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BUSINESS DYNAMICS AND TERRITORIAL FLEXIBILITY (♣)

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ABSTRACT:

Why does the location of new firms differ according to the characteristics of the industry? What relation is there between the technologically dense base of firms and the urban environment in which they appear? Does the autonomy of new firms when deciding their location differ according to the characteristics of the industrial sector and the size of the establishment? This study approaches these questions in Spanish manufacturing between the years 1980 and 1994. It is assumed that new industrial establishments decide to locate themselves in a certain city, ruling out other alternative locations. The results obtained indicate that decisions on location differ according to the technological density of the industries and their life cycle.

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1.- Introduction.

The spatial distribution of economic activities is characterised by the concentration of firms and population in a limited number of enclaves that stand out because of their high population density. Increasing urbanisation and the persistence of a certain geographical disequilibrium show that space is a significant dimension in the economy. The renewed interest in industrial location shown by a large number of researchers has a common denominator: Marshall.

The concept of the Italian 'industrial district' (Becattini, 1979), the economies of urbanisation (Jacobs, 1969), the theory of urban systems (Hoover, 1936), external technological and pecuniary economies (Scitovsky, 1954) and the model of monopolistic competition of the 'new economic geography' (Fujita, Krugman and Venables, 1999) are indebted to the distinction between internal and external economies formulated by Marshall (1890). For Marshall, the presence of industrial establishments offering specialised *inputs*, of a shared labour market and information flows give rise to local externalities that influence the efficiency of firms. The dimension of the economies external to the firm, but internal to the economic space, depends on the presence of *spillovers* between the firms.

The concept of spillover effect contributes an essential element for the correct understanding of increasing returns that occur during the process of local development. The city, the district, or the local productive system are, from this point of view, much more than the sum of their parts, as they internalise the local external economies that benefit the productive units present in the area. In this way the area is the framework that generates specific assets -*spillovers*- that are distributed among the various local activities, improving the performance of the firms. Nevertheless, by their very nature, external economies imply certain interdependencies outside the market and often it is difficult to determine the microeconomic mechanisms that explain their appearance (Blaug, 1962). It is because of this that, usually, empirical studies approach external economies as a true 'black-box', that is as a residual factor that explains the greater (economies) or lesser (diseconomies) efficiency of firms as a function of their location without deciphering the mechanisms that they produce.

The empirical literature that approaches the outlining of external local economies has many contributions. If only for their influence on later work, two studies should be pointed to. The first is the work of Glaeser, Kallal, Scheinkman and Shleifer (1992), that brings the distinction between external effects of an intra-industrial and inter-industrial nature into the debate. The second is the work of Henderson, Kundoro and Turner (1995), that defends

differences in patterns of location according to the characteristics of the industries. These studies encouraged a debate on the intra- and inter- sectorial nature of external economies[1]. According to this viewpoint, large cities provide firms with diversified environments that facilitate inter-sectorial economies -cross-fertilisation- but at the expense of incurring grater placement costs. On the other hand small nuclei specialised in a specific activity facilitate access to intra-sectorial economies and offer lower location costs.

Recently, the debate has not been as much concentrated on the dichotomy between diversified environments and specialised environments as on the coexistence in urban systems of diversified cities and specialised cities. To divine the presence of a single type of external economy is not then the question, but to establish in which circumstances industrial location pursues specialised or diversified environments, or even environments notable for their diversity and their specialisation in certain branches of industry. Urban diversity encourages innovation (Feldman and Audretsch, 1999 and Duranton and Puga, 1999), but when the life cycle of a product reaches a certain level of standardisation, firms are attracted by less dense and more specialised environments (Duranton and Puga, 2000).

The flows of industrial turnover and the choice of new locations vary with the life cycle of industries. In fact, at early stages business turnover is high, knowledge specific to the sector circulates without excessive difficulty and the firms are located near to urban nuclei with diversified productive structures and a large pool of human resources [2]. The diversity of production and the presence of *dynamic advantages* in the cities attract firms that operate in the most innovative sectors.

On the other hand, at the stages where the product is standardised business turnover is substantially lower, especially with regard to the entrance of new firms. Tacit intra-firm knowledge acquires greater importance and firms tend to locate in less densely populated surroundings, where the internal labour market and the reduction of certain costs (salary levels, the price of industrial land, etc.) surpass the benefits of the externalities offered by the more highly populated urban nuclei (Klepper, 1996). According to the gross rates of entry

[1] Since the appearance of these works a significant number of studies applied to the Spanish case have been carried out that analyse the role of external economies in the concentration, productivity and competitiveness of Spanish manufacturers (Callejón and Costa, 1995, Moreno, 1996, Serrano, 1997, de Lucio *et al*, 1998, Costa and Viladecans, 1999 and Viladecans, 1999).

[2] In North American metropolitan areas (MSAs), Simon (1998), Glaeser et al. (1992) and Rauch (1993) demonstrate the existence of a close relation between the growth of employment and levels of human capital among the workers. Cities with greater levels of training enjoy higher levels of personal income and salaries.

and exit, five stages in the life-cycle of industries can be distinguished (Agarwal and Gort, 1996): 1) moderate entry flow, 2) increasing entry and the rate of exit remains low; 3) the entry flow decreases; 4) low entry rates and, often, the exit rate is higher than the entry rate; 5) erratic behaviour of entry and exit flows.

It can be expected that external economies of diversification or specialisation predominate according to the life cycle of products. The coexistence of diversified and specialised urban structures is possible, if we take into account the fact that that the nature of external effects varies with the life cycle of industries. If economic concentrations produce external effects on local firms, it can be expected that the influence of these external effects will vary with the evolution of the industries. The existence of urban systems made up of cities of different sizes indicates that firms find different sources of attraction in their locations that correspond to a wide range of factors. There does not therefore exist any single logic to location, but a diversity of patterns according to the life cycle of industries, local external economies, and autonomy when firms decide on their location.

To sum up, during the primary stages of the product cycle firms tend to locate themselves in diversified environments (the incubator function of the urban environment is important, as a *nursery for firms*, Duranton and Puga, 2000), but with the standardisation of the production process the internal factors of the firm that urge greater geographical dispersion become more important. Activities with intense R+D activity are usually located in large cities that offer diversified environments where the degree of specialisation is of a reduced magnitude (Feldman and Audretsch, 1993)[3]. Densely populated urban nuclei have a greater pool of skilled workers, less adverse to risk and more able to learn the modern techniques that new scenarios demand (Glaeser, 1999).

