restructuring*, when higher productivity growth is reached through a less than average increase in employment[10] accompanied by good output performance;
c. *Industrial take-off*, when regions grow higher than average in employment terms, but they are not able to reach national productivity evolution.
d. *Deindustrialisation*[11], when lower than average increase in employment is not able to compensate the poor evolution of output, leading to losses in productivity.

Then, the economic performance of each region can be newly charted on a cartesian graph, as it is done in Figure 6.

[9] There is no regions in the *deindustrialisation* group defined by Camagni & Capello (1999). No one of the Spanish regions experienced an increase in employment and productivity under average at the same time during the period.
[10] Remember that there is not decreases in employment in the period, nor in output.
[11] The definition is different from Camagni & Capello's, as it can be seen in note 10.

Figure 6.- *Regional Patterns.*

Five regions evolve in a "virtuous cycle": the Vasque Country, Navarre, Galicia, Extremadura, and Murcia. Catalonia and Madrid, but also Balearic Islands and Canary islands, are inmersed in a restructuring process, with higher than average growth of productivity accompanied by a poor employment evolution. Andalucia, Castilla-La Mancha, Castilla y León and La Rioja support industrial take-off. Finally, Aragon, Cantabria and Asturias look like they are following a deindustrialisation process, with lower than average growth in employment accompanied by a decrease in productivity.

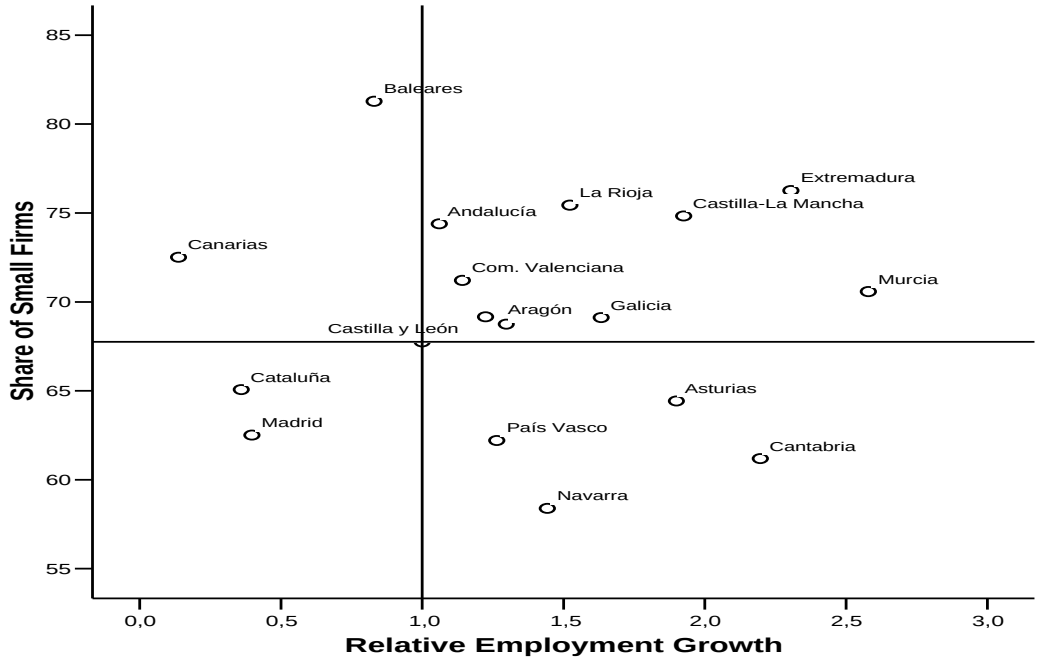
Now we can test the first hypothesis specified in the introduction by using the information of Figures 3 to 6.

