Business Dynamics and Efficiency in Industries and Regions: The Case of Spain[1]

Maria Callejón
Agustí Segarra

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 does not reach clear conclusions, 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 an approach 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, manufacturing, total factor productivity

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Maria Callejón
Departament de Política Economica i EEM
Universitat de Barcelona, Spain
E-mail: callejon@riscd2.eco.ub.es

and

Agustí Segarra
Departament de Gestió d'Empreses i Economia
Universitat Rovira i Virgili, Spain
E-mail: asb@fcee.urv.es

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 industries. Every year a relatively high number of firms[2] enter each sector, and an equally numerous group exits, so the net entry – frequently negative in manufacturing – is a small fraction of the total number of firms and an even smaller fraction of the market share, since the size of the incoming firms is well below the average of the industry.[3] Likewise, it can be seen that most of the exiting firms have operated in the market for a very short time. That is to say, most of the incoming firms do not manage to consolidate themselves and they decide to cease their activity.[4] Together with general turbulence and volatility, important variations in birth and death rates can simultaneously be seen on a time scale, in space and between sectors.

Such behavior raises a number of questions that we might group as follows: (i) what are the factors that determine the incentives for agents to enter an activity?; (ii) what effect does this observed turbulence have on market structure, its evolution and its efficiency?; and finally (iii), what implications do the birth and death of firms have on social welfare?. On the first two groups of questions there is already a body of literature of some importance, although the effects on welfare have been studied to a lesser degree, probably due to the significant limitations imposed by the insufficient availability of appropriate data. This study attempts to provide evidence about the effect of the entry and exit of manufacturing firms on the productivity of industries and regions. It is assumed that a significant share of incoming

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businesses use the edge technology available in their equipment and so contribute to increase total factor productivity. Firstly, the prevalent models of entry and industrial dynamics in current literature are reviewed to conclude that they lack sufficient universality to be applied to economies that occupy secondary positions in innovative capacity.

This paper is divided into five sections and an appendix. The first section deals with the determinants of entry and exit of firms and its relationship to efficiency. The second section contains a descriptive analysis of the entry and exit processes by industries and regions in Spain. The third section presents the econometric model employed in the regression analysis, whose results are discussed at the forth section of this paper. The econometric estimations are carried out at two levels: industries and regions. The fifth section contains the conclusions of the analysis. Finally, the appendix presents some additional descriptive data.

1. Entry models and efficiency

1.1. *Static and dynamic approaches*

Conventionally, we may distinguish two main lines of analysis in entry models, the first follows a traditional static approach, and the second is a dynamic approach in which innovation and technological progress determine the evolution of market structures.

1.1.2. *Traditional view*

According to the static view, entry is the mechanism by which competition erodes the market power of incumbents and the level of profits of the industry reach their long-run equilibrium. If the industry is perfectly competitive, entry eliminates all positive profits the incumbents could have achieved. If the industry is imperfectly competitive the level of long-run profits will depend on the height of the barriers to entry. The basic hypothesis is that there will be entry into one market whenever the expected profits exceed the level of profits sustainable in the long-run. The standard model is (Orr, 1974 and Geroski, 1991a):

$$\mathrm{ENT}_{it} = \gamma(\pi_{it} - b_i) + \mu_{it}$$

where ENT_{it} denotes the rate of entry into industry i in period t, π_{it} is the post-entry expected profit, b_i is the profit rate which can be sustained in the long run without attracting entry, it measures the height of the barriers to entry, μ_{it} is a random term and γ is a parameter which measures the speed of response of the incoming firms to the gap existing between expected short-run profits and profits sustainable in the long-run.

The static approach assumes that entry increases market competition and ultimately leads to efficiency improvements. Geroski (1989) found that entry of new firms and the selection process among them induce movements to, and shifts of, the production frontier. This was done by estimating a function of the usual type $y = \alpha l + \beta k + \theta$, where output growth depends on the rates of growth of labour l and capital k, and on θ. The intensity of competition in the market is captured in θ, which in turn depends on three explanatory variables: domestic entry rate, number of innovations, and the rate of import penetration. According to Geroski's estimate, entry would account for 30% of the growth in total factor productivity. Baldwin and Gorecki (1991a) reached very similar results with a sample of 167 four-digit Canadian manufacturing industries.

Evidence of productivity improvements associated to firm turnover does not imply automatically, nevertheless, that entry is induced exclusively by a situation of above-normal profits in the industry. Common experience tell us that entry occurs even in situations of zero-profits, and several studies (Acs and Audretsch, 1990) have found that entry is not substantially deterred in industries with large scale economies. Baldwin (1995) argues that there are at least two reasons to expect a positive entry rate in industries where profits have reached its long-term level. First, if firms are heterogeneous with respect to their cost function, low cost entrants may expect to displace less efficient incumbents. Secondly, entrants may expect to gain market share with a "superior" product, in terms of quality or novelty. Both situations are better dealt with using dynamic models of market structure than the traditional static approach.

1.1.2. *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 Orsenigo, 1996). Some of these approaches are inspired by evolutionist (Nelson and Winter, 1982) and product cycle (Abernathy and Utterbach, 1978) models. In Autretsch's version (1995, 1997) it is the possibility of exploiting an innovation which induces an agent to set up a new business. In the dynamic approach new firms are heterogeneous and so are incumbents. These asymmetries concern both the innovative and administrative capacity as well as the assessments that the agents make of the expected market value of a potential 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 agents may form different expectations. Agents also differ in their degrees of aversion to risk. Less risk-averse new entrants may be more prone to exploit a new idea than more bureaucratic, routinized incumbents (Audretsch, 1997).

The dynamic-evolutionist approaches allow the introduction of explanatory factors which are compatible with 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. Costs are supposed to be different and random among firms. The distribution of true costs is known to all, but no firm knows *a priori* what its true cost will be. The only way a potential entrant can know about its possibilities of survival is to actually enter the market. Efficient entrants grow and survive; inefficient entrants decline and fail. Under the assumption of homogeneous product, relative efficiency depends on the cost function. Thus, Jovanovic provides a theory of selection with incomplete information in which firms only know their own relative level of efficiency *ex post* as they operate in the industry.

1.2. *Technological regimes and the product cycle*

If innovation drives entry, different technological opportunities should give way to different entry rates across industries. And, actually, evidence from many countries data show an enormous degree of variability among entry and exit rates across industries. The models of the "technological regime" and the "product life cycle" seek to explain those differences. In the technological regime model entry and exit rates depend on the specific technological innovation speed of each industry. The product life cycle model hypothesizes that the speed of technological innovation varies according the stage of the product life.