This study provides empirical evidence on the theoretical matters mentioned but does not directly tackle the distinction between intra-sectorial economies (specialisation) and inter-sectorial economies (diversification) in industrial location in Spanish cities. However, adopting a dynamic dimension, it calibrates the heterogeneity of patterns of location and the geographical flexibility that gives rise to the coexistence of diversified urban environments together with specialised urban environments.

[3] The transmission of knowledge incurs greater costs when the distance between the creator and the imitator increases. Lucas, in fact, states that the existence of cities is due to the lower cost of transmission and acquisition of information. In his own words: *"What can people be paying Manhattan or downtown Chicago rents for, if not for being near other people?" (Lucas, 1988).*

2.-The location of new industrial firms in Spanish cities.

During the period between 1980 and 1994 a total of 124,957 new establishments began their activity in Spanish manufacturing, generating 800,458 new jobs. In spite of the high rate of opening of new industrial establishments only 396 initiatives, that is 0.32%, surpassed 100 workers, even though they created 117,737 new jobs, that is 14.71% of the total employment attributable to the opening of new industrial factories. The figures mentioned underline two aspects of interest in the creation of new industrial firms. Firstly, that the size of those entering, in spite of their being industrial activities, is small (the average size of the new establishments is 6.41 workers), new initiatives often incurring significant diseconomies derived from their small-scale[4]. Secondly, the rate of entry of new establishments reached high levels in all industries, demonstrating that in spite of barriers to entry the industrial market was experiencing a high turnover rate (entry and exit flows). The large share of small establishments in the entries together with the significant business turnover caused a high mortality rate in the first years of the new initiatives, especially amongst the small establishments (Callejon and Segarra, 1999).

The locations of new establishments were distributed among 5,679 cities. The large number of cities that registered the setting up of new industrial activities indicates that practically all-urban nuclei with more than 1,000 inhabitants benefited from the opening of new industrial establishments. The great magnitude of the creation of establishments and the wide range of locations indicate that location decisions depend on a notable variety of factors related to the individual characteristics of the firms (size, technology used, residence of the entrepreneur, etc.), the sectorial characteristics (the geographical area of the market, the life-cycle of the product, the technological base, barriers to entry of new firms, etc.) and local assets (support activities, the level of specialisation in a certain industry, the diversity of the *industrial-mix*, the industrial atmosphere, etc.)[5].

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[4] The distribution of new industrial establishments by size between 1980 and 1994 was as follows: 49.8% only had one worker, 22% had between 2 and 5 workers; 15.2% between 6 and 10; 8.2% between 11 and 20; 3.6% between 21 and 50, 0.6% between 51 and 100; 0.3% between 101 and 500, and finally, establishments with more than 500 workers only came to 0.02% of new registrations (Register of Industrial Establishments).

[5] In the case of Spain the determining factors in the location of new establishments have been analysed using the survey method in various studies. Examples of this are the studies of Aurioles and Pajuelo (1988), Vázquez and Cotorruelo (1997) and Galán *et al* (1998).

The information supplied by the *Registro de Establecimientos Industriales (REI)* (the Register of Industrial Establishments) on the location of new industrial firms allows the patterns of location followed by new establishments in Spanish cities to be approached in detail[6]. The information available covers the period between 1980 and 1994, providing an adequate time perspective to carry out a dynamic study of change in the logic of location according to the life-cycle of industries.

Firstly, a descriptive approach to the patterns of location followed by new industrial establishments is offered. It is especially important to point out two relevant aspects of industrial location. In the first place, that location decision differs considerably according to the sector of activity of the new establishments. In the second place, that the autonomy of firms in deciding on a suitable location varies considerably according to the initial size of the new establishment.

The opening of a new industrial establishment means that a number of decisions must be taken about the industry in which the new plant will operate, the technology used, the scale of production and, also, the optimum location for the industrial plant. Even so, the territory should not be understood as a passive dimension in the process of locating firms. Rather the opposite, as every city, to a greater or lesser extent, participates actively in the creation of local advantages that attract new firms to the detriment of the remainder of alternative locations.

It is possible to interpret the location decisions of industrial firms as a result of a dynamic process in which new firms guided by their maximal behaviour and seeking the optimum enclave interact with cities competing to offer their local advantages. From the geographical point of view, cities compete to develop endogenous enterprise-creating processes and to attract new investment. From the microeconomic point of view, firms choose their optimum location, rejecting the remainder of the alternative locations.

It is nevertheless important to remember that firms enjoy varying levels of autonomy in deciding their location. Large investments enjoy greater autonomy in placing their establishments in local places that offer the greatest advantages. On the other hand, amongst

[6] The REI is a database of MINER that provides administrative information on the opening and expansion of industrial establishments. More precisely the REI provides information on the sector of activity of the new industrial establishments or the expansion of these, on the investment made, the number of workers, the electrical power supplied and the geographical location of the establishments on a municipal scale. For the REI the unit of information is the establishment. This fact allows a more precise geographical approach as the disadvantages associated with other registers where the unit used is the company and not the establishments are eliminated.

the small-sized establishments, a high percentage of the locations are the result of random processes related to the residence of the entrepreneur. Even so, in these circumstances the residence of the small entrepreneur should not be thought of as an exogenous factor, but it should be asked what the local environments that favour the creation of new entrepreneurs are. In this sense the cities fulfil a double mission: configure the framework (institutional, geographic, technological, etc.) of relations between local firms and provide a suitable environment for the appearance of new entrepreneurs (Audretsch and Vivarelli, 1996).

***Table 1*: New industrial establishments according to activity and size of the city. 1980-1994.**

Number of workers according to the city population						
	Natural resources	*Labour intensive*	*Economies of scale*	*Differentiated products*	*R+D intensive*	*Total*
More than 100000 inhab.	31016	70381	37176	96579	15467	250619
Between 20000-99999 inhab.	27453	72912	23525	73144	7347	204381
Between 5000-19999 inhab.	27931	69557	24238	65105	2581	189412
Less than 5000 inhabitants	25415	56347	26571	45040	2673	156046
Total	111815	269197	111510	279868	28068	800458
Percentage of workers according to the city population						
	Natural resources	*Labour intensive*	*Economies of scale*	*Differentiated products*	*R+D intensive*	*Total*
More than 100000 inhab.	27,74	26,14	33,34	34,51	55,11	31,31
Between 20000-99999 inhab.	24,55	27,08	21,10	26,14	26,18	25,53
Between 5000-19999 inhab.	24,98	25,84	21,74	23,26	9,20	23,66
Less than 5000 inhabitants	22,73	20,93	23,83	16,09	9,52	19,49
Total	100,00	100,00	100,00	100,00	100,00	100,00

Source: *Registro de Establecimientos Industriales (REI)* (the Register of Industrial Establishments). Ministry of Industry.