If we adopt the regional patterns previously defined and assume a strict definition of the hypothesis, stating that "*industrialised regions with the highest share of small firms should be the regions with the highest growth*", the assumption is rejected, in employment and productivity analysis. Only a member of the *industrialised regions based on small firms*, Murcia, belongs to the *virtuous cycle*. The other regions of Group II are included in *take-off* (La Rioja, Castilla-La Mancha and Comunidad Valenciana), or *deindustrialization*, Aragon. In fact, I*ndustrialised regions based on large firms* are better represented in *virtuous cycle*, with the Vasque Country and Navarre as their representatives. Finally, it is surprising the

position of Catalonia in the *restructuring* area, with a higher than average growth of productivity accompanied by a lower increase in employment.

The results are very different if we use a softer hypothesis and affirm that "*regions with the highest share of small firms should be those with the highest employment growth, independently of the industrialisation degree of the region*" and graph the relationship between the share of small firms and Relative Employment Growth. As it can be see in Figure 7, most of the Spanish regions are drawn in the line that support the assumption: 9 regions have a higher than average share of small firms combined with a higher employment growth, meanwhile other two regions, Madrid and Catalonia, also support the assumption since they have a lower than average rate of employment growth and, at the same time, a lower share of small firms.

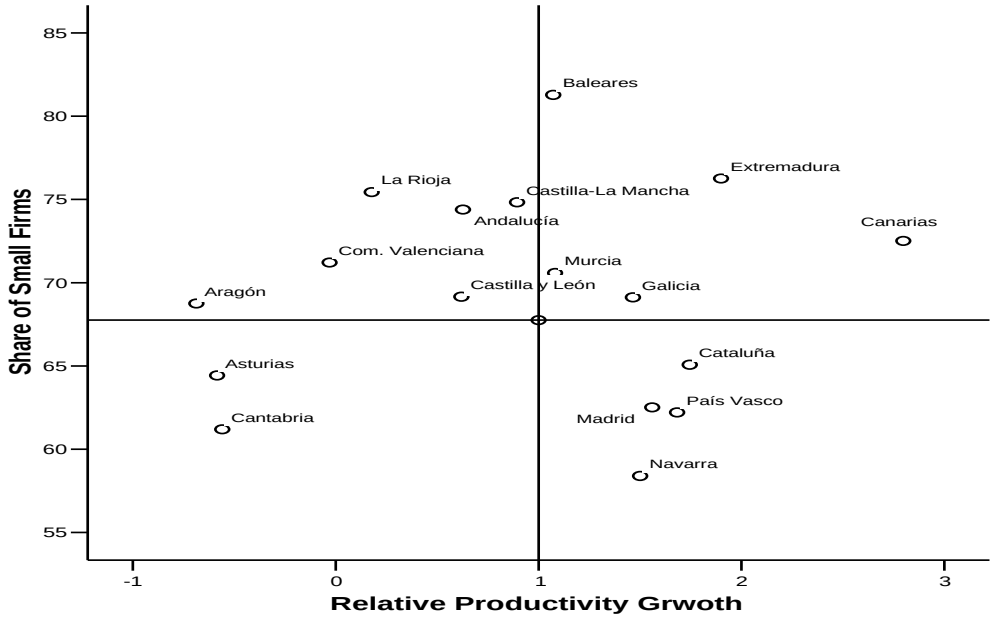
Figure 7.- *Share of Small Firms versus Relative Employment Growth.*



Finally, the softer hypothesis can be tested against Relative Productivity Growth. The assumption is rejected, as it is shown in Figure 8. Seven regions support the hypothesis, and ten rejected it. Especially relevant is the situation of the most developed Spanish regions: Catalonia, Madrid, the Vasque Country and Navarre are all of them in the area with higher

than average growth of productivity combined with a lower share of small firms, rejecting the conjecture.

