Post-entry and Pre-exit Performance of French Manufacturing Firms*

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Abstract

This paper analyses post-entry and pre-exit performance of Manufacturing firms using a French dataset covering 14 manufacturing industries over the period 1990-2002. The main focus is on market selection mechanisms looking at total factor productivity levels of entrants and exitors relative to incumbent firms. Entrants are found to outperform incumbents, while exitors are less efficient than their surviving counterparts. We nonetheless found key distinguishable features of exit patterns between young and mature firms. Young exiting firms do not display productivity disadvantage relative to incumbent firms. By contrast, mature exiting firms display large and persistent productivity disadvantage relative to their surviving counterparts (shadow of death effect). The determinants of exit differ for entrants and incumbents. Productive inefficiency is a key determinant of the exit of mature firms but not entrants.

Key Words: entry and exit patterns, firm level data, TFP indexes, market selection
JEL Classification Code: D24, L11, L60.

1. Introduction

In market-based economies, firms are continuously subject to market selection forces. At all time, firms must make sure to be profitable enough in order to remain on the market.

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The determinants of the relative abilities of firms to survive on competitive markets are diverse and complex. In this paper we focus on productive efficiency criteria and investigate if productivity differences between firms are a key determinant of their relative ability to survive. The link between productive firm heterogeneity and industrial dynamics (entry, exit and reallocation of market shares) have successfully been integrated into the standard general equilibrium framework (Jovanovic, 1982) which, in turn, helps to discuss the relationship between industry characteristics, technology, and firm's productivity distribution (Ericsson et Pakes, 1990, Hopenayn, 1992). These models are now confronting empirical data due to the increasing availability of Longitudinal Micro-datasets (LMDs) in a large variety of countries (see Bartelsman and Doms 2000 and Tybout 2001 for recent surveys).

Our paper adds to this literature using a dataset for French Manufacturing firms over the period 1990-2002. We compute measures of Total Factor Productivity (TFP) for all French firms above 20 employees operating in manufacturing industries. We follow the productive performance of entering, continuing, and exiting firms over time in order to address the issue of the efficiency of market selection mechanisms. On main issue is to investigate to which extent efficiency criteria play a similar selection role at different stage of a firm life. Behind this hypothesis, lies the idea that several competitive games co-exist within a same courtyard. More specifically, the competition that prevails between incumbents and entrants may not involve the same selection mechanisms than the competition that prevails among incumbent themselves.

The paper is organized as follows. Section 2 presents the literature background. Section 3 discusses issues involved in building our longitudinal data set. In Section 4, we focus on young firms and describe the relationship between productivity firm heterogeneity and post-entry performances. In Section 5, we do a similar exercise on mature firms in describing the relationship between productivity firm heterogeneity and pre-exit performances. Section 6 concludes.

2. Literature background

Recently, comprehensive and large plant- and firm-level datasets have been made available in a large variety of countries to address the issue of the contribution of plant and firm turnover to the productivity growth of manufacturing industries. A non-exhaustive list of contributions includes Baily et al. (1993), Haltiwanger (1997), Foster et al. (2001) for the United States, Griliches and Regev (1995) for Israel, Liu and Tybout (1996) and Eslava et al. (2003) for Chile and Colombia, Hahn (2000) and Awe, Chen and Roberts (2001) for South Korea and Taiwan, and Nishimura, Nakajima and Kiyota (2005) for Japan. Furthermore, Scarpetta et al. (2002) and Bartelsman et al. (2003) provide

comparisons of the contribution of turnover to productivity growth within 10 countries including France[1].

Basically, it has been shown that exiting firms were usually concentrated in the lowest part of the productivity distribution, suggesting that markets were contributing to aggregate productivity in rightly selecting against inefficient firms. Evidence of this natural selection mechanism (NSM)[2] has been found in a large variety of countries. More surprisingly, such evidence has even been found in the case of developing countries, even though sources of markets distortion can be thought of as particularly prevalent in those countries (see Tybout 2000 for a survey of empirical evidence on the developing World).

