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BUSINESS DYNAMICS AND EFFICIENCY IN INDUSTRIES AND REGIONS. THE CASE OF SPAIN

ABSTRACT: High rates of firm births and deaths are a pervasive phenomenon across industries and territories. Most studies have related the great turbulence at the fringe of practically all manufacturing industries to positive effects on the long run performance of industries. According to these views business turbulence, although it has a relatively small incidence on net entry, leads to allocative improvement and stimulates innovation. The existing set of empirical studies do not reach clear results, however, and many questions are still open. Our contribution analyses the relationship between business dynamics in manufacturing and the growth of total factor productivity in industries and regions. After a review of current literature on entry and exit it is argued that most models are tailored to suit the processes observed in industries and regions that are near the technological frontier, and we propose a model that could be more representative of middle range economies such as Spain. According to this approach new firms are seen more as users of innovations than producers of innovations. We adopt a model based on a vintage capital framework in which new entrants embody the edge technologies available and exiting businesses are supposed to represent the most marginal obsolete plants. Both industries and regions are represented by a Hall's type production function which controls for imperfect competition and economies of scale. The results show that both entry and exit rates contribute positively to the growth of total factor productivity in industries and in regions.

Key words: entry and exit, total factor productivity, manufacturing.

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0. INTRODUCTION

One of the most striking phenomena in the evolution of economic activity is the high rate of turbulence observed in the business structure of nearly all the industrial sectors. Every year a relatively high number of firms[1] enter each sector, and an equally numerous group exits, so the net entry is a small fraction of the total number of firms and an even smaller fraction of the market share, since the size of the entering firms is well below the average of the sector[2]. Likewise, most of the exiting firms have been in the market for a very short time. That is to say, most of the entering firms do not manage to become consolidated and they decide to cease their activity[3]. Together with large turnover and volatility rates, data on new business demostrates the existence of huge variations in rates of formation according to sector, through time and in space.

Such behaviour raises a number of questions that we might group as follows: (i) what are the factors that stimulate agents to set up a new business?; (ii) what effect does this observed turbulence have on market structure, its evolution and its efficiency?; and (iii), what implications do the birth and death of firms have on social welfare. On the first two questions there is already a body of literature of some importance, although the effects on well-being have not yet been studied so extensively. This study attempts to provide evidence about the effect of the entry and exit of manufacturing firms on the global efficiency of industries and regions. This is only a first step in addressing the third and most relevant question in our view. We adopt the hypothesis that incoming businesses use the very latest technology available and so contribute to improve the total factor productivity. The paper is organized into five sections and an appendix. The first section reviews some of the prevalent models of entry and industrial dynamics in current literature and argues that there is a bias in many current theoretical developments that make them unsuited to dealing with economies that are not on the technological frontier. The second section contains a descriptive analysis of our data base. The third section presents the empirical model based on a vintage capital framework. The forth and fifth section contains the results of the estimations a and find that both entry and exit rates affect positively total factor productivity of industries and regions. The appendix contains additional descriptive statistics of the data base used.

1. APPROACHES TO ENTRY AND EXIT

Various entry models have been described in economic literature which attempt to explain what the decision to set up a new business depends on. One usual element in traditional approaches is the assumption that agents will enter the market if they expect to obtain profits that exceed or at least equal the opportunity cost of the resources employed in the future activity. But beyond this reasonable and also trivial point, traditional assumptions of the theory of industrial organization fail to match with certain observed facts. For example, the rates of entry are unexpectedly high even in sectors with significant barriers to entry - for example, those that are capital intensive and with a high efficient minimum scale. Such entry rates are also puzzling given the limited probabilities that the new firms will survive.

Evidence from different studies finds two general trends in the relationship between rates of entry and exit. First, there is a strong positive correlation between rates of entry and exit across industries and - in our data - across regions. That is, industries and regions with high entry rates also show high exit rates. Second, the bulk of firms exiting from an industry tend to be new and small businesses. With the exception of this two facts the relationship between new and incumbent establishment is not at all clear. Audretsch (1995) addresses this question using the metaphorical ideas of *displacement* and the *revolving door*, and asking which of the two effects dominates in a particular industry: if incumbent firms are displaced by new entrants or, as with a conical revolving door, the new entrants are the same firms that exit after a short period of time. The top part of the door represents the largest firms and revolves much more slowly than the lower part.

Evidence suggests that the displacement effect is generally small in the short run, specially in those industries with larger minimun efficient scale where the survival of the new born is harder. On the other hand the positive impact of entry on total factor productivity that has been found by Geroski (1989) and by ourselves in the present article (see section 2), seems to imply that the displacement effect can be much more significant in terms of aggregate efficiency that in terms of the number of incumbents being displaced from the market. Two possible and complementary, not alternative, explanations for this positive impact can be adopted. First, we may consider that entry rates measure potential competition and that incumbents react to it by improving their efficiency. The second explanation is based on a vintage capital hypothesis in which technological progress is embodied in new plants. In the second part of this paper the model we estimate adopts this second hypothesis.

One crucial aspect that has not been yet studied in the available literature refers to why gross entry rates are so high if new business also bear such a high risk of failure. The assumption of asymmetric capabilities adopted in some models can help, but it does not explain why agents take wrong decisions so often. A recent and curious experiment (Thaler, 1997) seems to support the idea that rationality is less pervasive than theory usually assumes. Another possibility is that entrants exploit limited opportunities of the type *hit and run.* In a different perspective, there is anecdotic evidence that government promotion programs aimed at small firms could foster behaviours of the type *take and run*. More research is needed to find out if welfare could be improved with a reduction in the rate of new business failures.

Greatly simplifying the situation, there are two main approaches to the theory of entry into business. The first is the traditional static approach of industrial organization, and the second is a dynamic approach in which innovation and technological progress determine the evolution of market structures. A different concept, explicit or not, of the nature of the firm underlies each approach.

Traditional approach. In the static approach entry models are based on the traditional microeconomic theory of the firm, that is, the representative firm is described through a production function in the way that Rosenberg (1982) termed the *black box* theory. The entry process is seen as the mechanism by which competition erodes the market power of incumbents and the profits of the industry reach its long run equilibrium. If the industry is perfectly competitive, the entry eliminates any short-run positive profits of incumbents. If the industry is imperfectly competitive the long run profits will depend on the height of the entry barriers. In this type of approach, the basic hypothesis is that there will be new companies entering the market whenever the expected profits exceed the level of sustainable profits in the long run. For example:

$$E_{it} = \lambda(\pi_{it} - b_i) + \mu_{it}$$

where E_{it} denotes the rate of entry into industry i in period t, $\pi_{it}$is the profit rate expected after the entry, b_i is the profit rate sustainable in the long run, μ_{it} is a random term and λ is a parameter which represents the speed of response of the new firms to the difference between expected short-run profits and profits sustainable in the long run (Geroski, 1991a).