Figure 8.- *Share of Small Firms versus Relative Productivity Growth*



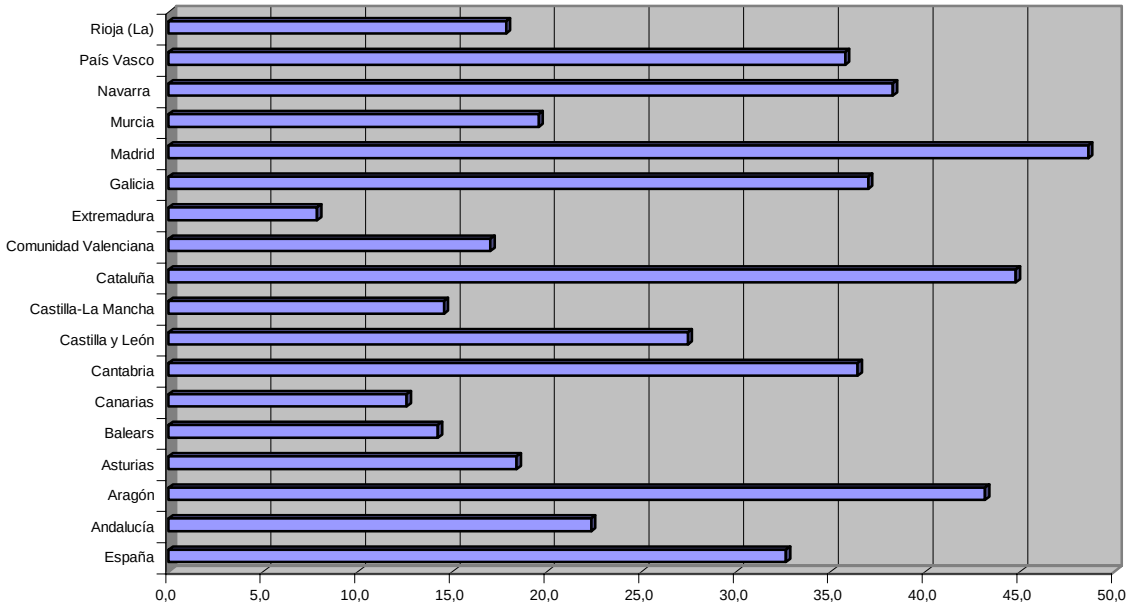
2. Spanish Regions' Growth and Innovative Attitude.

The second hypothesis proposed at the Introduction of the article supported the idea that there is a positive relationship between innovation activity and economic growth. Its application on regional studies means that *those regions with a higher innovative attitude should be the regions with higher growth*.

The variable selected in order to proxy the innovative attitude of Spanish regions is the share of high and medium-high technological industries in total industrial employment[12][13]. Its regional relevance is shown in Figure 9.

[12] Industries included on this group are defined in the Appendix.
[13] Other variables, specially R+D expenses as a percentage of the Gross Domestic Product, were also proved, but the results were very similar since this variable is highly correlated to high and medium-high industries share on employment.

Figure 9.- Share of High and Medium-High Technological Industries.
Employment. 2002



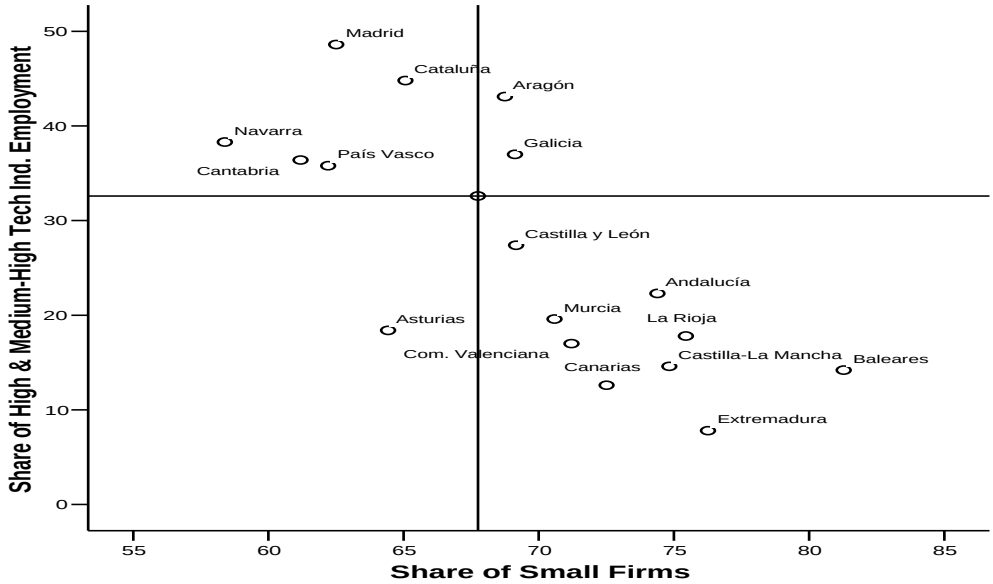
The presence of highly qualified industries in Spanish regions is very heterogeneous. The average, 32.6% of industrial employment, is largely surpassed by the most developed areas, such as Madrid (48.6), Catalonia (44.8), Aragon (43.1), Navarre (38.3), the Vasque Country (35.8) or Cantabria (36.4). On the other extreme, far below national average, are located Extremadura (7.8), Canary Islands (12.6), Balearic Islands (14.2) or Castilla-La Mancha (14.6).