According to Nelson and Winter (1982) there are two basic types of technological regimes: the entrepreneurial regime and routinised the regime. Under the entrepreneurial technological regime new innovating firms confront low entry barriers linked to the acquisition of knowledge. Their knowledge frequently proceed from R+D carried out in other related industries, as well as from R+D carried out by incumbents in the same industry. That is, new firms are created at a high rate as a consequence of knowledge externalities.

The routinised technological regime presents opposite features that do not favour innovative entry, given that new knowledge is developed fundamentally within incumbents mostly as result of cumulative *learning by doing* inside the organization and presents a strong "tacit" component not easily transferable. Entry is not easy.

The product life cycle (PLC) (Abernathy and Utterback, 1978) differs from the technological regime model in that while the latter assumes that the technological regime is specific to the industry, the PLC model – which was inspired by the car industry evolution – implies that each and every one of the manufacturing industries conform to the PLC. The technology of each industry experiences several phases. In the introductory phase is characterized by rapid product innovation and high entry and exit rate. Later, during the growth phase of the industry, product innovation is slower, due to design standardization, and economies of scale become important. The entry rate and the number of firms in the market stabilizes. In the phase of maturity, price competition increases and there are few entries and many exits.

The above PLC model hinges crucially on the assumption that all industries reach a phase of design standardization, which is true with the car industry, but does not fit to the evolution of many other activities. Recently, Klepper (1996) has put forward a new version of the PLC model where firms are allowed to keep on introducing product and process innovations and improvements at a rhythm which is decided endogenously. Firms decide how much they spend on R+D and their innovative rhythm depends on this. The value of a reduction in the unit cost thanks to a process innovation is proportional to output, that is to say the size, of the firm. As a firm grows, it becomes more interested in process innovations. In the absence of further shocks, the industrial structure is marked by the advantage of the first entrant. Klepper's version of the PLC is compatible with the observed fact that the group of firms belonging to core of one industry is usually much more stable than the periphery. It also gains plausibility by enabling product innovation to be endogenised by the industry.

The common feature of the mentioned dynamic approaches is that entry – and exit – is related to innovation possibilities. After acknowledging that those models make a good representation of one part of the industrial organization processes, some observations can be made. For instance, few is said about the role of imitation in the evolution of market structure, even if we know that more firms act as imitators rather than innovators. On the other hand, the crucial aspect of the social welfare consequences of dynamic models of firm turnover is not often analyzed. In the static model entry improves welfare through enhanced competition (movements to the frontier). And it could be assumed that in the dynamic models innovative entry impacts positively on productivity (shifts of the frontier) but, often, welfare aspects are not fully analyzed.

1.3. *Embodied technology*

The explanatory power of models based on the technological regime notion and PLC, largely inspired by experience in the United States and a few other countries which are at the technological frontier, seems weaker when analyzing technologically intermediate economies – Spain, for instance – in which innovations are adopted mainly by diffusion and imitation, and only to a much lesser extent by endogenous generation of new knowledge. Actually, imitation incentives presumably dominate innovation incentives also in most industries of the leading developed countries.

If imitation dominates innovation measured in entry rates, it would be interesting to build models in which a large share of entrants seek to adapt product and process innovations, tried and tested previously in other more advanced markets, to specific, in most cases local, markets. For the sake of simplicity we may assume that a substantial part of technological change is embodied in capital goods of the latest generation. The incentive of entrants would be to exploit the advantage of the margin of greater efficiency they enjoy in comparison with incumbents, as they operate with the most modern equipment, and possibly organization, available. In this *embodied technology* model, that is a variant of the *vintage capital* type models, 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 could be captured by changes of total factor productivity, so that entry and exit would be positively correlated to change in total factor productivity.

Some facts observable in reality grant the above hypothesis plausibility. In most manufacturing activities process and product technological innovation take place continually in the form of frequent marginal improvements. This constant technological progress likewise leads to continuous improvements in manufacturing equipment and, in many cases, to organizational improvements. This implies that the equipment acquired on a certain date suffers from a slow but constant process of obsolescence. Nevertheless, once incumbent plants have incurred the sunk costs of installing the latest vintage equipment, they tend to try to amortize it 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. 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 in their equipment will increase.

Among the possible specifications of an

embodied technology model it seems particularly attractive the version proposed by Campbell (1998). The production function for each establishment adopts the form:

$$Y = (Ke^{v_t})^{1-\alpha}N^{\alpha}$$

where the output Y is a function of the quantity of capital K and labour N used and of the level of idiosyncratic productivity of the plant v_t. The technology presents constant returns although the level of technology with which each plant operates depends on the age of its equipment t.

The assumption of asymmetry implies that each firm exploits the technology within its reach with different degrees of efficiency. That is to say that the initial level of productivity of a plant, v_t, established in period t is a random variable normally distributed,

$$v_t \sim N(z_t, \sigma_e^2)$$

z_t being an index of embodied technology equivalent to the mean efficiency in the exploitation of the technology of the firms born in period t. This index follows a random path with a positive drift, $z_t = \mu_z + z_{t-1} + \varepsilon_t^z$ where ε_t^z is a random variable with zero mean. Individual productivity follows a time pattern such that $v_{t+1} = v_t + e_{t+1}$ where e is a random term with zero mean. Therefore, the firms differ in their capacity to exploit the technology embodied in their equipment and, also, this capacity is not altered in the course of time except by the influence of random shocks of a temporary nature.

The approach to the entry process proposed by the embodied technology model is consistent with the idea that many productive sectors with low intensity in technology and slow demand growth, or those that Pavitt (1984) called *supplier dominated*, technologically depend on the industries manufacturing the equipment. A considerable part of manufacturing production from virtually all countries originates in sectors that are not high-technology industries, in so far it can be assumed that the embodied technology model is representative of at least a relevant segment of manufacturing industries.

Other studies could be mentioned which give support to the above model. Oley and Pakes (1996) found that in incumbent plants, productivity growth is trivial. What is more, Geroski (1991b) finds it useful to distinguish between innovations produced and innovations used when analyzing the sources of growth in productivity, and finds that used innovations appear to have a greater positive impact on total factor productivity than self-produced innovations. One plausible objection to Campbell's model is that incumbent plants also modernize their equipment periodically. This fact, nevertheless, does not change the positive impact of entry – and exit – on total factor productivity, specially if, as Yorukoglu (1998) argues, new machinery is not used at existing plants as effectively as at new plants.