Indeed, numerous empirical studies have found a positive relation between gross entry rates and profit levels throughout the business cycle. Since the profits of firms appear to be connected in overall terms to the economic cycle in industry, this entry model actually takes the level of demand in the sector as the determining variable. However, empirical studies show that only a part of the variation in the entry rates can be explained by the *gap* that exists between short- and long-run profit rates, but there is no general agreement about which are the relevant variables, and frequently the results obtained in different studies contradict each other. For example, Dunne and Roberts (1991) find that the rate of entry and exit are negatively correlated with the price-cost ratio and the capital-output of the sector. On the other hand, other studies conclude that capital intensity does not deter entry while intensity of advertising does (Acs and Audretsch, 1990).

Traditional approaches expect to find that entry leads to an increase in the degree of competition in the markets, and ultimately to an increase in efficiency. Geroski (1989) finds that the total factor productivity is positively related to entry. He does so by estimating a function of the usual type $y = a\ n + b\ k + q$, where the growth in output y depends on the growth rates of labor n and capital k, and on the residual q. The degree of competition in the market is introduced in q, which in turn depends on three explanatory variables: rate of entry, number of innovations and the rate of import penetration. According to Geroski's estimate, entry would account for 30% of the variability in total factor productivity. The dynamic approach which we shall discuss below differs in that q does not attempt to capture the degree of competition in the market, but the level of knowledge that generates innovations (Audretsch and Acs, 1991).

Dynamic approach. Dynamic approaches associate the processes of entry and exit of establishments with processes of innovation and change in industry (Audretsch, 1991; Dosi, Marsili, Orsenigo and Salvatore, 1993; Malerba and Orsénigo, 1996). Some of these approaches are based on evolutionist (Nelson and Winter, 1982) and product cycle

(Abernathy and Utterbach, 1978) models. In Autretsch's version (1995) it is the possibility of exploiting an innovation which induces agents to enter a market. The firm is seen as an entity which has a stock of specific knowledge which it must manage in order to increase it and appropriate its market value. Unlike the static approach, in which firms are assumed to have similar capacities, the dynamic approach is based on the assumption that both new plants and incumbents are asymmetric. These asymmetries concern both the innovative and administrative capacity as well as the assessments that the agents make of the expected value of a certain innovation; so the incentives for entering the market are not determined by the existence of *gaps* between expected and normal profits, but by the existence of *gaps* between the assessments that the agents make of the expected value of an innovation. All innovations are uncertain as far as their result in the market is concerned and the expectations of the agents can vary. Likewise, agents may have different degrees of aversion to risk.

One of the distinguishing features of this type of analysis is that it focuses on individuals as entrepreneurs and not on the firm in the abstract. In this context, the formation of new business can be the result of knowledge asymmetries and divergencies in the expected value of a potential innovation. In many cases new businesses are set up by highly skilled individuals formerly employed in firms that refuse to adopt a given innovation (Saxenian, 1990). The situation is then well described in Hirschman (1970) terms if we say that the employee chooses the *exit* option in opposition to the *voice* option. The new entrepreneur uses the specific knowledge formerly acquired in that way, and this lowers the cost of entry of new plants.

As we shall see below, the dynamic approach introduces explanatory elements which are compatible with the observed variability in entry rates across time, industries and space. It is also compatible with Jovanovic's theory (1982) which gives a plausible explanation of the disproportion between the high rate of gross entry and the low rate of net entry. According to Jovanovic, the only way of finding out whether an innovation will be accepted by the market is to experiment with it directly. In Jovanovic's scheme, the new entrepreneurs are unsure about their ability to manage a new firm start up, and entry is thus a process of learning. In the first place, they learn if they are producing the *right stuff*, that is to say, if there will be sufficient demand. In the second place, they test their ability to adapt to market conditions, that is to say, to the characteristics of competition and the relationships with suppliers and clients. So, in Jovanovic's model, entry on a large scale is part of a mechanism of selection in which many alternatives are tested and were efficient firms grow and survive and inefficient firms decline and die.

Technological regimes*. S*ome industrial sectors have a greater capacity than others for generating innovations, that is to say, they have different degrees of technological opportunities which are reflected in the dynamics of entry and exit and in other aspects of the market structure. However, the enormous variability of the empirical data on business dynamics means that it cannot be explained by the single concept of sector specific technological opportunities. Other complementary rather than alternative models have been put forward in an attempt to explain business dynamics in greater depth. Of these, some of the most developed are the models based on the notion of technological regimes and the models of the product's life cycle (PLC).

The concept of technological regime comes from Winter (1984) and has been adopted and reworked by other authors. Audretsch and Acs (1991) relate the expectations of agents about the future value of an innovation to the type of technological regime. Two basic types are described: the routinized regime and the entrepreneurial regime, each of which is a specific combination of conditions of technological opportunity, the degree of cumulativeness of technological knowledge and the characteristics of the knowledge base. That is to say, the firms in a particular industrial activity may find themselves in a broad or narrow context of technological opportunities; their actual and potential efficiency may depend to a greater or lesser extent on the accumulation of know-how and investments made in R+D in the past; and their knowledge base may be characterized by different proportions of codified, scientific knowledge and tacit knowledge.

In very few words, under the entrepreneurial technological regime the technological base of firms is characterized by low degrees of cumulativity, low degrees of appropiability and, logically, a low component of tacit knowledge, thus it favours entry. The routinized technological regime being characterized by the importance of accumulated learning by doing does not favor the entry of new firms.

The product life cycle. The process of business dynamics has also been tackled using a model based on the product life cycle (PLC). The PLC approach also attempts to account for the variations observed in business dynamics, market structures and the innovative capacity of firms and sectors. The difference between the PLC and the technological regime model is that while the latter assumes that the technological regime is specific to a particular sector, the PLC model implies that each and every one of the industrial sectors reflect the PLC.

As shown in the best known formulation by Abernathy and Utterback (1978), who chose the automobile industry as an illustrative case, manufacturing industries characterized by a history of technological progress follow a pattern from birth to maturity the most stylized features of which are represented by the PLC. According to this model, the technology of each industry presents several phases. In the introductory phase, the manufacturers test numerous designs and uncertainty about market preferences is high. The capital equipment is still not very specialized and the industry experiences high entry rates and low exit rates. Later, during the growth phase, one design emerges as dominant and the variety of products in the market decreases. Accumulated experience favors process innovation and this results in more specific equipment and assets. Economies of scale become important and firms below the minimum efficient scale have difficulties in surviving. The entry rate and the number of firms in the market stabilize. Exit increases relatively to entry. In the final phase of maturity and decline, the concentration of the market increases and process innovation decreases. Price competition dominates in the industry and there are few entries and many exits.