Table 1 summarises the distribution of new industrial establishments created between 1980 and 1994, according to their sector of activity and the size of the city. With the purpose of facilitating the interpretation of the data, the manufacturing branches of the CNAE have been grouped using the criteria proposed by the OECD that distinguishes five large industrial groups according to the variable that determines competition in industrial markets: natural resource intensive sectors; labour intensive sectors; sectors with great economies of scale; sectors with great capacity for differentiating their products; and finally R+D intensive sectors (the distribution of the branches of the CNAE-2 numbers among these groups mentioned can be found in Table A-1 in the Appendix).

Spanish cities with populations above 100,000 inhabitants account for 31.3% of new employment; the urban nuclei with populations between 20,000 and 99,999 inhabitants 25.5%; nuclei between 5,000 and 19,999 inhabitants 23.6%; and finally cities of less than 5,000 inhabitants 19.4%.

When looking at the industrial groups it can be seen that the capacity of the urban nuclei to attract new investments differs noticeably according to the characteristics of the industries. The sectors that are natural resource intensive tend to be placed in small nuclei. Labour intensive activities predominate in the intermediate-sized cities (between 20,000 and 99,999 inhabitants). The majority of industries with differentiated products choose the medium-sized and large cities. Technologically highly intensive sectors predominate in the large cities. Finally, establishments that operate in sectors with great economies of scale, as can be expected because of the greater size of the investments, present an erratic line of location, even if they are notable for placing themselves in large cities (more than 100,000 inhabitants) and small ones (less than 5,000 inhabitants).

Table 2: **Distribution of job creation according to the size of the new establishments. 1980-1994.**

Establishments with less than 100 workers						
	Natural resources	*Labour intensive*	*Economies of scale*	*Differentiated products*	*R+D intensive*	*Total*
More than 100000 inhab.	27,77	26,88	29,76	33,98	59,04	30,79
Between 20000-99999 inhab.	23,20	25,70	27,71	25,42	21,20	25,31
Between 5000-19999 inhab.	25,37	25,78	25,91	23,76	12,17	24,61
Less than 5000 inhabitants	23,67	21,63	16,62	16,84	7,60	19,29
Total	100,00	100,00	100,00	100,00	100,00	100,00
Establishments with more than 100 workers						
	Natural resources	*Labour intensive*	*Economies of scale*	*Differentiated products*	*R+D intensive*	*Total*
More than 100000 inhab.	27,56	12,37	38,76	38,12	44,69	34,34
Between 20000-99999 inhab.	32,60	52,85	11,08	31,00	39,38	26,81
Between 5000-19999 inhab.	22,68	26,87	15,41	19,86	1,30	18,18
More than 5000 inhab.	17,16	7,91	34,75	11,01	14,64	20,67
Total	100,00	100,00	100,00	100,00	100,00	100,00

Source: *Registro de Establecimientos Industriales (REI)* (the Register of Industrial Establishments). Ministry of Industry.

These patterns of location according to the characteristics of the industries appear more strongly if the initial size of the establishments is included in the analysis, distinguishing the small establishments with less than 100 workers and the medium-sized and large establishments. Table 2 shows, in percentages, the location of the industrial groups according to the size of the city and the initial size of the establishment. A greater tendency can be seen in the small investments to place themselves in the nuclei mentioned above in each of the industrial groups, except in the industries with great economies of scale. On the other hand the medium-sized and large establishments show greater autonomy in their type of location.

The differences between the small and the medium-sized establishments in geographical location becomes appreciable in size in labour intensive sectors, sectors with great economies of scale and in the branches with differentiated products. Investments with more than 100 workers that are labour intensive tend to be located in medium-sized cities (between 20,000 and 99,999). Activities that enjoy great internal economies of scale tend to be concentrated in large cities. Finally, industrial plants dedicated to the manufacture of differentiated products prefer to locate themselves in cities of more than 20,000 inhabitants. New initiatives in the sectors R+D intensive sectors mostly appear in large cities, even though the larger-sized investments tend to diversify their locations as they move towards the medium-sized cities (between 20,000 and 99,999 inhabitants) and the small nuclei with populations of less than 5,000 inhabitants, but in any case not very distant from the large urban nuclei. Nevertheless, cities with more than 100,000 inhabitants lose their power of attraction as a location with the passage of time: in the period 1980-84 these cities concentrated 67.1% of newly created job; in the period 1985-90 63,3% and in the period 1991-94 only 40.8% (see Table A-2 in the Appendix).

Table 3: **Job creation of R+D intensive sectors in the biggest cities. 1980-1994.**

	All the establishments		*Establishments with more than 100 workers*			
Cities	*Employment*	*%*	*Employment*	*%*	*Employment (Province)*	*%*
MADRID	6987	24,8	2262	29,4	4536	59,0
BARCELONA	2598	9,2	431	5,6	1946	25,3
VALENCIA	514	1,8	0	0,0	125	1,6
SEVILLA	286	1,0	0	0,0	0	0,0
ZARAGOZA	226	0,8	0	0,0	100	1,3
Total 5 cities	10611	37,8	2693	35,0	6707	87,3
Cities with more than 100.00 inhab.	15467	55,1	3435	44,7	3435	44,7
Total cities	28068	100,0	7687	100,0	7687	100,0

Note: It indicates the employment of establishments with more than 100 employees located in each province.

Source: *Registro de Establecimientos Industriales (REI)* (the Register of Industrial Establishments). Ministry of Industry.

It is interesting to observe the pattern of location followed by the technology intensive establishments as, similarly to other countries (Fingleton, 1992, Harrison *et al*, 1996, Brower *et al* 1999, Feldman y Audretsch, 1999), the majority of the new firms dedicated to activities with high levels of R+D locate their industrial plants in the areas of the large cities. In fact, 37.8% of the jobs created by the R+D sectors were placed in the five largest cities in the country (Madrid, Barcelona, Valencia, Seville and Zaragoza), most notable of all being the great specialisation in these activities in Madrid. If the figures in Table 3 are examined,

establishments with 100 workers or more tend to locate in the medium-sized cities to the detriment of large cities (cities with more than 100,000 inhabitants absorb 55.1% of the jobs in R+D but only 44.7% of employment corresponding to establishments of 100 or more workers).