Nonetheless, market selection processes may work more or less efficiently across countries, industries and over time depending on a potentially large variety of factors. For instance, Scarpetta et al. (2002) argue that, on average, firms tend to exit with better relative productivity levels in downturn times and in mature and/or restructuring industries. Nishimura, Nakajima and Kiyota (2005) advocate that natural market selection mechanisms no longer work in severe recessions as indicated by the fact that, over the last decade in the recessive Japanese economy, mature unproductive Japanese firms staid in the market while younger efficient ones exited. Awe, Chung and Roberts (2002) compare data for Taiwan and South Korea from 1983 to 1993, a period of rapid economic expansion for both those economies. They conclude that institutions in Taiwan have, nonetheless, been more effective in supporting the market selection process against unproductive firms. Consequently, plant and firm turnover have much more contributed to the productivity growth of the Taiwanese manufacturing industries compared to the Korean ones.

Our paper pursues this line of empirical research by reporting new evidence on France. It proposes to relate firm productivity (TFP) and entry and exit patterns in French manufacturing industries over the 1990-2002 period. In order to organise this empirical investigation, we rely on some empirical implications derived from the recent literature on stochastic dynamic industry equilibria with heterogeneous firms.

The starting point of this literature are the seminal models by Jovanovic (1982) and Hopenhayn (1992). In those models, firms are endowed at birth with a time invariant profitability parameter, which determines the distribution of its future profit stream. A central feature of the model is that a new firm does not know what its relative efficiency is (its cost function), but rather discovers it through the process of Bayesian learning from its actual post-entry profit realizations. By continually updating such learning, the firm decides to expand, contract, or exit. In this model, learning is said to be *passive*

1) Others countries are the United States, Germany, Italy, United Kingdom, Canada, Denmark, Finland, Netherlands and Portugal.

2) Nishimura, Nakajima and Kiyota (2005) refer to economic Darwinism.

because information is obtained as a costless by-product of operating and also because learning does not affect the actual productivity of the firm. It simply "reveals" the pre-determined and time-invariant relative efficiency of the firm.

By contrast, in "active learning" models such as Ericson and Pakes (1995) it is assumed that the firm knows the current value of the parameter that determines the distribution of its profits, but that this value changes over time in response to the stochastic outcomes of the firm own investments, and those of other actors in the same oligopoly market. The firm grows if successful, shrinks or exits if unsuccessful. In this model, learning is said to be *active* not only because it requires specific efforts but also because it allows the firm to improve its relative performance.

Those models have been the subject of empirical tests. In particular, Baldwin and Rafiquzzaman (1995) uses Canadian plant level data over the 1970-89 period to investigate to which extent the improvements in the performance of any entry cohort are the result of a pure selection process that culls out the (pre-determined) most inefficient entrants or of an evolutionary learning process that allows survivors to improve their productivity performance relative to incumbent firms. Their main conclusion is that both pure selection and evolutionary learning affect post-entry performance, but selection per se is a more important contributor to the overall growth of a cohort.

Using Spanish firm-level data, Farinas and Ruano (2005) test the implications of the Hopenayn (1992) model. They find that the productivity distribution of continuing firms stochastically dominates the distributions of entering and exiting firms. Moreover, the group of failing members of any entry cohort has lower productivity than the group of surviving members of the same entry cohort. Finally, they find that the post-entry productivity level of entering firms grows more rapidly than the productivity of incumbent firms, although this pattern is not always highly significant. This pattern is not solely consistent with a pure selection process as the one at work in the Hopenayn (1992) model but may also result from learning effects playing a role through investment, exploitation of scale economies, etc.

We propose to investigate these issues further using a French dataset by emphasising both common and divergent predictions which emerge from the passive and the active learning models about post-entry and pre-exit dynamics. Our methodology to compute productivity indexes is close to the one used in the Farinas and Ruano (2005) paper. Our focus is more in line with the Baldwin and Rafiquzzaman (1995) paper as we shed some lights on the relative importance of pure selection and active learning in shaping post-entry patterns. We add however to this paper in extending the relevance of this distinction to the analysis of pre-exit patterns of mature firms and in emphasising the role of imperfect competition in shaping both post-entry and pre-exit selection processes. Finally, in putting the focus on the distinction between young and mature firms we also come close to the literature that emphasised the distinction between small and large firms

(Audrescht, 2005)[3].