The PLC model hinges crucially on the assumption that all industries reach a phase of design standardization, but reality shows us that this is not so in all cases. Recently, Keepler (1996) has put forward a new version of the PLC model which attempts to gain in universality by dispensing with the assumption of design standardization. In Keepler's model, firms can keep on introducing innovations and improvements in the design at a rhythm which is decided endogenously. Firms are assumed to be asymmetric in terms of innovative capacity, but they have the same level of technological opportunities throughout their life. Firms decide how much they spend on R+D and their innovative rhythm depends on this. The incentives to innovate are not the same for product and process innovations. While product innovations are aimed at new clients, process innovations are encouraged by existing demand and they give rise to reductions in unit costs. The value of the reduction in the unit cost thanks to an innovation is proportional to the output, that is to say the size, of the firm. As a firm grows, it becomes more interested in process innovations. If there are no further shocks, the model leads to an evolution of the industrial structure which is marked by the advantage of the first entrant. This result is limited, however, because the firms are faced with convex adjustment costs if they decide to increase their size. Kleeper's version of PLC is compatible with the fact that the business structure that forms the nucleus of the industrial sectors is usually much more stable than the periphery and also has the advantage of enabling product innovation to be endogenized by the industry. Despite this, the variability in entry and exit rates show that there must be other determining factors that are not considered by the PLC.

Embodied technology. Models based on the technological regime notion and PLC, largely inspired by experience in the United States and a few other countries which are technological leaders, probably do not have sufficient power of generalization to be useful in economies with intermediate technological capacity such as the case we study -Spain- in which the main way of introducing innovations is by diffusion and imitation, and only to a much lesser extent by endogenous generation of new knowledge. Both the PLC model and the concepts relative to technological regimes seem to fit in better in a context where the representative entering firm is genuinely innovative, or rather, where the entrants are located near the technological frontier.

One way of attempting to correct the inconsistency between the hypotheses which are implicit in the technological regime and PLC models can be to assume that a considerable number of innovations are incorporated into the latest vintage equipment of new plants. For firms from countries such as Spain, it would be appropriate to construct models in which most of the entering firms consider competing in a local or niche market. What most entrants intend is to exploit product and process innovations that have been developed and tested previously in other more advanced markets. In this case, the incentive of the entering establishments is to take advantage of their margin of superior efficiency in comparison with established plants since they have more modern equipment and, possibly, organization. In this *vintage capital* model, the entry of firms, accompanied by the exit of more obsolete plants, results in an increase in the overall efficiency of the industry. The expected effect of entry under this imitative context would be captured by changes of total factor productivity. In other words, entry and exit rates have to be positively correlated with changes in total factor productivity.

Some observable facts make the above hypothesis plausible. On the one hand, in most manufacturing industries process and product technological innovation take place continually in the form of frequent marginal improvements. This constant technological progress normally ends up by being embodied in changes in the manufacturing equipment and in organizational improvements. On the other hand, once incumbent plants have incurred the sunk costs of installing the latest vintage equipment, they tend to try to recover their investment as much as this is possible; the result is that older plants will be less efficient than new ones for reasons of obsolescence but they will tend to delay modernization or their exit as much as possible so as to recover the greatest amount of sunk costs as possible. However, in the depressed phases of the business cycle the most marginal plants will be driven out of the market and, subsequently, during the next recovery, the entry rate of firms with new embodied technology will increase.

Campbell's *vintage capital* model (1997), in which the new establishments embody all the technological progress, attempts to explain the shocks undergone by production and productivity. His hypothesis is that establishments are asymmetrical in the degree of efficiency with which they exploit the technology at their disposal, and for each establishment he defines a production function of the type:

$$Q = \left(Ke^{v_t}\right)^{1-\alpha} N^{\alpha}$$

where the output Q is a function of the quantity of capital K and labor N used and of the level of initial idiosyncratic productivity of the plant v_t. Technology exhibits constant returns although the level of technology which each plant has access to depends on its age and is fixed throughout its life. The assumption of asymmetry means, however, that individual productivity follows a random pattern such that $v_{t+1}=v_t + e_{t+1}$ where e is an i. i. d. variable. This model -together with a set of hypotheses which greatly simplify the working of the economy- reproduces the basic patterns observed in manufacture: entry is procyclic and exit is countercyclic, entry and exit are positively correlated with total factor productivity growth.

The concept of the entry process which is given by the vintage capital models is consistent with the idea that many sectors of the type that Pavitt (1984) called *supplier dominated* - and which are more commonly known as low technology industries - technologically depend on the suppliers of equipment. This is not a marginal fraction of manufacturing activities since a considerable part of manufacturing production from virtually all countries originates in sectors which do not belong to high-tech industries.

Along the same lines, various studies could be mentioned which give support to the *vintage capital* type models. Oley and Pakes (1996) found that in incumbent plants, productivity growth is trivial. What is more, when Geroski (1991) analysed the sources of growth in productivity, he found it useful to distinguish between innovations produced and innovations used. He found that used innovations appear to have a greater positive impact on total factor productivity than self-produced innovations. Finally, there is empirical evidence from surveys carried out with small and medium-sized Spanish firms (Costa et al., 1993) that suppliers of machinery are a fundamental source of innovation.

2. THE ENTRY AND EXIT PROCESS IN SPANISH INDUSTRY

In this first empirical approach, we shall analyse the gross rates of entry and exits of establishments from three viewpoints: the temporal evolution recorded between 1980-1992, sectorial differences in the flows of business turnover, and, finally, the intensity in the renewal of the industrial fabric recorded in the regions of Spain.

During the period 1980-1992, in all of the Spanish manufacturing industries, the flows of business turnover are clearly synchronized with the long economic cycle which the Spanish economy began with the recession at the end of the seventies and continued with the recovery in the second half of the eighties and, finally, concluded with the crisis at the beginning of the present decade. The net rate of entry is negative during the period of industrial adjustment and, subsequently, there are net increases in the number of industrial establishments during the period 1987-1990.

Establishments are clearly opened procyclically, the minimum for the period being recorded in 1981 (3.54%) and the maximum in 1987 (8,25%). The closure of establishments has a more moderate anticyclical behaviour, the maximum being in 1982 (9.57%) and the minimum in 1990 (5.84%). For the whole of the period studied, the gross rate of openings reaches an average of 6.12% in contrast to 7.88% for the gross rate of closures. In net terms, the fall in the number of industrial establishments was 1.76% per annum.

The data for the entry and exit flows of industrial establishments are particularly intense in the processes of busines turnover and, in the case of Spain, break with the industrial dynamics. Indeed, if we make a distinction between the adjustment and rationalization phase of industry -1980-1985- and the period of recovery and subsequent economic moderation -1986-1992-, it can be seen that the gross rates of establishment closures have more stable average values -8.15% and 7.65%, respectively-, in comparison with the considerable recovery in the gross opening of new establishments in the second half of the decade -4.83% and 7.22%, respectively.

The data presented suggest that the opening to the exterior initiated by the Spanish economy, after 1986, caused an increase in business mobility, because of the increase in new establishments and the closure of old ones. The greater intensity in the rhythm of opening and closure of establishments led to a considerable increase in the rate of volatility -entry and exit flows less the net variation in the establishment park- which went from 9.60% in the period between 1980-85 to 13.43% in the period 1986-92.