It can perhaps be inferred from the figures that there is a close relation between the size of a new establishment and its tendency to place itself in less populated urban surroundings. Nevertheless, the information shown in Table 3 moderates this statement. Large establishments in R+D sectors show a greater capacity to combine the benefits found in densely populated environments and the location of new plants in neighbouring cities that have a lower population density and offer lower location costs. The patterns of location of these establishments demonstrate the existence of a set of centrifugal forces that displace the new factories towards smaller-sized cities that form part of the urban metropolis. There is a tendency to move away from the great urban conglomerations but, in general, the large R+D firms locate their factories within the metropolitan areas of large cities. In the five cities with the greatest population, new R+D establishments created 35% of the jobs. However, when the area under observation is expanded to the provincial demarcation corresponding to these cities, the percentage of employment rises to 87.3%[7].

3.-Factors determining industrial location.

A large number of firms begin their activities in industrial markets every year. Before beginning their productive activity the firms are confronted with two decisions of vital importance for their later success in the market: firstly the size and the technology of their industrial establishments and secondly the geographical locations of the new plants. The two questions that the new firms must tackle are closely related. In fact, the larger sized establishments, as has been seen under the previous heading, enjoy greater autonomy in optimising their location, whilst the micro-establishments remain subjected, to a large extent, to the residential hinterland of the entrepreneur.

This section presents a simple formulation of the location decisions taken by new industrial enterprises. It is supposed that in an certain industry *i* a certain number of firms, *N*, begin their activity and decide on their optimum location among *M* Spanish cities. The

[7] A province is a Spanish administrative unit smaller than the region.

establishment *k* chooses the location *j* that maximises the expected profits[8], which can be expressed in the following way:

$$\pi_{k,i,j} = f\left(\bar{\pi}_{i,j},\ g(V_{i,j} + V_{i,\neq j})\right) + (\varepsilon_{k,i,j} + \eta_{i,j})$$

where $\bar{\pi}_{i,j}$ is a random variable that includes the benefits of locating in city *j* proceeding from factors such as the supply and the prices of the factors of production, the availability of natural resources, the local tax burden, the local development policies and the stock of infrastructures, among other things; $g(\bullet)$ is a function that includes the effects that are external to the industrial establishment but internal to the area. The spillover effects in the local area are of a twofold nature, in relation to the industrial activity that generates the pecuniary or technological spillover. Depending on the industrial sector to which the establishments that generate the external economies belong a distinction can be made between intra-industrial and inter-industrial external effects. The first occur between local firms that operate in the same sector (*Vij* is a vector that captures the external effects produced by the remainder of the industrial establishments in the same sector located in the same city as our establishment *k*). The second exist because of the presence of crossover effects between firms in different industrial sectors ($V_{i,\neq j}$ is a vector of the external effects produced by the local establishments that operate in other sectors). The function also presents two error terms. The first, $\eta_{i,j}$, includes those non-observable characteristics that equally influence the location of firms in a certain sector *i* in the city. The second, $\varepsilon_{k,i,j}$, indicates that there can be intrinsic elements in the location of an individual firm, such as the place of residence of the entrepreneur, in addition to those that are included in the previous terms. Omitting this term for error, the function for expected benefits is obtained for a firm of the type belonging to a sector *i* that decides to locate in a certain city *j*:

$$\pi_{i,j} = f\left(\bar{\pi}_{i,j},\ g(V_{i,i} + V_{i,\neq j})\right) + \eta_{i,j}$$

[8] There is a considerable amount of literature on the determining factors of industrial location from which a model of the location decision of new establishments can be developed. The assumptions that are used here come from neoclassical economic theory that is derived from the first contributions of Weber (1909). In these contributions, the initial hypothesis that influences business location is the maximisation of profits, with an emphasis on the reduction of costs. The original model has been modified later, increasing its degree of sophistication (Isard, 1956; Lösch, 1959 and Greenhut, 1963).

In practice it is impossible to observe $\pi_{i,j}$ (Ellison and Glaeser, 1997) and only the value of the new creations of firms C_{ij} is observed in a sector and city. If it is supposed that the creation of firms in a sector *i* and in city *j* depends on the profit expected by a firm of the type in this sector –i.e., $C_{ij}=f(\pi_{i,j})$ –, then:

$$C_{i,j} = f\left(\bar{\pi}_{i,j},\ g(V_{i,ji} + V_{i,\neq j})\right) + \eta_{i,j}$$

This expression constitutes the basis for the later econometric development to estimate the effect of external economies on the creation of new firms. The dependent variable is the job creation in each sector and city by the new firms and the explanatory variables will be the variables belonging to the city, distinguishing those that can be considered external economies $g(\bullet)$ from the remainder.

The logic of the analysis consists in admitting the hypothesis that the actual creation of firms is an indicator of the presence of profits above the minimum expected profit $\pi_{i,j}^{*}$ that should be, in any event, above 0. If the expected profits are below this minimum value the location of new employment will not occur in the city.

$$C(\pi_{i,j})=0 \qquad \text{if} \qquad \pi_{i,j} \leq \pi_{i,j}^{*}$$

$$C(\pi_{i,j})>0 \qquad \text{if} \qquad \pi_{i,j} > \pi_{i,j}^{*}$$

That is to say that the presence of the sector in the city indicates that the net profits from its location in the area are positive, whereas if the sector is not present it can be deduced that the net profits are negative. This fact introduces a possible selection bias of the sample that should be taken into account in the econometric estimation.

The hypothesis put forward, along the lines of the argument presented in the previous section, is the following. When an entrepreneur decides on the optimum location for an establishment a *trade-off* is confronted as the entrepreneur is obliged to choose among more or less diversified environments. That is a environment where the external economies will be of a inter- or intra-industrial type. Depending on the product cycle in which the company finds itself, the optimum environment will not always be the same. Therefore a not very mature firm should be installed in urban environments where innovations circulate more rapidly while on reaching a certain level of maturity in the industrial process these advantages are reduced and the entrepreneur can contemplate alternative locations in less densely populated surroundings.

4.- The econometric estimation and results

Explanatory variables

The statistical information available allows the empirical estimation of a part of the model proposed in the previous section. Therefore the explanatory variables of the creation of employment on the part of new firms included are grouped together in the function $g(\bullet)$.