3. A comprehensive dataset on French manufacturing firms

3.1. Data sources

The firm data set used in this paper is collected by the French Ministry of Industry (SESSI). The French Census of Manufacturing (called EAE[4]) is a unique census collecting information about inputs and outputs of all individual firms of more than 20 employees. This census allows us to trace quite extensively the performance of firms over time. Compared to the existing literature, an interesting feature is that data are directly collected at the firm level, not at the plant level. This means that we are dealing with firm (not plant) turnover. This has the advantage of avoiding potential spurious effects when assessing the specific role of market selection for productivity growth. Indeed, a plant closure is never the direct consequence of a market selection process. It is the direct consequence of a firm decision. It is likely that a firm decides to close a plant because the latter is not productive enough. This selection process is not however a pure market selection process. It is internally organized by the firm and then depends both on the ability of the firm to restructure and on the capacity of the market to constrain firms to get rid of unproductive units. In order to assess properly the contribution of market selection (not the ones of firms' internal capabilities) in promoting productivity growth, it is therefore better to consider firm turnover and not plant turnover. Additional industry-level data, mainly used in productivity computations, come from the INSEE database (French System of National Accounts).

3.2. Entry and exit patterns

We rely on the following standard definition for entrants, continuing and exiting firms: an entrant is a firm existing in the reference year t but not in t-1; An exiting firm is a firm existing in the reference year t but not in t + 1; A continuing firm is a firm existing in the reference year t and t + 1 and t - 1[5]. Applied to our dataset, these definitions induce

3) Farinas and Ruano (2005) also distinguish between large firm and small firms but their underlying theoretical model (the Hopenayn (1992) one) rules out any independent impact of the size of the firms on their relative performances.

4) *Enquête annuelle d'entreprises*

5) In accordance to the OCDE definition (See Bartelsman Scarpetta and Schivardi (2003)), firms existing only one year are considered as "one year firms" and are neither counted as entrants or as exiters.

a few re-entry phenomena, essentially due to the +20 employees threshold effect[6]. This effect induces an overestimation of firm turnover rates. However, as only the smallest firms in the sample are concerned, it may not bias so much the inputs or output-weighted entry and exit rates.

According to these definitions, the dataset exhibits average firm entry and exit rates of about 9 and 10%, respectively. The firm turnover rate[7] averages then 18% per year with a slightly decreasing trend over the period of investigation (see Table 1 & Table 2). These numbers are slightly lower than the ones reported for France by Bartelsman, Scarpetta and Schivardi (2003). Their firm turnover rate for manufacturing is around 24% by year in the period 1989-1994 which ranks France as a relatively high turnover country in

Table 1. Entry and exit by year

Year	Entrant	Continuing	Exiting	Turnover rate
1990	1 887	19 351	1 738	18.7
1991	2 130	19 181	2 057	21.8
1992	1 683	18 896	2 415	21.7
1993	1 157	18 295	2 284	18.8
1994	1 961	17 785	1 667	20.4
1995	1 511	17 816	1 930	19.3
1996	1 644	17 679	1 648	18.6
1997	1 626	17 828	1 495	17.5
1998	1 374	18 007	1 447	15.7
1999	1 304	17 911	1 470	15.5