Table 1 Rate of entry and exit of industrial establishments. Spanish manufacturing: 1980-92					
	Rates of entry and exit of industrial establishments				
Year	Gross rate of entries	Gross rate of exits	Net rate of entries	Rate of turnover	Rate of volatility
1980	3.54	7.75	-4.22	11.29	7.07
1981	3.65	9.13	-5.48	12.78	7.30
1982	4.38	9.57	-5.19	13.95	8.75
1983	5.90	5.74	0.15	11.64	11.48
1984	5.28	9.25	-3.97	14.54	10.57
1985	6.22	7.45	-1.23	13.67	12.44
1986	6.80	8.48	-1.68	15.29	13.61
1987	8.25	7.36	0.89	15.61	14.72
1988	7.59	7.07	0.52	14.66	14.14
1989	7.77	6.79	0.98	14.56	13.59
1990	7.03	5.84	1.19	12.87	11.68
1991	6.92	9.02	-2.10	15.93	13.83
1992	621	8.95	-2.74	15.16	12.42
Period 80-85					
Mean	4.83	8.15	-3.32	12.98	9.60
Standard deviation	1.14	1.46	2.27	1.31	2.23
Period 86-92					
Mean	7.22	7.64	-0.42	14.87	13.43
Standard deviation	0.69	1.20	1.68	1.01	1.04
Period 80-92					
Mean	6.12	7.88	-1.76	14.00	11.66
Standard deviation	1.53	1.30	2.42	1.48	2.56
Source: Registro de Establecimientos Industriales and Encuesta Industrial.					

The intensity of business turnover is significantly different between the industrial sectors (see table A.1). The characteristics which determine the entry and exit barriers, the cost structure, the existence of specific assets, the potential for vertical and horizontal differentiation of products, together with the degree of rivalry between the established firms, among others things, determine the intensity of the opening and closure of establishments. Between 1980-1992, as well as industries that have a low business turnover -office equipment and others; the metal and iron and steel industry- there are industries with a high rate of entry and exit - transport equipment; electrical material; rubber and plastics; textiles, shoes and clothing; wood and other manufacturing goods, etc. It should be pointed out that there is a positive correlation between sectorial entries and exits, that is to say that those industries that have considerable entry bariers also have exit barriers. The entry and exit flows of establishments in industrial sectors are quite stable throughout the Spanish regions. This suggests that the factors that determine business turnover are related to the structural characteristics of the different industrial markets. International comparisons between industrial sectors suggest the same.[4]

If business mobility is to be correctly assessed, it is advisable to use penetration rates which show the amount of employment in the entering establishments in relation to the employment in the established firms in the industry. Industrial turnover measured using penetration rates reduces the turmoil in the gross entry rates. For the period 1981-1992, the gross rate of entry into the Spanish manufacturing industry was 6.27%, while the penetration rate decreased to 2.86% (see table A.2). These results reveal that the entrants are much smaller than the average size of the establishments already in the industry. For the whole of the manufacturing industry, new entrants have a relative size of 44.9% of the established firms.[5] Among the industries with a lower relative size of entrants are metal ores and iron and steel, transportation material, and electric material. For these three sectors, the relative size of entrants fluctuates between 11.4% and 21.1% of the units established in the industry. In contrast, in the office equipment and computer industry entrants are larger than already established firms. This is in agreement with the life cycle of the industry's products and the opening of new establishments of a more efficient size.[6]

From the data available, it can be seen that the establishments which enter a sector are smaller in terms of the number of jobs than those that cease their activity. A significant percentage of the new entries aim to exploit the incomes offered by direct access to local markets or the temporary availability of an innovative product or process. Likewise, studies on the capacity for survival of the entering cohorts indicate that the percentage of firms which stay in the market is quite stable among countries and is clearly regular over time. For Spanish industry, the survival rate is 95% for the first year of newly created companies, 90% for the second year and 85% for the third year (Fariñas et al. 1996). In studies carried out in other countries, only half of the new entries continue operating after five years. In the United Kingdom, for the cohort of new firms of 1978, the survival rate was 94%, 82%, 70%, 63% and 51% for the first five years of life (Geroski 1992).

The survival rate is particularly low in small businesses. The difficulties relatively small units have in generating economies of scale connected to production, together with difficulties in increasing their market share lead to high mortality rates. many of the establishments which enter a sector end up by ceasing activity afteronly a few years. On the one hand, a considerable percentage of business mobility consists of the entry of small establishments encouraged by the possibilities of taking advantage of extra profits, and on the other, the difficulties these businesses have in bringing these expectations to fruition mean that a sizeable part swell the flow of exits. Even though there is a displacement effect caused by the increase in competitive pressure because of the entry of new establishments, a high rate of industrial mobility can be accounted for by the low rate of survival of businesses which begin their industrial activity. In this respect, the impact of the new entries on the structure of industrial markets does not only depend on the gross rate of entry, but also on the relative size of the entrants and on their capacity to get a foothold in the market, in terms of survival and growth of the new firms.[7]

Finally, let us analyse industrial mobility among the Spanish regions. There are considerable differences in the level of industrial turmoil. While the manufacturing industries of Madrid, Valencia, Murcia, Andalucía and Catalunya have high rates of entry and exit, Extremadura, Navarra and the two Castillas have rates of industrial turnover which are well below those for Spanish manufacturing industries as a whole.

Table 2 Regional entry and exit rates (1981-1992)							
	Entry and exit rates					Cyclical component	
Regions	**Gross entry rate**	**Gross exit rate**	**Net entry rate**	**Rate of turnover**	**Rate of volatility**	**Entries**	**Exits**
Andalucía	6.91	7.98	-1.07	14.89	13.83	25.20	52.18
Aragon	5.95	7.58	-1.63	13.52	11.89	24.26	46.31
Asturias	5.21	6.34	-1.12	11.55	10.43	30.54	91.66
Baleares	5.36	7.51	-2.15	12.87	10.72	33.11	97.81
Canarias	6.88	6.65	0.23	13.52	13.30	33.03	116.84
Cantabria	5.50	7.18	-1.68	12.68	11.00	26.08	106.95
Castilla-Leon	4.59	7.16	-2.57	11.74	9.18	19.73	24.30
Castilla-la Mancha	4.86	6.75	-1.89	11.61	9.72	40.60	36.73
Catalunya	629	7.91	-1.63	14.20	12.57	31.99	65.83
Valencia.	8.27	8.75	-0.48	17.02	16.54	26.25	33.77
Extremadura	2.87	5.97	-3.11	8.84	5.73	54.42	11.,21
Galicia	4.76	6.96	-2.21	11.72	9.51	25.64	51.80
Madrid	9.72	11.09	-1.38	20.81	19.43	22.82	60.14
Murcia	7.40	8.19	-0.80	15.59	14.79	32.89	92.31
Navarra	4.72	5.13	-0.41	9.85	9.44	27.16	85.42
País Vasco	5.96	6.71	-0.75	12.67	11.92	39.17	105.34
La Rioja	4.80	7.33	-2.53	12.13	9.60	17.13	92.14
Spain	6.33	7.89	-1.56	14.22	12.67	21.67	17.15

Note: The cyclical component expresses the normal standard deviation for the average of the period 1980-1992.
Source: Registro de Establecimientos Industriales and Encuesta Industrial.