Finally, there is certain 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, and the main one in many cases.

If it seems too restrictive, Campbell's model can be modified to allow for increasing returns at the production function. On the reasonable assumption that firms are subject to learning curves, their average cost decreases as accumulated production increases. We can rewrite the individual production function as:

$$Y = \Omega(Ke^{v_t})^{1-\alpha}N^{\alpha}$$

where Ω represents the effects (only positive) of learning by doing economies and depends on the size of accumulated output. With this assumption it would be possible to account for external effects derived from the business cycle. The output growth of each firm linked to an expanding business cycle would influence the speed with which accumulated production grows and this would be captured by Ω. The econometric model of the third section, although not derived from Campbell's model, adopts the idea of external effects arising from growth in aggregate demand to the industry.

1.4. *Exit*

The rate of exit is in most manufacturing industries greater than the rate of entry. Exits have been found to behave procyclically, in the sense that exits increase during recessions and decrease during the phases of expansion of economic activity (Table A.2). We also know that entries and exits are correlated across industries, in the sense that in high entry industries exits are also high. Nevertheless, the crucial question of how entry affects exit is difficult to answer.

Audretsch (1995) addresses this question in a metaphorical way in terms of two possibilities: the *displacement* effect and the *conical revolving door* effect. Put another way, if the displacement effect predominates the incoming firms expel the less efficient established firms from the market, in a type of "creative destruction" process. On the other hand, the predomination of the conical revolving door effect implies that exiting firms are the same ones that entered a short time before, having survived only a short time in the activity. The image of the conical revolving door represents the fact that the speed of entry and exit is much higher at the base, where the small firms are gathered, than at the summit.

The studies available on the survival of firms seem to indicate that the revolving door effect prevails over the displacement effect, although significant differences across industries can be observed. For example, some studies find that the industries where economies of scale are significant the survival rates of newcomers are lower, as it is relatively more difficult to reach the minimum efficient scale. Differences can also be observed according to the type of newcomer. New independent firms have a higher risk of failure in the years immediately after their entry. On the other hand, in the opposite sense, Geroski (1989), as well as us in this study, detected a positive effect of entry on productivity, which leads to the conclusion that the displacement effect is significant.

One puzzling aspect is: why is entry so high if the newcomers confront such a big risk of failure? Asymmetry among the capabilities of the newcomers may help to explain the facts, but the question remains of why so many decisions to enter turn out to be erroneous. A possible line of reasoning would be related to the notion of bounded rationality and risk-aversion. There is some anecdotal as well as systematic evidence[5] that many entrants have not gathered a lot of information about conditions in their market before they decide to set up a new business.

Another possibility is that the newcomers are rational and their objective, rather than to ensure the survival of the firm in the long term, is to exploit opportunities that are very limited in time of the *hit and run* type. Anecdotal evidence is sometimes found that local or regional public support for small and medium-sized companies can stimulate in some cases behaviour of the *take and run* type. Nevertheless, and especially in the case of manufacture, the size of the sunk costs limits the possibilities for practicing hit/take and run activities.[6] If it was possible to demonstrate that there is insufficient rationality in the agents, and this generates unnecessary social costs due to excess turnover and incorrect allocation of resources, it would be interesting to find out what policy-makers could do to improve the information that the agents use to take decisions.

2. The entry and exit process in Spanish manufacturing industry

We begin the empirical approach with the analysis of the rates of gross entry and exit of establishments in Spain from three viewpoints: the evolution recorded between 1980–1992; the differences in the flows of business turnover among industries; and, finally, the intensity of the renewal of the industrial structure experienced by the regions of Spain.

Current literature employs various indicators for measuring the intensity of business dynamics. The most employed measures are the gross entry and exit rates that relate the absolute number of establishments that begin or end their activity with the total number of establishments of the industry. From these figures it is easy to obtain the net entry rate, that measures the variation in the number of establishments in the industry between two consecutive periods. From the above rates it is easy to obtain an indicator of the total mobility of the sector, whether it is the turnover rate – the sum of entries and exits divided by the number of establishments in the industry –, or whether it is the volatility rate – the sum of entries and exits less the absolute value of the net entry rate –. Other measures used by some authors include an index of gross entry of new firms with respect to total employment in the industry (Reynolds, 1994 and Baldwin and Gorecki, 1991) or even an index of market penetration that relates the employment in the incoming firms to total employment in the sector.

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, continued with the recovery in the second half of the eighties then, finally, concluded with the crisis at the beginning of the present decade. The rate of net entry is negative during the period of industrial adjustment and, subsequently, achieves net increases in the number of industrial establishments during the period 1987–1990, to end with a reduction in the number of establishments during the years 1991 and 1992. The creation of establishments is clearly procyclical, the minimum for the period being recorded in 1981 – 3.54% – and the maximum in 1987 – 8.25%. The closure of establishments nevertheless has a more moderate, but also procyclical 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 births reaches an average of 6.12% in contrast to 7.88% for the gross rate of deaths. In net terms, the fall in the number of industrial establishments was 1.76% per annum (Table I).

The data for the entry and exit flows of industrial establishments show the importance of the processes of business turnover and, in the case of Spain, that there is a break in the trend towards the middle of the eighties. 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 rates of exit show more stable average values –8.15% and 7.64%, respectively –, than the values recorded for the gross rate of entry, that experienced a considerable recovery in the second half of the decade –4.83% and 7.22%, respectively.

TABLE I
Rate of entry and exit of industrial establishments, Spanish manufacturing industries: 1980–1992

Years	Rates of entry and exit of industrial establishments				
	Gross rate of entry	Gross rate of exits	Net rate of entry	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	6.21	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: Registry of Industrial Establishments and Industrial Survey.

The data presented suggest that the opening to foreign markets initiated by the Spanish economy after 1986 caused an increase in business mobility, as much because of the increase in the rate of creation of new establishments as for the closure of old installations. This greater intensity in the rhythm of entry and exit of establishments led to a considerable increase in the rate of volatility – entry and exit flows less the net variation in the total number of establishments – which increased from 9.60% in the period 1980–1985 to 13.43% in the period 1986–1992.