Along these lines, the explanatory variables included in the model can be put into three groups. In the first place, following the work of Feldman and Audretsch (1999) and Duranton and Puga (1999), the indices of relative specialisation and diversity are considered with the purpose of studying the influence of the productive system on the new locations. The level of specialisation gathers the intra-industrial effects mentioned earlier while that of diversity gathers the inter-industrial effects. On the other hand, and in order to study the economies of agglomeration -also in an inter-industrial area-, a set of variables are included that attempt to discriminate between cities in relation to their size with the purpose of studying various local patterns depending on the size of the city. Finally, and along similar lines, the density of population variable has been considered in order to take into account the possible congestion of the cities, the availability of land and, indirectly, its price. Nevertheless it should be noted that only having available the total area of the cities and not the urban area -the real determining variable- could mean that the result of this variable is not very representative. To have a measurement of the level of relative specialisation -not absolute- of a city *j* in a determined activity *i*, the index is calculated by dividing the share of employment in a sector as a part of the total local employment by the proportion that this sector represents for national employment as a whole:

$$ESP_{ij} = \left[\frac{\frac{L_{ij}}{L_j}}{\frac{L_i}{L}} \right]$$

where L indicates employment, i the sector and j the city. The diversity of the productive structure is usually measured from the inverse of the Hirschman-Herfindhal index:

$$DIV_j = \frac{1}{\sum_i \frac{L_{ij}}{L_j}}$$

In order to achieve an index that is more representative of the variety of manufacturing activities present in a city an index was calculated using the original information -the 21 branches of manufacturing corresponding to the divisions of the CNAE-

93-, previous to their aggregation into the five broad activities proposed by the OECD. To avoid problems of endogeneity, both variables were calculated with the information on the creation of establishments for the previous periods before the one being analysed. Because of this the first period (1980-1984) was not considered in the econometric analysis. For the second period (1985-1990) these variables were constructed with the information from the preceding period. Finally, for the third period (1991-1994) two alternatives were available, use the information for the previous five-year period (here named the flow variable) or even use the information accumulated from the two previous periods (here named the stock variable) to gather the productive structure of the area. This distinction allows an analysis of whether the relevant information in the decision-making on location on the part of the entrepreneurs is that from the previous five years -that includes the most recent dynamics of the productive structure- or whether it is the accumulated information of the establishments created since 1980. It should be kept in mind that the disappearance of establishments from the previous years is not considered even though it is known that a significant proportion of the new industrial establishments stop their activity during the first years of their life (Callejón and Segarra, 1999).

When calculating the productive specialisation and diversity variables from information on establishments created, the hypothesis assumed is that the new business creations reproduce the real productive structure of the area (formed by the firms already existing and the creations of previous periods). According to this hypothesis, it would seem reasonable to think that the productive structure of an area stays unaltered over time and that the new establishments would be a reflection of the stock of firms already existing. Nevertheless, this supposition is not exempt from limitations as the productive dynamics can vary with time and, therefore, new establishments may not reproduce the previously existing productive structure.

To analyse the influence of population on the creation of new establishments a very flexible functional form was considered through the inclusion of five variables that classify the cities in groups of different ranges of population. So five dummy variables were constructed that take the value 1 if the city belongs to a certain range of population and 0 if it do not. The variable finally introduced is the population in interaction with each of these variables. The five ranges of population chosen were the following: more than 500,000 inhabitants, between 500,000 and 100,000 inhabitants, between 100,000 and 50,000 inhabitants, between 50,000 and 20,000 inhabitants and less than 20,000 inhabitants.

The estimated coefficient obtained for each of these dummy variables is tyhe partial derivative between the new job created and the size of the population and, as such, the slope of the curve which relates the new created job with the population. The value of this coefficient indicates the number of jobs created on average when the population increases by 1000 inhabitants in each of the ranges of inhabitants. Therefore it includes the intensity with which the cities, in relation to the size of their population, have a greater or a lesser capacity to attract new establishments. The fulfilment of the hypothesis put forward in the previous sections with regard to the influence of the product cycle on location decisions should appear in the obtention of smaller coefficients for the cities of larger size as time passes. That is to say it would be found that cities of a greater size would have a smaller and smaller capacity to attract new establishments to the benefit of cities of an intermediate size.

The expression finally used in the econometric estimation will be:

$$C_{i,j} = \alpha + \beta\, ESP_{ij} + \gamma\, DIV_j + \xi\, DEN_j + \sum_{K=1}^{5} \phi_K D_k POB + \eta$$

The problem of the selection of the sample

As was pointed out in the previous section, in order to carry out a correct econometric estimation of the proposed model of industrial location the potential selection bias should be taken into account. This bias would exist if we do not consider the observations (cities) in which no establishments have been set up in the period analysed. In the first place it should be pointed out that similar studies carried out on an international as well as a national scale have used geographical areas larger than the city. This fact means that they have information on each of the manufacturing activities in all of the geographical units under consideration. In spite of this, in some cases and for certain industrial sectors in some areas no establishments have been created. In this situation most of the studies choose to analyse only those geographical units where the sector is present. The selection of a part of the sample, ignoring, as far as the sector being analysed is concerned, those areas without activity in that sector, can give biased parameters and, therefore, can affect the final conclusions on the influence of the various factors on the location of the manufacturing activities[9].

[9] The sample used, described in the second section can be considered representative of all economic activity in Spain as it covers all those cities in which an industrial establishment was created between 1980 and 1994. This means a total of 5,679 cities that represent 98% of the Spanish population.

The empirical evidence has used various solutions to correct this problem and thereby avoid having to eliminate nil observations from the sample. An immediate first choice is that followed by some studies, as for example in that of OhÚallacháin y Reid (1996), which consists in aggregating the productive sectors in order to eliminate the nil observations. This choice means eliminating part of the explaining power from the model when variables are included in it that measure inter-sectorial relations.In fact the alternative that seems most suitable is that proposed in the work of Jaffe *et al.* (1993), Henderson (1994), Smith and Florida (1994), Henderson *et al.* (1995), Braunnerhjelm and Svensson (1996) and Maurel and Sédillot (1997). To correct the above mentioned problem of selection, the contributions put forward a model of selection and consider the information from the areas as a whole including those where the analysed sector is not present.

The estimation of the model

According to these studies, the model is estimated as a selection model in two stages, similar to that proposed by Heckman (1976). The classical selection model is made up of two equations. In our case, the first equation is that presented in the previous section in which the dependent variable - the volume of job created in the sector *i* in the city *j* - is observed even when the sector *i* is not present in the city, while in the second equation the dependent variable is only observed when the sector *i* is present in the city. Heckman shows that assuming that the joint distribution of η is a normal bivariant, the expectations of the level of job created in the city can be expressed as:

$$C_{i,j}(L>0) = \alpha + \beta\, ESP_{ij} + \gamma\, DIV_j + \xi\, DEN_j + \sum_{K=1}^{5} \phi_K\, D_k POB + \phi\, \lambda$$

λ being a parameter denominated 'the inverse of the *Mill ratio*'. In the event that problems exist in the selection of the sample, the estimation of the equation using only the observations from the cities where the establishments are installed and, therefore, job is created, will omit one variable (λ), which will cause a bias in the coefficients estimated if this variable is correlated with the variables included in the specification. This result is the basis for Heckman's (1976 and 1979) procedure for estimating in two stages. In this case specifically the procedure presents the following characteristics:

a. A 'probit' model is estimated of the determiners of location in the productive sectors. From the results obtained the value of the variable λ is calculated.[10].

b. A model is estimated with only the observations corresponding to the cities in which the sector has created a present establishment - with values that are not nil for employment in the sector - using λ as a control variable.

c. The procedure for estimation is by GLS. Specifically, White's (1980) procedure to correct the heteroskedasticity present in the model of selection.

d. The results of the estimation allow the existence of a selection bias to be shown.