3. EMPIRICAL MODEL

The model in this section adopts a vintage capital framework but differs substantially from standard vintage capital models. It is assumed that new entrants embody new process technologies but it does not require that all technological innovation is embodied in entrants. It is also assumed that total factor productivity is influenced both by technological improvements in incumbents and the vintage capital embodied in new entrants.

The model allows for asymmetries between entrants but does not model them explicitly. It is assumed that at least one part of the newly constructed plants have access to leading edge technology and this affects positively the change in total factor productivity. The more efficient plants displace those incumbents with more obsolete equipment and organization. Another fraction of the new businesses will not succeed in surviving and will exit the industry after a short period of time, as the image of the revolving door describes.

If entrants embody latest vintage technology and displace some of the least efficient incumbents, both entry and exit rates should impact positively on total factor productivity (TFP) at industry level and also at regional level. Both the industry and the region are represented by a Solow type production function which controls for market power and economies of scale (Hall, 1986).

Consider a production function where the output Y_{ij} for industry "i" of region "j" depends on the quantity of factors used, labour N_{ij} and capital K_{ij}, and a productivity index A_{ij}:

$$[1] \qquad Y_{ij} = F(A_{ij}, K_{ij}, N_{ij})$$

After taking logarithms and differentiating with respect to time, the annual rate of growth of output in sector "i" of region "j" is given by the expression:

$$[2] \qquad dy_{ij} = da_{ij} + \varepsilon_{N, ij}\, dn_{ij} + \varepsilon_{K, ij}\, dk_{ij}$$

where dy_{ij}, dn_{ij}, dk_{ij} and da_{ij} are, respectively, the rates of growth, expressed as logarithmic differentials, of the value added, the labor employed, the stock of physical capital and the index of Hicks-neutral technical progress (dx_{ij} = dX/X= dlnX, when x = n, k, a). Finally, $\varepsilon_{N,ij}$ and $\varepsilon_{K,ij}$ are the elasticities of the output with respect to labour and capital ($\varepsilon_{x, ij} = \partial Y / \partial X * X/Y$, when x = n, k).

If we assume constant returns to scale ($\varepsilon_{N,ij} + \varepsilon_{K,ij} = 1$) and long-run competitive equilibrium, the growth rate of total factor productivity coincides with Solow's residual. In this case, the elasticities of the production function with respect to labor and capital can be measured by the observed factor shares in value added. In competitive equilibrium firms are price-takers and marginal cost is set to equal price so, applying Euler's theorem, the output is distributed according to the units used and the unit price of each factor.

However, if we allow for non-constant returns to scale and for firms with market power (Hall, 1986) we shall have a homogeneous production function F (.) of degree $\gamma_{i,}$ where the elasticities of the output with respect to labor and capital are the product of the ratio of price to marginal cost and the factor share.[8]

When the assumption of perfect competition and constant returns is relaxed, the growth of the value added in a representative industry-region are the sum of three different components. The first is the percentage change in the productivity index. The second is the product of the elasticity of scale and the percentage change in capital. Finally, the third is the changes in the labour-capital ratio weighted by the price-cost ratio and the labor share in the output.

$$[3] \qquad dy_{ij} = da_{ij} + \gamma_{ij}\, dk_{ij} + \mu_{ij}\, \alpha_{N,ij}\, (dn_{ij} - dk_{ij})$$

In the new expression, da_{ij} correctly captures the improvements of total factor productivity in the presence of returns to scale and market power. The rate of change in the corrected productivity index - da_{ij} - will differ from Solow's residual to a greater or lesser extent, depending on the magnitude of the returns to scale and the presence of market power in the manufacturing sectors. Taking into account that Solow's residual includes the variations in output not accounted for by the changes in the quantity of factors used ($\theta^{S}_{ij} = dy_{ij} - \alpha_{N,ij}\, dn_{ij} - (1-\alpha_{N,ij})\, dk_{ij}$), from the above expression we can easily derive an equation in which the dependent variable is not the output but Solow's residual. If we subtract the expression $\alpha_{N,ij}$ dn_{ij} + (1-$\alpha_{N,ij}$) dk_{ij}, from the two members in [3], we get:

[4] $$dy_{ij} - \alpha_{N,ij}\, dn_{ij} - (1-\alpha_{N,ij})\, dk_{ij} = \theta^{S}_{ij} = da_{ij} + (\gamma_{ij}-1)\, dk_{ij} + (1-\mu_{ij})\, \alpha_{N,ij}\, (dk_{ij}-dn_{ij})$$

From this equation it can be seen that Solow's residual overestimates (underestimates) the true growth in productivity if the industry has increasing (decreasing) returns to scale and operates in markets of imperfect competition in which firms have market power.

Now, if we assume that firms incur fixed costs which give rise to economies of scale in production and we also accept that in the short term there are ajustement costs, firms will reach the efficient scale when the level of production enables the firm to reduce costs. The contribution of Caballero & Lyons (1990) shows that some of the increasing returns of production depend on external economies connected to the business cycle. The presence in the short term of external effects connected to the business cycle intensifies the utilization of the installed capacity and the quasi-fixed factors and facilitates the appearance of increasing returns.

In order to build an empirical model that adapts to the data available we shall suppose that the growth of corrected productivity index -*da*- can be modelled as a function of five components: changes in total factor productivity (that is to say, technical progress in the strict sense); the external economies that are derived from the evolution of total industrial output; the improvements in productivity attributable to the turnover of manufacturing establishments; and, finally, a random term. That is to say:

[5] $$da_{ij} = \theta_{ij} + \beta_1\, dy_i + \beta_2\, e_{ij} + u_{ij}$$

We include the turnover of firms in every industry-region as one of the determinants of productivity growth in order to reflect technological effort in the broad sense -improvements in organizational profiles, vintage technology embodied in new capital assets - which goes along the renewing of manufacturing establishments. In econometric contrasts, the entry and exit flows of establishments are defined by three variables: the gross rate of entry, the gross rate of exit and the rate of turnover. When these three indicators of business dynamics are estimated separately, the problems which can generate temporal correlation among the rates of entry and exit are avoided.

By introducing the above parameters into [4], we obtain the following empirical equation which will serve as a base for subsequent econometric development.

[6] $$\theta^{S}_{ij} = \theta_{ij} + \beta_1\, dy_i + \beta_2\, e_{ij} + (\gamma_{ij} -1)\, dk_{ij} + (1 - \mu_{ij})\, \alpha_{n,ij}\, (dk_{ij} - dn_{ij}) + u_{ij}$$

where the growth of Solow's residual (θ^{S}_{ij}), for industry "i" in region "j", is the sum of six components: 1) technical progress in the strict sense (θ_{ij}); 2) external effects which are derived from the overall evolution of manufacturing activity (β_1); 3) the efficiency gains caused by business turnover (β_2); 4) the elasticity of scale of production (γ_{ij}); 5) variations in the capital-labor ratio weighted by the labor share on the income and price-cost ratio; 6) and, finally, a random term.