Following Camagni & Capello (1999), our interest is also to identify the innovative regions characterised by a high share of small firms. In fact, they describe four areas to be tested by the data:

a) *"milieux innovateurs* area, characterised by high innovative attitude and a high share of small firms relative to national level;
b) *traditional local districts* area, where a greater than (national) average share of small firms is accompanied by a lower than average innovation rate;
c) *lagging large firms* areas, characterised by both a lower than average share of small firms and a lower than average innovation rate;

d) *innovative large firms* areas where, even though the number of small firms is lower than national level, the rate of innovation is greater, indicating that an innovative process is underway, driven by large enterprises"[14].

Figure 10.- *Share of Industrial Small Firms versus Share of High and Medium-High Technological Industries on Employment.*



There is a clear negative relationship between share of small firms and the relevance of high and medium-high technological industries in Spanish regions. There are only two regions classified in the *milieux innovateur* area, Galicia and Aragon, and no one in *lagging large firms*. Most of the Spanish regions belong to *traditional local districts* or *innovative large firm* areas.

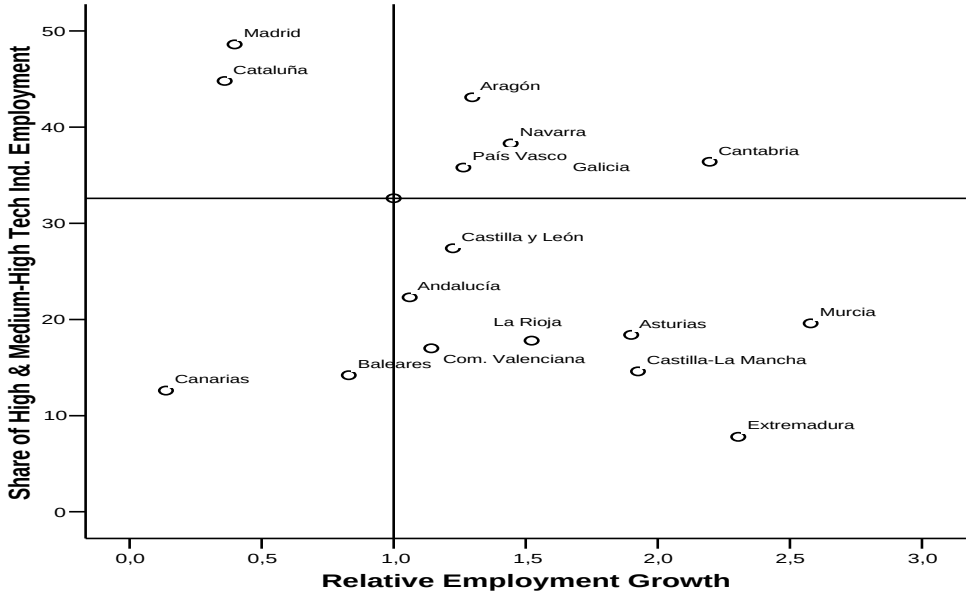
Finally, Figure 11 provides the graph relating industrial employment growth and innovative attitude of Spanish regions.