The variables chosen to estimate the probit model, basically determined by the availability of statistical information on the local area, are the population, the square of the population, the productive density and diversity[11]. Estimations are carried out for each of the five groups of activities following the criteria of the OECD and for the periods 1985-90 and 1991-94.

Results

After the econometric estimation of the model of location of the new establishments for each of the five groups of manufacturing sectors, according to the OECD classification, it was verified that the local factors differed distinctly in relation to the activity involved. The econometric estimation underlines the heterogeneity of the patterns of location pointed to in the descriptive presentation of job created by new industrial establishments in Spanish cities.

Coinciding with studies of the coexistence of specialised and diversified environments in the same urban system, it was shown that the significance of the specialisation and diversity variables could occur simultaneously in the location patterns of the same group of industries. Specialisation and diversification are significant in the activities with differentiated products in the two sub-periods studied. The time persistence of both parameters shows that the industries that make up this group seek local placement where the presence of firms in the same sector is significant but at the same time compatible with diversified productive

[10] For an explanation of the procedure for estimation in two stages of the standard selection model Heckman (1976 and 1979) can be consulted. For reviews of the literature on these types of model Amemiya (1984) and Greene (1990).

[11] The results of the estimation of the first stage, probit model have not been included and the second stage of the model, only that which includes the Mill Ratio adjustment variable, appears in Table 4.

structures that favour inter-sectorial external economies. Identical results were shown by the sectors intensive in economies of scale, though only for the 1991-1994 period. For the five groups as a whole, the variable for productive diversity loses significance as time advances, the opposite of what occurs with the specialisation variable.

The new establishments in the R+D intensive sectors, with the passing of the years, tend to move to the medium-sized cities of the *hinterland* of the large cities that show higher levels of specialisation (the variable for specialisation presented a high and significant parameter during the 1991-1994 period). This evidence is rationally compatible with the fulfilment of the hypothesis of the influence of the product-cycle on location decisions. In fact, except for those activities intensive in natural resources, this hypothesis is fulfilled for the other sectors analysed. These results indicate that industrial placement in the large cities, more diversified and more densely populated, loses attraction, as the life of the product advances, in favour of enclaves situated in smaller cities with greater specialisation. The results seem to indicate that in the Spanish case, the hypothesis of the product life-cycle is not only fulfilled for technologically advanced activities and those with high levels of innovation but can be extended to the rest of the productive activities with varying levels of product standardisation. In the same way the population density of the city loses force with the passing of the years. For the natural resource intensive sectors this variable shows a negative significant parameter in all the estimations, which demonstrates the tendency of the new establishments to be located in less populated cities with relatively lower salaries. On the other hand, the density of the city is positive in all the estimations for the sector with differentiated products and the R+D intensive sector, even though it only reaches statistically significant levels in the 1991-1994 period. These results reinforce the previous argument concerning the emergence of certain centrifugal forces that push the new establishments towards cities with less demographic density than urban metropolis. The results given by the dummy variables for the populations of the cities in which the new establishments decide to set up permit the relation between the size of the city and location decisions to be studied. The parameters obtained allow an approach to the relation between the size of the city and location from a sectorial perspective and from a temporal perspective.

The value of the coefficients obtained for the variables for the size of the cities are generally higher in the smaller-sized cities as for every inhabitant these have a greater capacity to create employment. In other words, an increase of 1000 inhabitants in a small city has a much greater impact with regard to the capacity to attract new activities than in a larger

city. Nevertheless, as elasticities are being dealt with, the number of jobs finally created in absolute terms is always greater in the larger-sized cities.

Table 5: **Elasticity values of size city variables obtained from the estimation**

	Natural resources		*Labour intensive*		*Economies of scale*		*Differentiated products*		*R+D intensive*	
	1985-90	1991-94	1985-90	1991-94	1985-90	1991-94	1985-90	1991-94	1985-90	1991-94
Pop>500.000	0.48	0.62	1.22	0.86	1.91	0.37	2.31	1.79	1.36	0.42
100>Pop>500	0.50	1.02	1.23	1.49	n.s.	n.s.	1.71	2.36	1.62	0.22
50>Pop>100	0.56	1.15	n.s.	1.09	n.s.	n.s.	1.85	2.97	3.58	n.s.
20>Pop>50	0.26	1.35	n.s.	2.08	n.s.	n.s.	2.57	2.38	4.68	n.s.
Pop<20.000	n.s.	1.21	n.s.	n.s.	n.s.	n.s.	n.s.	3.31	5.06	n.s.

Source: Self-elaboration from the information in Table 4.
Note: n.s.: Indicates that the parameter of the estimation is not significant.

It should be added that in this context of analysis, of greater interest than the absolute value is the variation over time of the slope of the curve that relates population with the job creation and, in this case, the evidence indicates a reduction of this slope in the larger-sized cities. Therefore, in all cases the coefficient of the variable for the cities of more than 500,000 inhabitants diminishes between the periods 1985-90 and 1991-94, while, in the event that they are significant, the coefficients that represent the smaller cities increase their value. In this way it can be seen that in relative terms a process of *delocation* of the productive activities of large cities is taking place towards smaller-sized cities that even so, it should be remembered, may form part of the same metropolitan area or area of influence.

In the natural resource intensive sectors elasticity on the municipal scale (the value of the elasticities of the size of the city indicates the average number of jobs created when the population increases by 1000 inhabitants) increases with the size of the city. In addition, in all of the ranges of size of city the value of this parameter increases during the 1991-94 period. The results indicate that the small cities have greater location advantages for these establishments. The greater value of the parameters in the estimations for the 1991-94 period indicates that these advantages increase as the years pass. In the labour intensive sectors the greater significance of the parameters during the 1991-94 period, among the medium-sized and small cities, shows a greater tendency among the new establishments to locate in these local environments. Activities with great economies of scale, as can be expected, are the ones that show a weaker relation between population size and industrial location. The sectors with differentiated products present a statistically very significant elasticity of city size. The results indicate that between the period 1985-90 and the period 1991-94, the large cities lost

attraction for the location of these activities in favour of the medium-sized nuclei (between 50,000 and 500,000 inhabitants). Finally the R+D intensive sectors indicate that new establishments are predominantly in large cities but also tend to locate in nuclei with a smaller population. Nevertheless, as was indicated in the second section in this study, when new firms in R+D intensive sectors decide to locate outside the large city seldom do they go very far from its area of influence. Even so, the time perspective indicates that the location patterns of R+D intensive establishments created between 1991 and 1994 were less influenced by the absolute size of the city population.