Table 2. Turnover rate by industry

	Number of firms			Labour		
Industry	Entry	Exit	Σ	Entry	Exit	Σ
Clothing & Footwear	9.2	15.2	24.4	5.1	9.3	14.4
Printing & Publishing	9.2	11.0	20.1	5.4	6.6	12.1
Pharmaceutical	8.1	8.4	16.6	4.3	6.2	10.5
House Equipment	8.3	10.4	18.8	4.8	5.9	10.7
Automobile	7.3	7.1	14.4	7.2	6.6	13.8
Transportation Machinery	8.9	9.4	18.2	5.5	3.5	9.1
Machinery & Mechanical Equip.	9.7	9.8	19.5	5.0	5.5	10.6
Electrical & Electronic Equip.	11.9	12.4	24.2	5.4	5.4	10.8
Mineral	7.6	8.6	16.2	3.9	4.7	8.6
Textile	7.6	10.0	17.6	4.7	6.5	11.3
Wood, Paper & Pulp	8.0	9.0	17.1	4.8	5.8	10.6
Chemical	8.1	7.1	15.2	3.9	3.8	7.8
Metallurgy, Iron & Steel	8.0	7.9	15.9	6.1	5.2	11.3
Electrical & Electronic components	9.5	8.9	18.4	5.2	5.7	10.9

6) For instance, a firm decreases its number of workers and goes out of the range of the French census but still exists in the market.

7) The turnover rate is defined as the sum of the entry rate and the exit rate.

comparison with other OECD countries.

Another feature of our dataset, quite in line with the existing literature, is that industries significantly differ according to their turnover rates. Table 2 shows the average of annual turnover rates for each of our 14 two-digit level industries. There is quite a large variability in these numbers across industries with higher firm turnovers occurring in clothing & footwear, printing & publishing, and the electrical & electronic equipment and smaller ones in the automobile, chemical industries, mineral industries, and metallurgy.

3.3. Productivity measurement

Following Caves, Christensen and Diewert (1982) and Good, Nadiri and Sickles (1997), the total factor productivity index for firm i at time t is measured in the following way:

$$\begin{aligned} \ln TFP_{it} = {} & \ln Y_{it} - \overline{\ln Y_t} + \sum_{\tau=2}^{t} (\overline{\ln Y_\tau} - \overline{\ln Y_{\tau-1}}) \\ & - \sum_{n=1}^{N} \frac{1}{2} (S_{nit} + \overline{S_{nt}}) (\ln X_{nit} - \overline{\ln X_{nt}}) \\ & - \sum_{\tau=2}^{t} \sum_{n=1}^{N} \frac{1}{2} (\overline{S_{nt}} + \overline{S_{\tau-1}}) (\overline{\ln X_{n\tau}} - \overline{\ln X_{n\tau-1}}) \end{aligned}$$

where Y_{it} denotes the real gross output produced by the firm i at time t using the set of inputs X_{nit} (labour, capital and materials). S_{nit} is the cost share of input X_{nit} in the total cost. The symbols with upper bar are corresponding measures for the reference point (the hypothetical firm). They are computed as the arithmetic means of the corresponding firm level variables over all firms in year t. Subscripts t and n are indices for time and inputs, respectively. This methodology is particularly well suited for comparisons within firm-level panel data sets as it guarantees the transitivity of any comparison between two firm-year observations by expressing each firm's input and output as deviations from a single reference point for each year.

The first characteristic our dataset shares with the firm-level productivity literature is the degree of heterogeneity among firm's productivity levels. Table 3 presents several measures of this heterogeneity. The first column reports, for each year, the standard deviation of productivity levels computed on the whole database. The second column shows the difference of the log of productivity for the firm at the 90th percentile and the log of productivity for the firm at the 10th percentile (the 90-10 differential). These numbers suggest a large variation in productivity. The spread in productivity between the firm at the top decile and the one at the first decile is about 70 % for the TFP. The 90-50, 50-10 and 95-5 differentials are shown in the next columns. Note that all of these productivity spreads are fairly stable over time, suggesting a persistent heterogeneity in

Table 3. Variability in Productivity

Year	St. Dev.	90 - 10	90 - 50	50 - 10	95 - 5
Total Factor Productivity (LnTFP)					
1990	0.371	0.730	0.462	0.268	1.049
1991	0.367	0.732	0.452	0.280	1.035
1992	0.366	0.715	0.438	0.276	1.024
1993	0.368	0.715	0.436	0.279	1.030
1994	0.372	0.705	0.431	0.274	1.027
1995	0.371	0.706	0.439	0.268	1.017
1996	0.367	0.689	0.421	0.268	1.013
1997	0.374	0.690	0.425	0.265	1.019
1998	0.381	0.694	0.431	0.263	1.027
1999	0.394	0.703	0.434	0.269	1.024
2000	0.410	0.729	0.463	0.266	1.061
2001	0.413	0.734	0.466	0.269	1.074
2002	0.402	0.732	0.465	0.267	1.049

Note: Standard deviation and percentile differences for *LnTFP*.

firm productivity levels.