Five regions present a positive relationship between the share of technologically developed industries and employment growth. Galicia and Aragon, classified on the area with higher than average industrial employment increase and share of technological industries, are the only two that support the assumption made in the Introduction: they are located in *milieux*

[14] Camagni & Capello (1999)

innovateur areas and have a higher employment growth. The other three regions included in upper right hand side of Figure 11 belong to *innovative large firm* areas.

Figure 11.- *Relative Employment Growth versus Share of High and Medium-High Technological Industries on Employment.*



Ten regions reject the assumption of a positive relationship between innovation activity and regional industrial employment growth, since they are located in a line that cross Figure 11 from upper left hand side to lower right hand area.

3. **Analysis of the Influence of Size, Innovation, and Regional variables on Industrial Employment Evolution. Microdata level.**

As it was said at the Introduction, one of the usual ways of testing, at microlevel data, if SMEs experience a higher increase in employment is to test Gibrat's law of "proportionate growth", which states that "the probability of a given proportionate change in size during a specified period is the same for all firms in a given industry regardless of their size at the beginning of the period".

The studies testing Gibrat´s law have incorporated different variables, adding relevant information on the characteristics associated with employment growth, such as the *innovating activity*, under the assumption that innovators experience a higher increase in employment (Licht & Nerlinger (1998); Storey & Tether (1998); Almus & Nerlinger (1999, 2000); or Freel (2000); the *age* of the firm testing if the youngest grow bigger (Reid (1995); Harhoff et al (1998), Heshmati (2000) in an explicit way, or Almus & Nerlinger (2000) and Audretsch et al (1999) in an implicit one); *industrial technological development*, under the hypothesis that bigger growth occurs in more technologically developed industries (Almus & Nerlinger (1999, 2000), Harhoff et al (1990), Audretsch (1995), Audretsch et al (1999), or Freel, (2000)); and *agglomeration effects* (Wiseen & Huisman (2003)), supporting Gibrat's law rejection in urban areas, where small firms will grow faster, and, at the same time, the law's fulfilment in not urban areas, at least for large firms. Many of those variables have been included for the Spanish case in Calvo (2004).

The present section test Gibrat's law using Spanish data taking into account regional variables. The data come from the *Firms Strategic Behaviour Survey* for the period 1998-2002. A sample of 1255 firms is used: 1161 of them survive, and, consequently, 94 disappeared over the 5 year period. A typical Gibrat's equation is estimated, where last period employment depends on first period employment and the rest of variables (innovation, age, legal liability, industry technological development, and regional variables). Because of sample attrition, we use the procedure proposed by Heckman (1979), estimating by maximum likelihood, including a probit survival equation.

3.1. **Model.**

In order to test Gibrat's law we use a typical equation in which employment in the last period (2002) is dependent on employment of the first period (1998) and the rest of variables. The original equation is:

$$\log S_{i02} = \beta_0 + \beta_1 \log S_{i98} + \Sigma_j \beta_j X_j + \varepsilon_{i02} \qquad (1)$$

Where S_{i01} is the employment of the i_{th} firm in 2002; S_{i98} is the employment of the same firm in 1998, and X_j are the other variables.

Gibrat's law holds if β_1 is not significantly different from 1. Small firms have grown more if β_1 is less than 1, and big firms will have grown more if β_1 is greater than 1.

The estimation of the β's by least squares with existing firms in 2002 runs the risk of bias arising from sample attrition. The appropriate econometric method to solve this problem is a two-step method suggested by Heckman (1979). This requires the introduction of an additional explanatory variable in the least squares regression – the inverse Mill's Ratio – obtained from a probit model on firm's survival, in the least squares regression for surviving firms. The probit equation is:

$$SUPERV = \varphi_0 + \varphi_1 \log S_{i98} + \Sigma_j \varphi_j Y_j + \mu_{i02} \qquad (2)$$

Where SUPERV takes 1 if the firm has survived until 2002, and 0 if it has closed. Y_j are the other variables included in the equation[15].