The intensity of business turnover is significantly different among industries (Table A.1). The characteristics which determine the barriers to entry and exit, the cost structure, the existence of specific assets, the potential for vertical and horizontal product differentiation, together with the degree of rivalry between the established firms, among other things, determine the intensity of the entry and exit of establishments. During the period 1980–1992, as well as industries that have a low business turnover – office equipment and others; the metal and iron and steel industry – industries can be found with an intense dynamic of entry and exit – transport equipment; electrical goods; rubber and plastics; textiles, footwear and clothing; wood and other manufactured goods, etc. 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 point in the same direction.[7]

The data confirms an aspect already noted in studies for other countries, that there is a positive correlation between entries and exits, that is to say, that those industries that have considerable barriers to the entry of new establishments also have barriers to exit. Entry rates also show a strong positive correlation with the macroeconomic business cycle. As can be expected, exit rates are negatively correlated with the phase of the business cycle, but the correlation is not so close (Table II).

Differences across industries not only affect the dynamics of the opening and closure of establishments but also the net entry rates. Indeed, together with sectors that enjoy sustained growth in their firm's stock – office machinery; transport equipment; paper and printing products; rubber and plastics – can be found activities that suffer from a notable reduction in the number of establishments – ores and iron and steel, textiles, footwear and clothing, wood, cork and other manufactured goods; food, beverages and tobacco; etc. – It is also important to point out the great differences in indicators of volatility. This measurement expresses the business mobility of industries more closely, being an indicator that is more adjusted to industry characteristics – capacity to differentiate products, expenditure on R+D, the presence of specific assets, etc. – that determine barriers to the entry and exit of establishments. Low levels of volatility are presented in the office machinery, ores and iron and steel sectors, that contrast with the intense business mobility of the electrical material and transport equipment industries.

If business mobility is to be correctly assessed, it is advisable to use market share rates which show the amount of employment in the incoming establishments in relation to the employment in the established firms in the industry. Industrial turnover measured using market share 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 market share rate decreased to 2.86% (Table A.3). These results reveal that the newcomers are much smaller than the average size of the existing establishments. For the whole of the manufacturing industry, newcomers have a relative size of 44.9% of the established firms.[8] Among the industries with a lower relative size of entrants are metal ores and iron and steel, transportation equipment, and electric material. For these three sectors, the relative size of entrants fluctuates between 11.4% and 21.1% of the average established firms. In contrast, in the office equipment and computer industry newcomers are larger than already established firms.

From the data available, it can be seen that the establishments which enter a sector are smaller in terms of employment than those that cease their activity. A significant percentage of the new entries seek to earn the profits expected from direct access to local markets. Or to exploit an innovative product or process by acquiring a patent or a franchise. Likewise, studies on the capacity for survival of the incoming cohorts indicate that the percentage of firms that 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).[9] 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 limitations that relatively small units have in achieving economies of scale, together with difficulties in increasing their market share lead to high mortality rates. Many of the establishments that enter a sector end up by ceasing activity after only 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 certain extraordinary profits, and on the other, the difficulties these businesses have in bringing these expectations to fruition mean that a sizable part of recent newcomers 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, given the limited size of the newcomers, a high rate of industrial mobility can be accounted for by the low rate of survival of the 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 newcomers and on their capacity to get a foothold in the market, in terms of the survival and growth of the new firms. (Baldwin and Gorecki, 1991).

Finally, let us analyze industrial mobility among the Spanish regions (Table II). There are considerable differences in the level of industrial turmoil. While the manufacturing industries of Madrid, the Community of Valencia, Murcia, Andalusia and Catalonia have high rates of entry and exit, Estremadura, Navarre and the two Castiles have rates of industrial turnover which

TABLE II
Regional entry and exit rates (1981–1992)

Regions	Entry and exit rates					Cyclical component	
	Gross entry rate	Gross exit rate	Net entry rate	Rate of turnover	Rate of volatility	Entries	Exits
Andalusia	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
Balearic Islands	5.36	7.51	–2.15	12.87	10.72	33.11	97.81
Canary Islands	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
Castile-Leon	4.59	7.16	–2.57	11.74	9.18	19.73	24.30
Castile-La Mancha	4.86	6.75	–1.89	11.61	9.72	40.60	36.73
Catalonia	6.29	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
Estremadura	2.87	5.97	–3.11	8.84	5.73	54.42	116.21
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
Navarre	4.72	5.13	–0.41	9.85	9.44	27.16	85.42
Basque Country	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: Registry of Industrial Establishments and Industrial Survey.

are well below those for Spanish manufacturing industries as a whole.

3. Model

The object of this section is to present a theoretical model that permits the empirical determination of the influence of entry and exit flows of industrial establishments on the total factor productivity. In the first place we show the characteristics of the technology and of the markets of the industrial sectors of a region, to afterwards include the gross rates of business entry, exit and turnover as a component of the total productivity of the industry.

For the industry 'i' of the region 'j' in the period 't' the quantity of output obtained – Y_{ij} – is the result of the combination of capital and labour – K_{ij} and N_{ij} – according to the following production function,

$$Y_{ij} = F(A_{ij}, K_{ij}, N_{ij}) \tag{1}$$

where the output depends on the quantity of workers (N), on the stock of physical capital (K) and the productivity index (A) that includes the variations in production not attributable to changes in the use of the productive factors.

If we take into account that technology can present non-constant returns to scale and that firms often exercise a certain market power (Hall, 1986), we shall have a homogeneous production function F (.) of degree γ_i,[10] where the elasticities of output with respect to labour and capital are the product of the price-cost ratio and the factor share in value added.[11] If we consider as a starting point the general value added equation suggested by Hall (1986), the percent change of the output in a representative industry-region depends of three different components. The first is the percent change in the productivity index. The second is the product of the elasticity of scale and the percent change in capital. Finally, the third is the percent change in the labour-capital ratio weighted by the price-cost ratio and the share of labor in value added.

$$\mathrm{d}y_{ij} = \mathrm{d}a_{ij} + \gamma_{ij}\mathrm{d}k_{ij} + \mu_{ij}\alpha_{N,\,ij}(\mathrm{d}n_{ij} - \mathrm{d}k_{ij}) \tag{2}$$

where $\mathrm{d}y_{ij}$, $\mathrm{d}n_{ij}$, $\mathrm{d}k_{ij}$ and $\mathrm{d}a_{ij}$ are the rates of growth, expressed as logarithmic differentials, of the value added, the labour employed, the stock of physical capital and the productivity index ($\mathrm{d}x_{ij} = \mathrm{d}X/X = \mathrm{dln}X$, when $x = y, n, k, a$). Finally, γ_{ij} is the elasticity of output with respect to total input, μ_{ij} is the degree of market power and α_{ij} is the share of labor in value added.