For some part, this heterogeneity reflects the contrasting performance of French manufacturing industries during the 1990-2002 period. However, even after controlling for the industry, firm heterogeneity remains high. This suggests that some firms are intrinsically more productive than others and it is worthwhile to investigate further how those differences in firms' productivity relate to entry and exit patterns both at the aggregate (whole manufacturing) and at the industry level.

4. Post-entry performance

Using the previously emphasised distinction between passive and active learning models of industrial dynamics and considering that imperfect competition is likely to prevail on manufacturing goods markets, one can identify at least three different types of learning involved by entry. First, entry can reveal to new firms information about *their relative abilities at birth*. If ability at birth is the only source of firm heterogeneity[8], post entry selection will induce that only the firms which will reveal themselves to be endowed with high enough efficiency levels will survive. Second, entry can reveal or produce knowledge about how to produce more efficiently. If this type of learning is pre-dominant, surviving entrants will be the ones which are the most skilled to progress[9]. These abilities can or

8) This extreme assumption prevails for instance in the Jovanovic 1982 model.

9) This type of learning is the one which is at work in the Ericson and Pakes (1992) model. It is also emphasised in evolutionary models in which new firms are assumed to be less experienced in terms of routines and best practices and have to grasp them after entry.

cannot be related with initial abilities in relative efficiency (i.e. abilities at birth). Third, entry can reveal or produce knowledge about "how to struggle" on imperfect competitive markets. If this type of learning is pre-dominant, technological abilities at birth or abilities to catch-up best practices after entry are not as important as the ability to face reactive strategies developed by powerful incumbent competitors[10]. According to this view, surviving entrants will be the ones which will succeed in overcoming their initial strategic disadvantage relative to incumbents firms.

In this Section, we shed some lights on the relative importance of these three types of learning while describing the post-entry performance of new entrants. We proceed in three main steps. First, we trace in time the average productivity (TFP) of each entry cohorts relative to incumbents firms. Second, we discriminate further between successful and unsuccessful entrants and compare their productivity levels not only among themselves but also between themselves and the incumbent firms. Finally, we examine how these productivity gaps are related to changes in the relative size and profitability for the two types of entrants: successful ones and unsuccessful ones. Catch up

Table 4 summarizes the first step. It traces in time the average productivity of entry cohorts relative to incumbents firms. For instance, the first line reports the average productivity of the 1990 entry cohort in 1990, 1991, 1992, etc., relative to the productivity of incumbent firms in the corresponding year. In this Table, the population of incumbent firms is defined as the population of firm born before 1990 and surviving during all the

Table 4. TFP level of entrants relative to incumbent firms by entry cohort (log difference)

Cohort	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1990	*-0.019*	*0.023*	0.037	0.034	0.042	0.034	*0.013*	*0.02*	*0.019*	*0.018*	*0.013*	*0.025*	*0.026*
1991		*-0.008*	0.041	0.05	0.057	0.057	0.06	0.054	0.045	0.035	0.033	0.036	0.028
1992			*-0.004*	0.034	0.05	0.046	0.038	0.038	0.03	*0.017*	*0.016*	*0.025*	0.027
1993				*0.023*	0.085	0.086	0.062	0.063	0.062	0.062	0.053	0.053	0.062
1994					*-0.001*	0.053	0.041	0.039	0.038	0.04	0.042	0.042	0.039
1995						0.045	0.066	0.074	0.062	0.07	0.064	0.061	0.06
1996							0.016	0.034	0.032	0.031	0.04	0.038	0.041
1997								*-0.019*	*-0.001*	*0.003*	*0.017*	*0.029*	*0.022*
1998									*0.027*	0.06	0.051	0.069	0.055
1999										*0.032*	0.072	0.08	0.073
2000											0.047	0.061	0.061
2001												0.041	0.055
2002													0.022