4.PRODUCTIVITY AND BUSINESS DYNAMICS IN THE SPANISH MANUFACTURING INDUSTRIES

We shall begin the empirical analysis with an OLS estimation of the effect of business turnover on total factor productivity in the different sectors of the manufacturing industries at national level. We have a data panel that includes the growth rates of the value added (logarithmic differentials) of thirteen industrial branches (all manufacturing activities) during the twelve years of the period 1980-1992. After controlling the Solow's residual for the presence of external effects, returns to scale and market power, we estimate the impact of entry, exit and establishment turnover flows on productivity. To prevent correlations between gross entry and exit rates, we give four estimates for the expression [6]: the first does not include a measure of business mobility; the second includes the gross rate of entry as an argument of Solow's residual; the third includes the gross rate of exit; and finally, the rate of turnover is considered as a measure of overall mobility.

Table 3 Entry and exit of industrial establishments and growth in productivity.
Dependent variable: Solow's residual
Period: 1981-1992.
Estimation method: OLS

	Estimation 1	**Estimation 2 Entry rate**	**Estimation 3 Exit rate**	**Estimation 4 Turnover rate**
θ_{ij} Corrected productivity	2.905 (4.330)	0.779 (0.859)	0.240 (0.262)	0.296 (0.319)
β_1 External effects	0.398 (3.15)	0.325 (2.830)	0.349 (3.125)	0.330 (2.931)
γ_{ij} Economies of scale	0.640 (1.903)	0.605 (2.157)	0.742 (1.134)	0.673 (1.802)
μ_{ij} Market power	1.482 (2.145)	1.380 (1.732)	1.555 (1.482)	1.462 (2.148)
Rate entry, exit and turnover		0.273 (3.335)	0.301 (4.280)	0.157 (3.892)
R^2	0.184	0.241	0.276	0.259
R^2 Adj.	0.168	0.221	0.192	0.239

Note: Total productivity is shown as a percentage. Statistic t in parentheses.
Number of observations: N * T= 13 * 12 = 156
Source: Registro de Establecimientos Industriales and Encuesta Industrial.

When the variables corresponding to the entry and exit flows in industrial sectors are used in the empirical estimation, the fit of the regression improves, and positive and statistically significant coefficients are obtained. For the industrial sectors of the Spanish economy the entry and exit of establishments is an important source of productivity increase, after the PTF has been corrected for the internal and external economies and market power. The average rate of growth of Solow's residual, during the period 1980-1992, was 2.65%. According to the results in table 3, industrial mobility, measured by the gross rate of entry, accounts for 27% of the growth in productivity; the gross exit rate accounts for 30%; and finally, the turnover rate, as an overall measure of entries and exits, accounts for 15%.[9]

It should be pointed out that the contribution of the entries and exits are both positive. The entry of new establishments leads to an investment process which incorporates more efficient capital and passive assets and contributes to growth in productivity. Parallel to this, the entry of new firms into the market entails the exit of the least efficient units -the displacement effect- or the closure of the recently created establishments -the revolving door effect. To find out whether industrial mobility has long-term effects on productivity an estimation was carried out by OLS using entry, exit and turnover rates as explanatory variables and the corresponding lags for one or two years.

Table 4 Entry and exit of industrial establishments: delayed variables
Dependent variable: Solow's residual
Period: 1981-1992.
Estimation method: OLS

	Estimation 1	**Estimation 2 Entry rate**	**Estimation 3 Exit rate**	**Estimation 4 Turnover rate**
θ_{ij} Corrected productivity	2.421 (3.307)	1.269 (1.315)	1.360 (1.266)	1.223 (1.189)
β_1 External effects	0.548 (4.171)	0.433 (3.376)	0.458 (3.621)	0.439 (3.488)
γ_{ij} Economies of scale	0.486 (2.669)	0.680 (1.565)	0.687 (1.656)	0.677 (1.704)
μ_{ij} Market power	1.314 (1.327)	1.198 (0.875)	1.562 (2.456)	1.434 (1.942)
Period t		0.515 (4.388)	0.279 (4.038)	0.215 (4.490)
Period t-1		-0.214 (-1.786)	0.457 (0.639)	-0.034 (0.627)
Period t-2		-0.175 (-1.453)	-0.148 (2.026)	-0.092 (1.864)
R^2	0.211	0.309	0.317	0.326
R^2 Adj.	0.194	0.278	0.287	0.296

Note:Total productivity is shown as a percentage. Statistic t in parentheses.
Number of observations: N * T= 13 * 11 = 143
Source: Registro de Establecimientos Industriales and Encuesta Industrial.

The results in table 4 confirm the causality between flows of business turnover and the growth in productivity. When current and lagged rates of entry are used in the estimation, high, statistically significant coefficients are obtained for contemporaneous variables, while the lagged variables show negative coefficients with lower degrees of statistical significance.[10]When the rates of exit and turnover are included, the results agree with the previous ones, although this can be interpreted as meaning that the exit of establishments has positive longer lasting effects on productivity. These results seem to confirm that the positive impact of business turnover on productivity has limited temporal validity. The smaller than average size of the entering establishments, the high mortality rates, and the difficulties which newly created units have at gaining market share, suggest that the formation of new establishments has little effect on the intensity of market competition[11] in the short run.

5.2 . PRODUCTIVITY AND BUSINESS MOBILITY IN THE REGIONS OF SPAIN

Available statistical data has permitted the construction of a data panel on added value for thirteen manufacturing industries for the seventeen Spanish regions during a period of twelve years (1980-1992), and we estimate the effect of business dynamics on regional productivity by means of a fixed effects model. For high levels of significance, the sign of the coefficient of the creation and closure of establishments is as expected. It should be pointed out, however, that the coefficients of the three measures of entry, exit and turnover are lower than those for Spanish manufacturing industries as a whole. This seems to confirm that the conditions in which manufacturing firms operate, as well as their idyosincratic characteristics - adjustment costs, external effects, economies of scale, etc.- differ quite considerably from one region to another.

The estimated coeficients indicate that there are significant differences in growth paths and turbulence in the entry and exit rates of establishments across regions. While some regions register high rates of growth in the corrected measure of productivity -Castilla-La Mancha, Catalunya, Madrid and Castilla-León-, other regions present moderate rates of productivity gains - Extremadura, the Canarias, Baleares, Murcia and Asturias. The hetereogeneity in the evolution of the corrected measure of productivity across regions persists even after the indicators of industrial mobility are included as arguments in the Solow's residual equation. The coefficients of the rates of business entry, exit and turnover are significant in all estimations and, interestingly, we can see that the coefficient for exit rates is much higher than the coefficient for entry rates.