In the new expression, productivity correctly captures the improvements in technical efficiency in the presence of economies of scale and market power. The rate of change in the corrected total factor productivity 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 industrial sectors. Taking into account that Solow's residual includes the variations in output not accounted for by the changes in the use of production factors ($\theta^s_{ij} = \mathrm{d}y_{ij} - \alpha_{N,\,ij}\mathrm{d}n_{ij} - (1 - \alpha_{N,\,ij})\mathrm{d}k_{ij}$) we can easily derive an equation in which the dependent variable is not output but the Solow's residual. If we subtract from the two members in Equation (2) the expression $\alpha_{N,\,ij}\mathrm{d}n_{ij} + (1 - \alpha_{N,\,ij})\mathrm{d}k_{ij}$, we get:

$$\theta^s_{ij} = \mathrm{d}a_{ij} + (\gamma_{ij} - 1)\mathrm{d}k_{ij} + (1 - \mu_{ij})\alpha_{N,\,ij}(\mathrm{d}k_{ij} - \mathrm{d}n_{ij}) \tag{3}$$

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 high adjustment costs in relation to the productive factors, firms will reach the efficient scale when the level of output enables the firm to exploit internal economies of production. In this way it is easy to establish a connection between the procyclical behaviour of total factor productivity and the external effects derived from the evolution of demand at higher aggregation levels. The contribution on this point of Caballero and Lyons (1990) shows that some of the increasing returns of production depend on external economies connected to the cyclical behaviour of the economic activity.

In order to build an empirical model that adapts to the available data we shall suppose that the growth of the corrected productivity index – da – for industry 'i' of region 'j' can be modeled in five components: percentage changes in the productivity of the sector (that is to say, technical progress in the strict sense); the external economies of the sector which are derived from the evolution of total industrial output ($\mathrm{d}y_i$); the improvements in productivity attributable to the turnover of industrial establishments (e_{ij}); an aggregate shock for each industry-region; and, finally, a random term:

$$da_{ij} = \theta_{ij} + \beta_1 dy_i + \beta_2 e_{ij} + v_{ij} + u_{ij} \qquad (4)$$

We include the turnover of firms in every industry-region as a determinant of productivity growth in order to reflect technological effort in the broad sense -improvements in the organizational profiles, technology embodied in new capital assets, changes in the industrial structure, etc. – which goes along with the renewal 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.[12] By introducing the above parameters into Equation (3), we obtain the following empirical equation which will constitute the base for subsequent econometric development.

$$\begin{aligned}\theta^s_{ij} = \theta_{ij} + \beta_1 dy_i + \beta_2 e_{ij} + (\gamma_{ij} - 1)dk_{ij} \\ + (1 - \mu_{ij})\alpha_{N,\, ij}(dk_{ij} - dn_{ij}) + e_{ij}\end{aligned} \qquad (5)$$

This equation establishes the growth of total factor productivity or Solow's residual (θ^s_{ij}), for industry "*i*" in region "*j*" as the sum of seven 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 production efficiency gains caused by business turnover (β_2); 4) the elasticity of scale of the industrial product (γ_{ij}); 5) variations in the capital-labour ratio weighted by the share of labour incomes on value added, the price-cost ratio; 6) an aggregate shock for each industry-region; and, finally 7) a random term.

4. Technical progress and business turnover

Firm entry and exit processes is an important mechanism in the renewal of market structure. Several studies have found that turnover is linked to output growth. New firms are of several types: incumbents that seek to diversify their lines of products; new independent entrepreneurs, or new business created by merger of previously existing firms. At the same time, business turnover is one of the sources of technical progress by the introduction of more efficient capital goods, the adoption of new organizational systems, or the development of new products.

Nevertheless, the link between business turnover and technical change depends on the characteristics of the industry and the nature of the incoming establishments. If at the technology intensive manufacturing industries the opening of new establishments is confronted with high entry barriers under the form of technological skills, at the capital intensive manufacturing sectors the barriers to entry depend on the necessary initial investment to reach the minimum efficient size.

For economies like Spain, which is below the technological frontier, the creation of new industrial establishments is associated to the incorporation of technologically advanced capital goods, and to the adoption of more efficient management systems. The positive interaction between technical change and accumulation of new capital goods manifests itself, in part, through the following mechanisms: new capital embodies part of the new technologies; the utilization of new modern capital often gives way to improvements in organisational models; and finally, last vintage equipment modify the environment in which production is carried out, incentivating learning processes among workers (learning by doing) (Wolf, 1991 and Griliches, 1994).

If the new generations of capital goods are more efficient than those existing, the investment process carried out by the new establishments constitutes a significant source of the incorporation of technical progress (Maddison, 1987). Indeed, the utilization of modern physical capital by new establishments should materialize into improvements in global productivity.[13]

4.1. *Productivity and business mobility 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 thirteen Spanish manufacturing industries. In order to perform econometric contrasts we use a data panel that includes twelve rates of annual variation, in logarithmic differentials, for the period 1980–1992. In the specification used, 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 turnover flows on total factor productivity. When the rates of entry and exit were both included as independent variables, the results obtained were not satisfactory due to the correlation between the rates of opening and closure of establishments. To avoid the presence of temporal positive correlations between gross entry and exit rates, we give four estimates for the expression Equation (5): the first does not include any measure of business mobility; the second includes the gross rate of entry as a component 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.

The fit of the regression improves when the variables corresponding to the entry and exit flows in industrial sectors are introduced into the empirical estimation, and positive and statistically significant coefficients are obtained. For the industrial sectors of the Spanish economy as a whole the entry and exit of establishments appears as an important source of productivity growth, after the TFP 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 shown in Table III, 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%.[14]

It is important to point 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 goods and intangible assets contributing positively to productivity growth. 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 recently created establishments – the revolving door effect. To find out whether industrial mobility has long-term effects on productivity, an estimation is carried out by OLS using current entry, exit and turnover rates, as well as their one and two years lagged values as explanatory variables.