Although this Heckman estimator is consistent, it is not fully efficient. Efficient estimates can be obtained by applying an iterative procedure that uses the estimates from the Heckman procedure as starting values and will lead, on convergence, to maximum likelihood estimates (Maddala (1983), Weiss (1998)). Therefore, in order to test Gibrat's law we jointly estimate equations (1) and (2) by Heckman procedure using maximum likelihood methods.

Employment has been defined adopting four different proxies:

a. $PERTOT_i$ is total employment of the ith firm at the end of the year, independently of working hours.
b. $ASATC_i$ is only composed by employees with full working hours of the ith firm.
c. $PERS1_i$ is a weighted employees' measure of ith firm. It is equal to employees with full working hours, plus half of employees with partial working hours plus one third of temporary employees.
d. $PERS2_i$ is a weighted measure of firm's human capital. It is the sum of employees with a degree (bachelors and engineers) plus half of employees with an intermediate degree, plus one third of the rest of employees.

[15] $X_j = Y_j$ in Heckman model to estimate the inverse Mill's ratio. On the Maximum Likelihood procedure it is possible $X_j \neq Y_j$, but we have preferred to maintain the equality.

The independent variables included in the equations are defined in the Appendix. But the four regional variables introduced in the equations deserve a special mention: The first one (PIBPC) proxies the wealth of the region. So, we will expect a positive sign associated to this variable on both equations; the second one, EMPINDSH, should have a positive sign on its estimator, since we could suppose a better behaviour of firms on industrialised regions; PARPYME is related to the relevance of small firms on regions employment. If size and growth have a negative relationship at macroeconomic regional level, as we supposed at the introduction, then the sign of the estimator should be positive; finally, IDPIB proxies the innovation effort of Spanish regions. We could assume a positive sign associate to this variable on growth and survival if the second hypothesis of the introduction is true.

3.2. **Data**.

The data used in this section come from the *Firms Strategic Behaviour Survey (ESEE)*. This is a survey of Spanish manufacturing firms that began in 1990 and is conducted annually for about 2000 firms[16]. We use a sample of 1255 firms[17]: for 1161 there is full information for the whole period, and 94 can be considered as firms that have exited the market (closed).

Some interesting results can be extracted from the comparison of survival and disappearing firms for the different definitions[18]: first, surviving firms are bigger than disappearing for all the definitions; secondly, the human capital employment definition implies smaller statistics, as we would expect, since this definition weights employees depending on the degree obtained; finally, there are not big differences between non weighted and weighted employees (PERS1 and PERTOT variables). This means that most of the employment of those firms is composed by employees with full working hours, as we can also trust if we look at the small differences between ASATC and PERS1.

[16] The questionnaire and general results of ESEE can be found in www.funep.es/PIE/ESEE/esee1.htm.
[17] The original size of the sample is 1283, but there are problems of information in any of the variables related to 28 firms. That is why Table 2' statistics use the first sample.
[18] The statistics of the employment variables are upon demand.

3.3. **Results**

Table 2.- *Estimation Results*.