Finally, we have run OLS estimations of the individual regional production functions which further highlight the differences across regions. Table 6 shows the results obtained using turnover rates as a global indicator of entry and exit flows. The regions with the highest-statistically significant coefficients are Murcia, Castilla-León, Andalucia and Castilla-La Mancha. In these regions business mobility is an important source of growth of our mesured corrected productivity. In contrast, the coefficients present negative sign - but low significancy - in Extremadura, Asturias, Navarra and the País Vasco, which are regions with entry rates well below the average. In total, the increases in total factor productivity in the regional manufacturing industries depends, to a significant degree, upon the capacity to maintain high rhythms of formation and closure of businesses.

Table 5 Productivity and industrial turnover in the regions of Spain
Dependent variable: Solow's residual
Period: 1980-1992.
Estimation method: Fixed effect model

	Estimation 1	**Estimation 2 Entry rate**	**Estimation 3 Exit rate**	**Estimation 4 Turnover rate**
θ_{ij}	2.554	2.070	1.377	1.669
Corrected productivity	(4.707)	(3.504)	(2.182)	(2.705)
β_1	0.413	0.392	0.401	0.391
External effects	(5.235)	(4.949)	(5.103)	(4.965)
γ_{ij}	0.988	0.981	0.976	0983
Economies of scale	(0.326)	(0.347)	(0.649)	(0.483)
μ_{ij}	1.791	1.786	1.805	1.793
Market power	(22.270)	(22.128)	(22.678)	(22.391)
Rate entry, exit and turnover		0.046	0.090	0.039
		(2.478)	(4.761)	(3.932)
Individual effects				
Andalucía	2.437	1.906	1.296	1.531
Aragon	3.006	2.634	2.051	2.309
Asturias	1.517	1.174	0.569	0.842
Baleares	1.066	0.161	-0.897	-0.484
Canarias	0.913	-0.219	-1.471	-0.996
Cantabria	3.468	2.885	1.994	2.378
Castilla-León	3.824	3.503	2.885	3.168
Castilla-La Mancha	5.146	4.486	3.644	3.984
Catalunya	4.034	3.687	3.203	3.406
Valencia	2.621	2.167	1.699	1.870
Extremadura	-0.529	-1.237	-2.182	-1.792
Galicia	2.113	1.683	1.104	1.343
Madrid	3.977	3.532	2.941	3.184
Murcia	1.201	0.667	-0.034	0.252
Navarra	2.458	1.775	1.006	1.301
País Vasco	2.851	2.605	2.082	2.327
La Rioja	3.135	2.795	1.992	2.377
R^2	0.210	0.212	0.216	0.214
R^2 Adj.	0.204	0.206	0.210	0.208
Test Hausman (FE vs RE)	0.159	2.727	3.896	3.469

Note: Total productivity is shown as a percentage. Statistic t in parentheses.
Number of observations: N *I* T= 2604
Source: Registro de Establecimientos Industriales and Encuesta Industrial.

Table 6 Entry and exit of industrial establishments per region
Dependent variable: Solow's residual
Period: 1980-1992.
Estimation method: OLS

Regions	Parameters					
	θ_{ij}	β_1	γ_{ij}	μ_{ij}	Rate of turnover	R^2
Andalucía	-2.91 (1.25)	0.26 (0.86)	1.57 (2.16)	1.04 (4.10)	0.22 (3.70)	0.20
Aragon	1.54 (0.73)	0.35 (1.59)	0.32 (4.94)	1.58 (2.79)	0.10 (1.14)	0.23
Asturias	2.61 (1.10)	0.46 (1.57)	1.04 (0.21)	1.14 (0.96)	-0.11 (-1.16)	0.03
Baleares	-1.09(-0.48)	0.04 (0.11)	1.21 (1.27)	1.71 (6.58)	0.07 (2.58)	0.27
Canarias	-0.58(-0.26)	0.54 (1.46)	1.18 (0.78)	1.57 (5.19)	0.02 (1.07)	0.18
Cantabria	2.03 (0.60)	0.98 (1.97)	1.63 (1.48)	1.16 (0.42)	0.02 (0.38)	0.04
Castilla-León	-0.10(-0.42)	0.26 (0.95)	0.68 (2.08)	1.38 (3.13)	0.27 (2.21)	0.16
Castilla-Mancha	2.70 (1.04)	0.10 (0.27)	1.35 (1.08)	2.79 (1.84)	0.15 (3.28)	0.71
Catalunya	2.46 (1.99)	0.28 (1.66)	0.98 (0.12)	1.09 (0.55)	0.02 (0.48)	0.03
Valencia	0.69 (0.32)	-0.01(0.05)	1.30 (1.37)	1.76 (3.05)	0.11 (1.33)	0.07
Extremadura	-0.40 (0.16)	0.75 (1.85)	1.26 (1.73)	1.69 (6.81)	-0.09 (-0.28)	0.27
Galicia	0.99 (0.53)	0.54 (2.00)	0.83 (0.71)	1.24 (1.66)	0.02 (0.50)	0.06
Madrid	2.18 (1.32)	0.68 (3.45)	0.56 (3.519	1.13 (0.57)	0.01 (0.19)	0.63
Murcia	-6.64 (2.00)	0.56 (1.35)	0.94 (0.48)	1.70 (3.09)	0.30 (2.97)	0.25
Navarra	2.46 (1.83)	0.84 (3.95)	0.77 (1.44)	1.22 (1.30)	-0.02 (-1.29)	0.12
País Vasco	3.03 (2.18)	0.40 (2.67)	0.89 (0.48)	1.32 (2.44)	-0.07 (-0.87)	0.09
La Rioja	1.60 (0.71)	0.22 (0.86)	0.79 (1.60)	1.40 (2.71)	0.09 (1.03)	0.16

Note: Total productivity is shown as a percentage. Statistic t in parentheses
Number of observations per region: N*T= 156
Source: Registro de Establecimientos Industriales and Encuesta Industrial.

6. CONCLUSIONS

Technological progress in manufacturing activities depends on the capacity and the effort of incumbent firms to innovate and adapt to changing conditions of demand and factor markets, but it also depends on the continuous renewal of the industrial structure. This work has focused on the impact of the entry and exit flows of businesses on the efficiency of regions and manufacturing industries.

From a data base corresponding to twelve manufacturing industries and seventeen regions (NUTS II) of Spain, it has been found that the rate of formation of new businesses as well as the rate of exit has a positive impact on the total factor productivity of industries and regions. The reason for this is that, according to our model, new establishments embody latest vintage technology in their capital equipment and organization. Most new entrants in technologically intermediate economies are imitators or users of innovations, rather than genuine producers of innovations, that try to exploit a local or regional market, or a niche market. Since exit rates also impact positively on productivity, it can be assumed that at least one part of entrants displace the more obsolete and inefficient incumbents.

The relatively low rates of survival among new business seems to prove that entrants are asymmetrical with respect to their capabilities, and it may well also mean that there is a lack of rationality in many decisions of entry. To sum up, it appears that exit rates are the combined result of two processes; on the one hand the process of displacement of inefficient incumbents by new establishments equipped with new-vintage process technology, on the other hand there is the operation of the *revolving door* meaning that many entrants fail to survive. This last process is sufficiently significant to raise the question, not analysed in this paper, if there is room to improve the welfare effects of business turnover by reducing the rate of failure.