The results shown in Table IV go deeper into the causality between business demography and productivity growth. When current and lagged rates of entry are used in the estimation, positive, statistically significant coefficients are obtained for current effects, but the lagged variables present negative coefficients with lower degrees of statistical significance.[15]

TABLE III
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 (3.415)	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)
Entry rate, exit rate and Turnover rate		0.273 (3.335)	0.301 (4.280)	0.157 (3.892)
R^2 R^2 Adj.	0.184 0.168	0.241 0.221	0.276 0.192	0.259 0.239

Source: Registry of Industrial Establishments and Industrial Survey.
Note: Total productivity is shown as a percentage, *t*-values in brackets.
Number of observations: $N \times T = 13 \times 12 = 156$

TABLE IV
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

Source: Registry of Industrial Establishments and Industrial Survey.
Note: Total productivity is shown as a percentage. t-values in brackets.
Number of observations: $N \times T = 13 \times 11 = 143$

One possible explanation for this apparently contradictory result could be found in the effect of entry of new rivals on the efficiency of incumbents. If existing firms have to accommodate the new entrants, they may be forced to reduce output. With fixed costs – as it is normal in manufacturing – a reduction in the scale of production of incumbents would result in rising average costs, losses in producer's surplus and an overall loss of efficiency (Nachbar, Petersen and Hwang, 1998). It is possible to hypothesize that, in a market with a great number of firms, accommodation processes take some time to happen, and do not manifest immediately after entry has taken place, but one or two periods later.

The exit rate also has diverging effects on efficiency depending of the elapsed time. While the positive impact at the current period reflect that exiting firms are those less efficient, and their disapearence improves the average labour productivity, the negative sign of the lagged exit rate is more difficult to explain. A posible hypothesis is that high rates of exit are also correlated with weak competitiveness of the industry, and that unfavourable condition is captured by the lagged variable, given that at the beggining the average productivity enhancing effects of the exit of inefficient plants dominates.

4.2. *Productivity and business mobility in the Spanish regions*

We begin the econometric contrast with the presentation of the results obtained by means of a fixed effects model for all the industrial sectors of the Spanish regions. For high levels of significance, the incidence of the creation and closure of establishments on productivity is of the expected sign. 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 the characteristics of the technology – adjustment costs, external effects, economies of scale, etc. – differ considerably from one region to another.

The differences in growth paths and turbulence

TABLE V
Productivity and industrial turnover in the Spanish regions
(Dependent variable: Solow's residual; Period: 1980–1992; Estimation method: Fixed effects 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	0.983
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 of entry, exit and turnover		0.046	0.090	0.039
		(2.478)	(4.761)	(3.932)
Individual effects				
Andalusia	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
Balearic Islands	1.066	0.161	–0.897	–0.484
Canary Islands	0.913	–0.219	–1.471	–0.996
Cantabria	3.468	2.885	1.994	2.378
Castile-Leon	3.824	3.503	2.885	3.168
Castile-La Mancha	5.146	4.486	3.644	3.984
Catalonia	4.034	3.687	3.203	3.406
Valencia	2.621	2.167	1.699	1.870
Estremadura	–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
Navarre	2.458	1.775	1.006	1.301
Basque Country	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

Source: Registry of Industrial Establishments and Industrial Survey.
Note: Total productivity is shown as a percentage. *t*-values in brackets.
Number of observations: $N \times I \times T = 2604$.

in the entry and exit rates of establishments in regional manufacturing leads to a high level of growth rates in regional productivity throughout the period 1980–1992. Indeed, together with the regions that reach high growth rates in global corrected productivity – Castile-La Mancha, Catalonia, Madrid and Castile-Leon –, we find regions that present moderate rates of productivity gains – Extremadura, Canary Islands, Balearic Islands, Murcia and Asturias. The heterogeneity of the evolution of the corrected measure of global productivity across regions persists once we include the indicators of industrial mobility as components in the Solow's residual. The rates of business turnover are significant in all estimations underlining, especially, the value of the coefficient for rate of exits is much higher than the coefficient for rates of entry.

Finally, the OLS estimations of the production functions of regional manufacturing further highlight the differences existing at a territorial level. With the object of using a global measure of industrial mobility, Table VI shows the results obtained using turnover rates as a joint indicator of entry and exit flows. Among the results obtained, those that stand out are the high and statistically significant values for the coefficients of business turnover in the regions of Murcia, Castile-Leon, Andalusia and Castile-La Mancha. In the industry of these regions business mobility is an important source of global productivity growth. In contrast, the coefficients of the measure of turnover present a negative sign, but of low significance, in Extremadura, Asturias, Navarre and the Basque Country. These four regions record an intensity in the renewal of their industrial structure, through the creation and the closure of establishments well below the levels that regional manufacturing as a whole reaches.

5. Conclusions

Technological progress in manufacturing activities depends on the capacity and the effort of firms to innovate and adapt to new conditions of cost and demand, but it also depends on the competitive mechanism embodied in the evolution of market structure. The persistence of the phenomenon of high entry rates of firms combined with high exit rates fosters the interest in: (a) identifying the incentives that lead agents to set up a business; and (b) to know more on the consequences of firm turnover on welfare. In this paper it has been argued that in economies that are characterized by being more users than producers of technology, models of technological change based on embodied technology can contribute to better understand industry and market dynamics.

The model of embodied technology, although better fitted to technologically intermediate economies, does not exclude the validity of the innovation models of entry. It is reasonable to assume that part of the entrants are innovators, and the rest are imitators or adaptators of products and processes first developed elsewhere. The proportion among both types of entrants – true innovators and imitators – may depend on the industry's technological regime and the general technological level of the country.

The empirical model and results presented in

TABLE VI
Entry and exit of industrial establishments by regions
(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
Andalusia	–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
Balearic Islands	–1.09 (–0.48)	0.04 (0.11)	1.21 (1.27)	1.71 (6.58)	0.07 (2.58)	0.27
Canary Islands	–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
Castile-Leon	–0.10 (–0.42)	0.26 (0.95)	0.68 (2.08)	1.38 (3.13)	0.27 (2.21)	0.16
Castile- La Mancha	2.70 (1.04)	0.10 (0.27)	1.35 (1.08)	2.79 (18.84)	0.15 (3.28)	0.71
Catalonia	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
Estremadura	–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 (3.51)	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
Navarre	2.46 (1.83)	0.84 (3.95)	0.77 (1.44)	1.22 (1.30)	–0.02 (–1.29)	0.12
Basque Country	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

Source: Registry of Industrial Establishments and Industrial Survey.
Note: Total productivity is shown as a percentage. t-values in brackets.
Number of observations per region: $N \times T = 156$.

this paper represents an indirect test of the assumption that a significant part of new firms contribute to improve total factor productivity by adopting modern technology that is embodied in the last vintage equipment they use. Evidence has been found that exits, as well as entries, impact positively on total factor productivity. This positive effect of exit on the productive efficiency of Spanish manufacturing is compatible with the dynamic approaches that associate business mobility with the process of innovation, and with asymmetries in information among agents.