	LPERS1	**LPERS2**	**LASATC**	**LPERTOT**
Gibrat's equation				
Constant	.529***	.158	.621***	.224
	(3.70)	(1.09)	(3.69)	(1.59)
Log S_{i98}	.937***	.971***	.934***	.966***
	(103.77)	(105.74)	(88.82)	(106.0)
Log AGE	-.078***	-.047***	-.093***	-.047***
	(4.95)	(3.02)	(5.00)	(3.03)
PROPDI	.062***	.037*	.038	.018
	(2.73)	(1.64)	(1.44)	(0.82)
EP	.031	.038*	.015	.039*
	(1.46)	(1.78)	(0.61)	(1.86)
KEXT	$4*10^{-4}$	$1*10^{-4}$	$6*10^{-4}$ *	$1*10^{-4}$
	(1.28)	(0.55)	(1.72)	(0.38)
INNPRO	.001	-.019	.028	-.015
	(0.08)	(0.83)	(1.10)	(0.69)
INNPRC	.093***	.097***	.108***	.096***
	(3.93)	(4.03)	(3.78)	(4.08)
TECHIGH	.052*	.074**	.046	.055*
	(1.78)	(2.50)	(1.36)	(1.92)
TECMED	.019	.034	.003	.039*
	(0.80)	(1.44)	(0.14)	(1.68)
PIBPC	$-1*10^{-5}$	$-9*10^{-6}$	$-2*10^{-5}$	$1*10^{-5}$
	(1.25)	(0.74)	(1.50)	(0.94)
EMPINDSH	.005**	.004	.006**	.004*
	(2.25)	(1.54)	(2.15)	(1.75)
PARPYME	-.001	$-8*10^{-4}$	-.001	-.002
	(0.31)	(0.16)	(0.21)	(0.30)
IDPIB	.081	.063	.101	.077
	(1.29)	(1.09)	(1.38)	(1.23)
Select equation				
Constant	.793	.698	.897	.711
	(0.93)	(0.83)	(1.05)	(0.84)
Log S_{i98}	.074	.032	.092*	.063
	(1.36)	(0.61)	(1.72)	(1.14)
Log AGE	.125	.149*	.108	.137
	(1.43)	(1.76)	(1.22)	(1.60)
PROPDI	.104	.095	.114	.089
	(0.80)	(0.74)	(0.88)	(0.69)
EP	-.273**	-.253**	-.277**	-.271**
	(2.21)	(2.09)	(2.24)	(2.20)
KEXT	-.003*	-.003*	-.004**	-.003*
	(1.85)	(1.79)	(1.99)	(1.75)
INNPRO	.285**	.295**	.278**	.290**
	(2.08)	(2.19)	(2.03)	(2.11)
INNPRC	.752***	.732***	.745***	.757***
	(5.74)	(5.67)	(5.71)	(5.77)
TECHIGH	.179	.232	.172	.182
	(1.00)	(1.31)	(0.96)	(1.02)
TECMED	.182	.234*	.175	.186
	(1.33)	(1.74)	(1.28)	(1.37)
PIBPC	$5*10^{-6}$	$3*10^{-5}$	$8*10^{-7}$	$9*10^{-6}$
	(0.08)	(0.41)	(0.01)	(0.13)

EMPINDSH	-.008	-.011	-.007	-.009
	(0.55)	(0.73)	(0.50)	(0.59)
PARPYME	$-8*10^{-4}$	-.002	-.003	.001
	(0.02)	(0.06)	(0.09)	(0.03)
IDPIB	-.195	-.297	-.174	-.209
	(0.52)	(0.78)	(0.46)	(0.55)
Rho	.036	.005	.043	.022
Sigma	.341	.341	.399	.337
Lambda	.012	.002	.017	.007
Log likelihood	-687.235	-695.461	-870.594	676.074
LR test[(1)]	.06	.00	.05	.02
Test for $\beta_1 = 1$[(2)]	49.3	9.73	39.54	14.02
Nº observations	1255	1252	1255	1255
Censored	94	96	94	94
Uncensored	1161	1156	1161	1161

**** Significant at 99%; ** Significant at 95%; * Significant at 90%..*
t- values in parentheses.
[(1)] *LR test of independent equations (rho=0). Chi-square(1).*
[(2)] *Chi-square (1)*

Gibrat's law is rejected independently of the employment definition. The estimator associated to the logarithm of employment in 1998 is always smaller than 1, meaning that *small firms have grown bigger than large ones.* At the same time, process innovation is also significant, supporting the assumption of a positive relationship between innovation and growth. Firm's age is also important in the growth equation, been negative the sign of its estimator.

From the point of view of the survival equation, innovation, both process and product, play a positive role. And standardisation of the product has associated a negative relationship. Therefore, we can affirm that innovating firms with a differentiate product have a bigger probability of survival.