Numbers in *italics* indicate non-significance at 5% level

10) This last type of learning may be especially important if competitive threats from existing firms change along the post-entry period. For instance, it can be the case that incumbents also lack from precise information about the actual threat the new entrants offer to existing firms. Incumbents may then have to wait after entry and the early maturation process to device reactive strategies in order to cope with the new competitive threat due to emerging adolescent entrants.

period of investigation[11]. A negative number means that new entrants have a productivity disadvantage relative to incumbent firms while a positive number reveals a productivity advantage[12].

The first important result emerging from Table 4 is that new entrants exhibit higher productivity records compared to incumbent firms. This result holds for each entry cohort from 1990 to 2002 and for almost all years of observation except, times to times, the very first year of entry. Moreover, it is noticeable that the few times the difference is negative (for instance the first year of the 1992 1994 and 1997 entry cohorts), the difference is not significant. In contrast, as soon as the difference turns to be at the advantage of entering firms (usually the second year of entry), it is also, almost everywhere, significant at the 0.05 level.

The observation that new entrants outperform incumbent firms contrasts with the earlier paper by Baldwin and Rafiquzzaman (1995) and with the recent one by Farinas and Ruano (2005) despite they use a similar methodology to compute relative productivity indexes. One explanation could be that our dataset is restricted to firms employing at least 20 employees. We then observe young firms rather than "true" new entrants. Nonetheless, our firm survival rates in the first years of existence are quite similar to what is usually found in post-entry analyses. Moreover, our results are consistent with other studies as the earlier one by Griliches and Regev (1995) on Israelian firms, and also the Dysney, Haskel and Heden (2003) study on UK data. This last paper also shows that new entrants outperform continuing firms.

If the French dataset does not support the idea that entering firms suffer from a productivity disadvantage relative to incumbent firms, it is consistent with a vintage hypothesis according to which new firms embody better technology than older ones[13].

This interpretation is further suggested in Table 4, as the productivity advantage of new firms over incumbents increases with the cohort age. For instance, if one computes the average of the productivity advantage of new firms over five years after birth, it is about 2,9 % for the 5 oldest entry cohorts and about 5,3% for the 5 youngest entry cohorts. Moreover, this advantage is statistically significant from the very birth of entrants in the case of the 3 youngest entry cohorts (2000, 2001, 2002) and not in the case of the older

11) While our investigation focuses on the 1990-2002 period, we can trace back the presence of a firm since 1984.

12) The relative productivity of entrants is computed in two steps. First, the relative TFP index of each new entrant is computed as the difference between individual TFP indexes (measured in log) and the average TFP index of their incumbent counterparts (i.e. incumbent firms which belong to the same 2-digit industry). Second, the relative productivity of the entry cohort is defined as the un-weighted average of the relative individual TFP indexes.

13) The underlying argument behind the vintage hypothesis is that a best practice frontier, which evolves over time and which is exogenous to the industry, is exclusively available for new firms (Jovanovic and Greenwood, 2001; Dwyer, 1998)

cohorts.

The fact that young firms outperform incumbent firms is puzzling for the theory and especially for the evolutionary learning view of post-entry selection process according to which productivity improvements of entry cohorts are driven by technological or best practice catching-up of entering firms. It is also at odds with the idea that new firms cope with a productivity disadvantage due to scale inefficiencies. The observation that entrants outperform incumbents in terms of productivity is consistent with the idea that incumbents benefit from some advantages over entrants. Indeed, despite this productivity disadvantage, mature firms do not exit the market. This reveals some degree of imperfect competition on French manufacturing good markets.