From the analysis of business turnover in Spanish manufacturing industries, some aspects can be highlighted. Gross rates of entry and exit of manufacturing establishments reach a high magnitude. The rate of entry of establishments is procyclical, in the sense that more establishments are created during the expansion periods. The rates of exit of establishments also adopt a procyclical behavior, in the sense that more closures occur during recessions. It should be noted that in Spain the industrial restructuring of 1978–1984, and the recession of 1991–1993, gave way to a significant reduction of the stock of manufacturing firms.

When we perform the regressions of gross rates of entry, exit and turnover on manufacturing total factor productivity, the coefficients obtained are positive and significant, showing a positive impact of business mobility on technical progress. But, interestingly, the lagged effects of entry and exit on productivity show a less clear picture, with negative coefficients for the two-period lag. One possible explanation for what appears as contradicting current and lagged variables is that accommodation of new competitors by incumbent's lowers their scale of production and raises costs. These results suggest that entry may be excessive and that a more selective entry process might improve the overall impact on efficiency.

Rates of entry and exit of establishments are quite heterogeneous across industries, showing the relevance of factors related to the presence of barriers to entry and exit, to the industry technological regime, and to the capacity for product differentiation at the industry. Differences across industries widen when looking at the share of employment corresponding to the incoming establishments. Together with industries where new entrants account for a significant market share in terms of employment – wood and other manufactured products, textiles, office machinery and metal products – in other industries entries have little influence on employment – ores and iron and steel, transport equipment and the agro-food industry. The data confirm that the size of newcomers is well below the average size of the incumbent establishments.

Entry and exit rates impact on total factor productivity with different intensity across regions. The observed variation in the effects on efficiency on a regional scale might suggest that many manufacturing establishments get into business with the objective of exploiting opportunities specifically linked to their local markets.

At the regional level business turnover shows significant variability, although much more moderate than the variability observed among industries. This fact seems to imply that the industry specific effects dominate geographic factors. The econometric estimations carried out demonstrate the importance of returns to scale and of market power, whose presence moderates the effects of business turnover on efficiency. At statistically significant levels, the rate of entry explains 4.6% of technical progress and the rate of exit 9.0%. The impact of business turnover on the productivity of the manufacturing industries of the regions is lower than the effects of turnover at an aggregate level.

Appendix

TABLE A.1
Rate of entry and exit of industrial establishments: 1980–1992

Industries	Entry and exit rates					Cyclic component	
	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: Registry of Industrial Establishments and Industrial Survey.

TABLE A.2
Correlations, figures 1980–1992

	Industrial production growth	Growth GDP	Entry rate	Exit rate
Growth GDP	0.93			
Entry rate	0.80	0.87		
Exit rate	–0.56	–0.55	–0.46	
Net entry rate	0.81	0.84	0.88	–0.83

Source: Registry of Industrial Establishments and Industrial Survey and the Bank of Spain.

TABLE A.3
Dimension and relative size of the entries of establishments by industrial sectors (1981–1992)

Industries	Gross entry rate	Rate of penetration	Size of entries	Average size	Relative size
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: Registry of Industrial Establishments and Industrial Survey.

Notes

[1] This paper forms a part of a broader research project with the support of the CICYT (SEC-96-0898).

[2] 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.

[3] Cable and Schwalbach (1991) find that statistics for 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 market share. The exit rates are 6.5% and 2.7%, respectively (see appendix).

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

[5] Bhide (1994) reports a survey among a sample of firms showing that entrepreneurs spend little effort on their initial business plan. It is found that 41% have no business plan at all, 26% have just a rudimentary, back-of-the envelope type of plan, 5% has worked financial projections for investors, and 28% have written a full-blown plan.

[6] Most of the literature tackling the problem of welfare losses due to excess entry is centered on markets with few firms. For instance, Nachbar, Petersen and Hwang (1998) argue that entry may lower social welfare if there are set up costs or if entrants have a cost disadvantage, and Klemperer (1988) finds the same detrimental effect on welfare, even if entrants are low-cost competitors, if consumers have costs of switching between products. But, in general, there is a lack of work on the hypothetical social costs of excess firm turnover.

[7] European network for SME Research (1996).

[8] For the period 1979–1987, 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).

[9] The sample of firms is drawn from the *Encuesta sobre Estrategias Empresariales* (ESEE), an annual survey on the activity of Spanish manufacturing firms carried out by the Ministry of Industry. The survey covers enterprises which employ 10 or more people.

[10] A homogeneous production function of degree γ_i, has the following relation between the elasticities: $\gamma_{ij} = \varepsilon_{k,\,ij} + \varepsilon_{n,\,ij}$. Where $\varepsilon_{N,\,ij}$ and $\varepsilon_{K,\,ij}$ are the elasticities of output with respect to labour and capital.

[11] If μ_{ij} is the ratio of price to marginal cost of 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 shares over output:

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

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

[12] The rates of entry, exit, turnover, and volatility are included in the appendix.

[13] Those are, of course, the stylised facts. In reality we now that many entrants are very weak in terms of technological and managerial skills, and in some industries that are undergoing severe restructuring processes some entrants use scrap capital.

[14] 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 that of Spain, in which there is a preponderance among new firms of small industrial establishments, half of the productivity gain can hardly be attributed to industrial mobility.

[15] Despite the fact that statistical sources and the values of coefficients differ somewhat, for the manufacturing industries in the United Kingdom during the period 1976–1979, the use of delayed variables highlights the positive effect of entries in the short term (Geroski, 1989).

References

Abernathy, W. and J. Utterback, 1978, 'Patterns of Industrial Innovation', *Technology Review* **80**, 41–47.

Acs, Z. J. and D. B. Audretsch, 1990, *Innovation and Small Firms*, The MIT Press.

Audretsch, D. B., 1995, *Innovation and Industry Evolution*, The MIT Press.

Audretsch, D. B., 1997, 'Technological Regimes, Industrial Demography and the Evolution of Industrial Structures', *Industrial and Corporate Change* **6**(1), 49–82.

Baldwin, J. R., 1995, *The Dynamics of Industrial Competition*, Cambridge University Press.