Finally, it does not look like regional variables play an important role in the survival and growth of Spanish firms during the period analysed. Only the share of industrial employment is significant in three of the four equations.

4. **Conclusions**.

Two assumptions were made at the beginning of this article: first, there is a negative relationship between the size of firms and their growth, especially in employment terms; secondly, innovation plays a positive role in the growth of firms.

The assumptions have been tested using two different approaches: first of all, data from seventeen Spanish regions have related their industrial employment growth with the share of small firms and the presence of high and medium-high technological industries; secondly, microdata have been selected in order to estimate the significance of size and innovation on employment growth, also including regional variables for better explain the changes in employment. All the data are referred to the period 1998-2002.

Size results at the regional level depend on the strictness of the assumption we assume: if we state that "*industrialised regions with the highest share of small firms should be the regions with the highest growth"* then the hypothesis is rejected. On the other side, if we affirm that *"regions with the highest share of small firms should be the regions with the highest growth, independently of the industrialisation degree of the region"* then the conjecture is accepted in employment terms but rejected if the growth variable is productivity.

At the same time, there is a very clear negative relationship between share of small firms and the relevance of high and medium-high technological industries in Spanish regions. Then, the assumption of a positive relationship between innovation activity and regional industrial employment growth is also rejected.

Microeconomic level data support the assumptions made at the beginning of this study: Small process innovating and young firms grow faster than old, large and non innovating firms. Innovation also plays an important role in the survival of firms.

On the contrary, regional variables do not play any important role in survival or growth. Only the share of industrial employment is significant in growth equation.

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APPENDIX.

HIGH TECHNOLOGICAL MANUFACTURING INDUSTRIES: Pharmacy; Office and computing machinery; Electronic machinery; Radio, TV and communications equipment; Medical and precision instruments, optics and clockmaking; Aeronautical and space equipment

MEDIUM-HIGH TECHNOLOGICAL MANUFACTURING INDUSTRIES: Chemical industry exception made of Pharmacy; Machinery and mechanical equipment; Electrical machinery; Motor vehicles; Other transport equipment.

DEFINITION OF HECKMAN'S EQUATIONS VARIABLES:

AGE.- Age of the firm, measured as the difference between its creation year and 1990. It is expressed in logarithms.

PROPDI.- Number of firm's owners on its directive board.

EP.- Product standardisation. Dummy variable, takes 1 if the product is standardise and 0 otherwise.

KEXT.- Share of foreign capital on firm. It takes values from 0 to 100.

INNPRO.- Product innovation. It takes the value 1 if it is a product innovating firm and 0 otherwise. A firm is defined as a product innovator if *"in any of the years along the period an innovation of product has been introduced"*.

INNPRC.- Process innovation. It takes the value 1 if it is a process innovating firm and 0 otherwise. A firm is defined as a process innovator if *"in any of the years along the period an innovation of process has been introduced"*.

TECHIGH.- It takes the value 1 if the firm belongs to one of these industries: Chemical products.; Office and computing machinery; Electrical and electronic machinery; Motor vehicles; Other transport equipment.

TECMED.- It takes the value 1 if the firm belongs to one of these industries: Basic metals; Non-metallic mineral products; Metal products; Machinery and mechanical equipment; Rubber and plastics; Other manufacturing industries.

TECLOW.- It takes the value 1 if the firm belongs to one of these industries: Food, beverages and tobacco; Textiles
Leather; Footwear, wearing apparel and other clothing; Wood and cork; Paper, graphic arts and publishing.

PIBPC.- Gross Domestic Product per head of the Spanish region the firm is located. Year 2002. Its expressed in million euros.

EMPINDSH.- Share of industrial employment on the Spanish region the firm is located. Year 2002. It takes values from 8.1 to 31.2.

PARPYME.- Share of small firms on total employment on the Spanish region the firm is located. Year 2002. It takes values from 58.4 to 81.3.

IDPIB.- Share of Research and Development expenditures in Gross Domestic Product in any of the seventeen Spanish regions the firms is located. Year 2002. It takes values from 0.26 to 1.90.