5.- Conclusions.

The study presented has attempted to approach an explanation of the mechanisms that influence the location of new industrial establishments. Along the lines of the most recent contributions, the hypothesis initially put forward is that these mechanisms differ in relation to the type of activity being dealt with, the size of the new establishment and the stage at which the product-cycle of this activity is to be found. Therefore an entrepreneur who wishes to find the optimum location for an establishment should ask what the most suitable environment for the productive process to be carried out is. This environment can be more or less densely populated and contain a greater or lesser variety of productive activities. That is that either inter- or intra-industrial external economies can predominate with greater intensity. It has been attempted to demonstrate the hypothesis that the size of the cities loses weight as an explanatory factor of new locations as productive activities progressively reach a greater level of maturity and less that densely populated environments are then preferred.

Using the information in the data base of the *Registro de Establecimientos Industriales (REI)* (the Register of Industrial Establishments) of the Ministry of Industry, that provides information about the creation of industrial firms in Spanish cities for the years 1980-1994, an analysis has been made in which the influence of the various types of external economies on these creations, and especially how this influence changes over time, has been studied.

The econometric estimation has been approached as a two-stage model with the purpose of correcting the selection bias that the exclusion of nil observations means. The results of this estimation show that the patterns of location vary in relation to the industrial activity being dealt with. Similarly, and along the same lines as the most recent studies, it was shown that levels of diversity and specialisation that influence the location of new establishments might exist in the same urban environment. Finally, the results indicate that, in the greater

part of the activities analysed, the larger-sized cites, more densely populated and with higher levels of productive diversification, have lost their attraction in favour of locations in smaller cities with higher levels of specialisation. So it seems that the hypothesis of the product-cycle as a key element in location decisions is confirmed.

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Table 4: **Results of the estimation of the model of firm creation (Dependent variable: Job creation)**

	Natural resources intensive sectors			*Labour intensive sectors*			*Scale economies intensive sectors*			*Sectors with Differentiated products*			*R+D intensive sectors*		
Variables	*Period 1985-90*	*Period 1991-94*		*Period 1985-90*	*Period 1991-94*		*Period 1985-90*	*Period 1991-94*		*Period 1985-90*	*Period 1991-94*		*Period 1985-90*	*Period 1991-94*	
Constant	11.458 (0.73)	8.210 (0.66)	2.158 (0.10)	170.308 (2.88)**	19.183 (1.59)	47.521 (1.28)	84.288 (0.82)	33.887 (2.14)**	7.479 (0.36)	16.836 (0.56)	5.510 (0.43)**	69.825 (3.74)**	320.135 (2.89)**	22.118 (0.29)	26.042 (0.37)
Esp. (Stock) ($Esp_{t-1,t-2}$)	0.00	0.550 (1.11)	0.00	0.00	15.444 (5.92)**	0.00	0.00	6.524 (3.01)**	0.00	0.00	13.223 (4.24)**	0.00	0.00	4.508 (1.85)*	0.00
Esp. (Flow) (Esp_{t-1})	0.522 (1.02)	0.00	0.396 (0.89)	26.754 (4.11)**	0.00	14.215 (7.35)**	3.733 (1.07)	0.00	3.423 (2.53)**	10.246 (7.07)**	0.00	8.796 (5.65)**	0.031 (0.03)	0.00	3.555 (1.38)
Diver (Stock) ($Div_{t-1,t-2}$)	0.00	0.109 (0.24)	0.00	0.00	1.640 (0.09)	0.00	0.00	1.932 (0.84)	0.00	0.00	1.584 (1.23)	0.00	0.00	2.684 (0.57)	0.00
Diver (Flow) (Div_{t-1})	3.843 (3.90)**	0.00	1.155 (0.45)	2.178 (0.61)	0.00	8.068 (0.98)	12.515 (1.68)*	0.00	9.359 (2.29)**	1.641 (1.90)*	0.00	19.589 (4.77)**	2.522 (0.95)	0.00	3.145 (0.53)
Density (Sup/Pop)	1.366 (1.71)*	6.294 (2.14)**	6.565 (2.02)**	0.598 (0.96)	0.491 (0.14)	1.501 (0.46)	26.785 (1.28)	4.201 (1.87)*	3.210 (1.35)	17.224 (2.78)**	2.294 (0.39)	0.962 (0.16)	6.617 (1.75)*	0.654 (0.23)	0.638 (0.22)
Population (>500)	0.477 (8.55)**	0.620 (20.45)**	0.620 (20.51)**	1.218 (19.88)**	0.851 (11.60)**	0.864 (11.82)**	1.908 (2.05)**	1.861 (2.08)**	0.366 (5.42)*	2.314 (21.68)**	1.823 (30.95)**	1.786 (31.60)**	1.364 (7.18)**	0.420 (9.14)**	0.424 (9.10)**
Population (100 a 500)	0.496 (3.89)**	1.017 (3.68)**	1.016 (3.71)**	1.229 (1.75)*	1.416 (3.64)**	1.487 (3.45)**	0.206 (0.30)	0.147 (0.25)	0.121 (1.30)	1.714 (5.66)**	2.564 (3.76)**	2.357 (3.53)**	1.615 (3.31)**	0.207 (1.57)	0.216 (1.78)*
Population (50 a 100)	0.560 (2.04)**	1.137 (3.62)**	1.153 (3.61)**	0.341 (0.40)	1.003 (3.88)**	1.088 (3.83)**	0.579 (0.33)	0.377 (0.36)	0.035 (0.18)	1.854 (3.06)**	3.275 (2.42)**	2.974 (2.18)**	3.579 (3.31)**	0.458 (1.15)	0.464 (1.23)
Population (20 a 50)	0.257 (0.44)	1.287 (2.83)**	1.347 (2.62)**	1.840 (1.25)	2.117 (4.32)**	2.077 (4.23)**	0.678 (0.19)	1.331 (0.68)	0.093 (0.26)	2.567 (2.29)**	2.410 (4.01)**	2.383 (4.08)**	4.682 (3.32)**	0.783 (0.86)	0.841 (0.94)
Population (<20)	0.369 (0.34)	1.093 (1.36)	1.215 (1.32)**	0.598 (0.10)	0.546 (0.76)	0.165 (0.18)	1.631 (0.31)	1.061 (0.41)	0.607 (1.04)	2.234 (1.06)	2.129 (1.97)**	3.308 (3.05)**	5.064 (3.36)**	0.287 (0.29)	0.323 (0.33)
Mill ratio	7.426 (1.60)*	2.849 (1.32)	1.418 (1.89)**	158.02 (2.94)**	18.867 (2.05)**	37.483 (1.65)	43.566 (1.77)*	17.310 (2.30)**	4.241 (1.43)	13.319 (1.51)	1.664 (1.87)**	49.701 (3.51)**	141.930 (2.98)**	17.032 (2.59)**	19.744 (2.72)**
R2	0.64	0.56	0.56	0.25	0.47	0.46	0.49	0.42	0.43	0.82	0.57	0.57	0.88	0.38	0.38
R2 adjusted	0.64	0.56	0.56	0.25	0.47	0.46	0.48	0.42	0.43	0.82	0.57	0.57	0.88	0.36	0.36
F Snedecor test	453.459**	276.95**	277.03**	96.11**	236.55**	207.89**	120.62**	85.92**	88.05**	1296.43**	367.21**	377.49**	253.53**	17.25**	17.13**
White test	553.92**	501.89**	722.71**	1554.45**	1524.33**	1094.49**	1159.31**	593.45**	607.40**	999.52**	484.29**	326.66**	303.52**	96.87**	88.36**
N° observations	2273	1933	1933	2569	2377	2377	1160	1058	1058	2521	2540	2540	307	262	262