Baldwin, J. R. and P. K. Gorecki, 1991a, 'Entry, Exit, and Productivity Growth', in P. A. Geroski and J. Schwalbach (eds.), *Entry and Market Contestability: An International Comparison*, Basil Blackwell.

Baldwin, J. R. and P. K. Gorecki, 1991b, 'Firm Entry and Exit in the Canadian Manufacturing Sector: 1970–1982', *Canadian Journal of Economics* **24**(2), 302–323.

Baumol, W. J., J. Panzar and R. D. Willing, 1982, *The Theory of Contestable Markets and Industry Structure*, San Diego: Harcourt Brace Jovanovich.

Bhide, A., 1994, 'How Entrepreneurs Craft Strategies that Work', *Harvard Business Review* **72**(2), 150–163.

Caballero, R. J. and R. K. Lyons, 1990, 'Internal versus External Economies in European Industry', *European Economic Review* **34**, 805–830.

Cable, J. and J. Schwalbach, 1991, 'International Comparisons of Entry and Exit', in P. A. Geroski and J. Schwalbach (eds.), *Entry and Market Contestability: An International Comparison*, Basil Blackwell.

Campbell, J. R., 1998, 'Entry, Exit, Embodied Technology, and Business Cycles', *Review of Economic Dynamics* **1**(2), 371–408.

Costa, M. T. et al., 1993, *Cooperación entre empresas y sistemas productivos locales*, Madrid: Instituto de la Pequeña y Mediana Empresa Industrial (IMPI).

Dosi, G.; O. Marsili, L. Orsenigo and R. Salvatore, 1993, 'Learning; Market Selection and the Evolution of Industrial Structures', *CCC Working Paper* No. 93-9, University of California at Berkeley.

Dunne, T. and M. J. Roberts, 1991, 'Producer Turnover in U.S.

Manufacturing Industries', in P. A. Geroski and J. Schwalbach (eds.), *Entry and Market Contestability: An International Comparison*, Basil Blackwell.

European Network for SME Research: 1996, *The European Observatory for SMEs*.

Fariñas, J. C. et al., 1992, *La PYME industrial en España*, Madrid: Editorial Civitas.

Fariñas, J. C. et al., 1996, *La empresa industrial en la década de los noventa: estructura de mercado y dinámica empresarial, DT. 9613*, Fundación Empresa Pública.

Geroski, P. A., 1989, 'Entry, Innovation, and Productivity Growth', *Review of Economics and Statistics* **71**, 572–578.

Geroski, P. A., 1991a, 'Domestic and Foreign Entry in the United Kingdom: 1983–1984', in P. A. Geroski and J. Schwalbach (eds.), *Entry and Market Contestability: An International Comparison*, Basil Blackwell.

Geroski, P. A., (1991b, Innovation and Sectoral Sources of U.K. Productivity Growth', *Economic Journal* **101**, 1438–1051.

Geroski, P., 1992, 'Entry, Exit and Structural Adjustment in European Industry', in K. Cool, D. Neven and I. Walter (eds.), *European Industrial Restructuring in the 1990s*, McMillan.

Griliches, Z., 1994, 'Productivity, R&D, and the Data Constraint', *American Economic Review* **84**, 1–23.

Hall, R. E., 1986, 'Market Structure and Macroeconomic Fluctuations', *Brookings Papers on Economic Activity* **2**, 285–322.

Hirschman, A., 1970, *Exit, Voice and Loyalty*, Cambridge, MA: Harvard University Press.

Jovanovic, B., 1982, 'Selection and the Evolution of Industry', *Econometrica* **50**(3), 649–670.

Klemperer, P., 1988, 'Welfare Effects of Entry into Markets with Switching Costs', *The Journal of Industrial Economics* **37**(2), 159–165.

Klepper, S., 1996, 'Entry, Exit, Growth, and Innovation over the Product Cycle', *American Economic Review* **86**(3), 562–583.

Lorenzo, M. J., 1992, *Flujos de entradas y salidas de establecimientos en el sector manufacturero español, DT 9203*, Fundación Empresa Pública.

Maddison, A., 1987, 'Growth and Slowdown in Advanced Capitalist Economies: Techniques of Quantitative Assessment', *Journal of Economic Literature* **25**, 649–698.

Malerba, F. y L. Orsenigo, 1996, 'The Dynamics and Evolution of Industries', *Industrial and Corporate Change* **5**(1), 51–87.

Marshall, A.: 1919, *Industry and Trade*, Great Britain: Macmillan and C.

Martín, A., 1992, *Los determinantes del crecimiento de la productividad en la industria española, DT 9204*, Fundación Empresa Pública.

Mueller, D., 1991, 'Entry, Exit, and the Competitive Process', in P. A. Geroski and J. Schwalbach (eds.), *Entry and Market Contestability: an International Comparison*, Basil Blackwell.

Nachbar, J. H., B. C. Petersen and I. Hwang, 1998, 'Sunk Costs, Accomodation, and the Welfare Effects of Entry', *The Journal of Industrial Economics* **47**(3), 317–332.

Nelson, R y S. Winter, 1982, *An Evolutionary Theory of Economic Change*, Harvard University Press.

Olley, S. and A. Pakes, 1996, 'The Dynamics of Productivity in the Telecommunications Equipment Industry', *Econometrica* **64**(6), 1263–1297.

Orr, D., 1974, 'The Determinants of Entry: A Study of the Canadian Manufacturing Industries', *Review of Economics and Statistics* **56**(1), 58–66.

Pavitt, K., 1984, 'Sectoral Patterns of Technical Change', *Research Policy* **13**, 343–373.

Reynolds, P., 1994, 'Autonomous Firm Dynamics and Economic Growth in the United States, 1986–1990', *Regional Studies* **28**(4), 429–442.

Reynolds, P., D. J. Storey and P. Westhead, 1994, 'Cross-national Comparisons of the Variation in New Firm Formation Rates', *Regional Studies* **28**(4), 443–456.

Saxenian, A. L., 1990, 'Regional Networks and the Resurgence of Silicon Valley', *California Management Review* **33**(1), 89–112.

Stigler, G., 1951, 'The Division of Labour is Limited by the Extent of the Market', *Journal of Political Economy* **59**, 185–193.

Wolff, E. N., 1991, 'Capital Formation and Productivity Convergence Over the Long Term', *American Economic Review* **81**, 565–579.

Yorukoglu, M., 1998, 'The Information Technology Productivity Paradox', *Review of Economic Dynamics* **1**(2), 551–592.