The average regional rates of entry and exit are within the values registered in other European regions (Reynolds, Storey and Westhead, 1994). During the period 1980-1992 the annual average gross entry rate across regions was 6,12% and gross exit averaged 7,88, with a negative rate of net entry of 1,76%. In the second half of the eighties, after the accesion of Spain to the European Union, the rate of turnover increased significantly, as a reflection of the more open and competitive context. Another tentative - not tested - explanation for the acceleration of turnover could be the launching of many government programs of support to small businesses. As might be expected, entry is positively correlated with the macroeconomic cycle and exit is negatively correlated to it.

Entry and exit rates across sectors exhibit a great variability and the same feature is usually observed in most countries. This is generally considered to reflect the differences among sectors in the heigth of barriers to entry, in technological opportunities and in the degree of product differenciation. The variability of gross entry between industries becomes still more pronounced if we look at the index of market penetration in terms of employment. In some industries the rates of market penetration of new establishments is relatively high - wood manufactures, textiles, business machinery and metalic products - and in others rates of market penetration are relatively low - steel, transport equipment and food processing industries. The size of new entrants is well below the average size of the industry.

Viewed from the regional dimension, the variability of entry and exit rates is significantly lower than among sectors, but it has been found that the sectorial effect dominates the regional effect.

NOTES

[1] For the sake of convenience, throughout this work the terms firm and establishment will be used synonymously, except when explicitly stated in the text. This simplification is justified because, although existing data bases of entry usually refer to establishments, the great majority of newcomers are firms of only one establishment.

[2] Cable & Schwalbach (1991) find that statistics about entry and exit are very similar in a sample of eight countries. The average entry rate is about 6.5% in terms of number and 2.8% in terms of foothold on the market. The exit rates are 6.5% and 2.7%, respectively (see appendix)

[3] Depending on the study and on the sample of countries, mortality rates are between 40% and 60% after five years.

[4] European network for SME Research (1996)

[5] For the period 1979-87, the mean relative size of new industrial establishments was 43% (Fariñas et al. 1992) while for industrial firms during the period 1991-1993, the relative size of entries went down to 30% (Fariñas et al. 1996).

[6] Klepper (1996).

[7] Balwin and Gorecki (1991).

[8] A homogeneous production function of degree $\gamma_{i,}$ has the following relation between the elasticities: $\varepsilon_{k,ij} = \gamma_{ij} - \varepsilon_{n,ij}$, and if μ_{ij} is the ratio of price to marginal cost in the industry-region "ij" ($\mu_{ij} = P_{ij} / MC_{ij}$), the elasticities can be expressed as a function of the marginal price-cost and factorial share:

$$\varepsilon_{X,\,ij} = \frac{P_{X,\,ij} * X_{ij}}{MC_{ij} * Y_{ij}} = \frac{P_{X,\,ij} * X_{ij}}{P_{ij} / \mu_{ij} * Y_{ij}} = \mu_{ij} * \alpha_{X,\,ij}$$

where $P_{X,\,ij}$,X_{ij} are the price and the units of the productive factors, μ_{ij} the ratio price/cost and $\alpha_{X,\,ij}$ the shares of capital and labor on output.

[9] Studies which use a similar methodology consider that the entry and exit of industrial establishments can affect the increase in productivity by about 50% (Martín, 1992). In our opinion, in economies such as the Spanish one, in which, of the new firms, there is a preponderance of small industrial establishments, half of the productivity gain can hardly be attributed to industrial mobility.

[10] Despite the fact that statistical sources and the values of coefficients differ somewhat, for the manufacturing industries in the United Kingdom during the period 1976-79, the use of delayed variables highlights the positive effect of entries in the short term (Geroski, 1989)

[11] During the period 1980-87, 97.2% of the new industrial establishments were smaller than 25 workers and the average size was 4.3 workers (Lorenzo, 1992).

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DATA APPENDIX

Table A.1 Rate of entry and exit of industrial establishments: 1980-1992)							
	Entry and exit rates					Cyclical component	
Industries	**Gross entry rate**	**Gross exit rate**	**Net entry rate**	**Rate of turnover**	**Rate of volatility**	**Entries**	**Exits**
Ores and metals	0,78	5,45	-4,66	6,23	1,56	67,17	88,73
Mineral Products	4,42	6,52	-2,10	10,94	8,84	32,40	27,17
Chemical Products	7,08	8,06	-0,98	15,14	14,16	35,26	62,54
Metal Products	6,89	7,60	-0,71	14,49	13,77	19,81	33,22
Ag./Ind. Machinery	7,82	9,38	-1,56	17,20	15,65	28,47	34,78
Office Machinery	2,62	0,49	2,13	3,12	0,99	103,19	1306,04
Electrical Goods	13,26	14,67	-1,40	27,93	26,53	24,83	27,62
Transport Equipment	16,01	14,22	1,78	30,23	28,44	91,89	124,03
Food/Bev./Tob.	3,07	5,25	-2,18	8,32	6,14	22,18	35,04
Textiles	8,52	12,04	-3,51	20,56	17,04	38,78	20,63
Paper/Printing	7,09	6,53	0,56	13,62	13,05	31,67	46,52
Rubber/Plastic	11,21	10,69	0,52	21,91	21,39	17,27	61,69
Other Manufacturing	7,70	9,94	-2,24	17,64	15,41	22,97	22,37
Total Manufacturing	6,12	7,88	-1,76	14,00	12,24	24,94	16,45

Note: The cyclic component expresses the normal standard deviation for the average of the period 1980-1992.
Source: Registro de Establecimientos Industriales and Encuesta Industrial.

Table A.2 Dimensions and relative size of the entrances of establishments by industrial sectors (1981-1992)					
Industries	**Gross entry rate**	**Penetration rate**	**Entry Size (a)**	**Incumbents Size (b)**	**Reletive Size (a/b)**
Ores and metals	0,79	0,11	25,7	192,5	13,37
Mineral Products	4,45	2,25	6,5	13,2	49,39
Chemical Products	7,26	2,35	15,6	49,1	31,82
Metal Products	7,03	3,92	5,1	9,4	55,47
Ag./Ind. Machinery	8,11	2,43	5,3	18,3	29,42
Office Machinery	2,87	4,37	32,4	21,0	154,60
Electrical Goods	13,53	2,88	10,1	48,2	21,12
Transport Equipment	15,63	1,78	15,7	136,8	11,48
Food/Bev./Tob.	3,15	1,78	4,6	8,4	55,50
Textiles	8,71	4,57	9,6	19,1	50,54
Paper/Printing	7,42	2,65	5,9	16,6	36,01
Rubber/Plastic	11,35	2,74	6,0	25,0	24,05
Other Manufacturing	7,85	6,03	4,0	5,3	75,03
Total Manufacturing	6,27	2,86	6,4	14,4	44,91

Source: Registro de Establecimientos Industriales and Encuesta Industrial.