NOTE: Rejection of the nil hypothesis **: 0.05; *: 0.01; F Snedecor test: Contrast of joint significance. In parenthesis, the contrast t Student individual test.

Table A-1: **Classification of the manufacturing activities according to the elements that influence their competitiveness**

CNAE	Description	Technological Contents
	Natural resources intensive sectors	
15	Food and beverages	Low
16	Tobacco	Low
21	Paper industries	Low
	Labour intensive sectors	
17	Textile industry	Low
18	Clothing and furrier's	Low
19	Leather articles and footwear	Low
20	Wood and cork	Low
36	Furniture and other manufactures	Low
	Scale economies intensive sectors	
24	Chemical industry	Medium
25	Rubber and plastic products	Medium
34	Vehicles	Medium
35	Other transport material	Low
	Sectors with differentiated products	
22	Printing industries	Low
26	Minerals and non ferric metals	Low
27	Metallurgy	Low
28	Metal products	Low
29	Machinery and mechanic equipment	Medium
31	Machinery and electric material	Medium
	R+D intensive sectors	
30	Office machinery and mechanic equipment	High
32	Electronic material, TV and communications	High
33	Medical instruments, optics and watchmaking	High

Source: OECD

Note: Extractive and energetic activities have not been considered

Tabla A-2: **Distribution of new job creation according to the sector and the size of the city**

	Cities	*Natural resources*	*Labour intensive*	*Economies of scale*	*Differentiated products*	*R+D intensive*	*Total*
Period 1980-1984							
More than 100000 inhab.	55	29,72	25,57	23,09	35,93	67,14	29,97
Between 20000-99999 inhab.	236	23,51	25,13	16,05	24,97	22,69	23,21
Between 5000-19999 inhab.	826	24,04	27,80	20,34	22,02	4,62	23,60
Less than 5000 inhabitants	2849	22,72	21,50	40,52	17,08	5,55	23,22
Total	3966	100,00	100,00	100,00	100,00	100,00	100,00
Period 1985-1990							
More than 100000 inhab.	55	26,90	26,27	47,68	34,32	63,36	33,37
Between 20000-99999 inhab.	236	25,00	28,73	21,94	26,40	18,88	26,19
Between 5000-19999 inhab.	831	24,56	24,86	17,97	23,68	10,58	22,93
Less than 5000 inhabitants	3152	23,54	20,13	12,41	15,61	7,19	17,51
Total	4274	100,00	100,00	100,00	100,00	100,00	100,00
Period 1990-1994							
More than 100000 inhab.	55	27,29	26,49	26,08	33,76	40,85	30,01
Between 20000-99999 inhab.	235	24,78	26,48	26,06	26,65	35,81	26,59
Between 5000-19999 inhab.	834	25,88	25,45	28,59	23,68	9,55	24,54
Less than 5000 inhabitants	2952	22,05	21,58	19,27	15,91	13,79	18,86
Total	4076	100,00	100,00	100,00	100,00	100,00	100,00

Source: *Registro de Establecimientos Industriales (REI)* (the Register of Industrial Establishments). Ministry of Industry.

Tabla A-3: **Distribution of new job creation in establishments with less than 100 workers**

	Cities	*Natural resources*	*Labour intensive*	*Economies of scale*	*Differentiated products*	*R+D intensive*	*Total*
Period 1980-1984							
More than 100000 inhab.	55	27,60	25,91	32,76	36,26	69,82	31,45
Between 20000-99999 inhab.	236	22,61	24,67	27,89	24,25	17,92	24,42
Between 5000-19999 inhab.	826	26,18	26,99	24,29	22,73	5,56	24,63
Less than 5000 inhabitants	2849	23,61	22,43	15,06	16,76	6,69	19,50
Total	3966	100,00	100,00	100,00	100,00	100,00	100,00
Period 1985-1990							
More than 100000 inhab.	55	27,63	27,62	32,97	35,37	59,68	31,87
Between 20000-99999 inhab.	236	23,08	26,28	26,89	25,79	18,72	25,50
Between 5000-19999 inhab.	831	25,31	24,96	25,23	23,44	13,63	24,12
Less than 5000 inhabitants	3152	23,97	21,14	14,91	15,41	7,96	18,51
Total	4274	100,00	100,00	100,00	100,00	100,00	100,00
Period 1990-1994							
More than 100000 inhab.	55	28,00	26,69	23,79	30,95	52,22	29,00
Between 20000-99999 inhab.	235	23,67	25,79	28,52	25,86	26,43	25,76
Between 5000-19999 inhab.	834	24,92	25,90	27,90	24,82	13,78	25,17
Less than 5000 inhabitants	2952	23,42	21,62	19,79	18,37	7,58	20,07
Total	4076	100,00	100,00	100,00	100,00	100,00	100,00

Source: *Registro de Establecimientos Industriales (REI)* (the Register of Industrial Establishments). Ministry of Industry.