Table 4 in itself does not allow further discriminating between a natural selection view of post-entry dynamics and a competitive selection view. Indeed, both types of selection process can still underlie the productivity improvements of any entry cohort in Table 1. For instance, the sharp increase in the relative productivity of entrants just after entry could be underlined by an intensive natural selection process against relative inefficient entrants (i.e. entrants whose productivity advantage at birth is not high enough to overcome some given initial disadvantages). Alternatively, differences in relative productivity at birth between entrants may not be as important as their ability to grow enough to cope efficiently with the reactive strategies that incumbent firms may put in motion as soon as they have precise enough information on the productivity advantage of the new entrants.

To further discriminate between both views, Table 5 below distinguishes between successful entrants (firms which survive more than 5 years) and unsuccessful or failing entrants (firms which failed within 5 years after their entry).

Table 5. Relative TFP by the number of years after entry (log difference)

Years	E/I	SE/I	FE/I	FE/SE	FE/SE (COH)
1	*0.006*	*0.000*	*0.011*	*-0.011*	-0.015
2	0.034	0.033	0.034	*0.006*	-0.026
3	0.037	0.037	0.037	*0.006*	-0.034
4	0.037	0.034	0.041	*0.008*	-0.027
5	0.034	0.036	0.021	*-0.013*	-0.056
6	0.034	0.034			
7	0.034	0.034			
8	0.031	0.031			
9	0.026	0.026			
10	*0.030*	*0.030*			

E= entrants; I = Incumbents, SE= surviving entrants, FE = failing entrants, COH: by cohort
Numbers in *italics* indicate non-significance at 5% level

In this Table, entry cohorts are pooled in order to put the emphasis on general trends in the maturation process of new firms. In this perspective, the first Column (*E/I*) which

reports the TFP differences between all entrants and incumbent firms, simply resumes the general trend which already emerged from Table 4 about each entry cohort. The two next Columns (*SE/I* and *FE/I*) allow comparing the productivity gaps of, respectively, successful and failing entrants relative to incumbent firms. Finally the two last Columns in Table 5 show TFP differences between entrants themselves. Simple TFP differences are reported in Column FE/SE while TFP differences controlled by cohort are summarized in Column FE/SE (CHO).

The first important result from Table 5 is that both successful *and* unsuccessful entrants outperform incumbent firms. Moreover, both of them "reveal themselves" to be more productive than incumbents as soon as year 2 after entry. Finally, both of them maintain their productivity advantage over years 3 and 4. It is only in year 5 (i.e the last year of exit for a failing entrants) that the average productivity advantage of unsuccessful entrants over incumbent firms fall behind the own advantage of successful entrants.

This result questions the hypothesis of a harsh pure selection mechanism just after entry. Indeed, if such a process was occurring, then one should observe a stronger revealed productivity advantage for successful entrants compared to unsuccessful ones. The competitive view according to which new firms have to learn how to compete on imperfect competitive markets is then the most plausible view in accordance to the basic stylised facts that emerges from the first three Columns of Table 5.

If we turn now to the last Columns, additional insights can be given on the performance of successful entrants relative to unsuccessful ones. While no TFP differences emerge at first sight (see Column SE/FE), successful entrants reveal themselves to be actually more productive than unsuccessful ones when TFP differences are controlled by the cohort (i.e. when the comparison involves only entrants of the same entry-cohort).

This productivity advantage of successful entrants over unsuccessful entrants may indicate that a pure natural selection mechanism is nonetheless at work. As this natural selection mechanism is not driven by the market competition with incumbent firms, it has to come from elsewhere. One hypothesis is that it comes from the competition that prevails between entrants themselves. This hypothesis is further investigated in Duration models in Section 7 below.

In order to go one step further, we also consider in Table 3 the maturation process of new entrants looking at their relative growth in terms of employment and profitability. Both indexes may give us more insights on the ability of some entrants (the surviving ones) to compete successfully against some others (their failing counterparts) and to grow rapidly enough to survive to the reactive strategies of incumbents.

Table 6a and 6b are built alike Table 5 except that relative profitability and size indexes are ratio and not differences. Consequently, a number equal to 1 in this Table (not to 0 as in Table 5) means identical performance. Once more, entry cohorts are pooled to put the

emphasis on general trends and successful entrants (*SE*) versus failing entrants (*FE*) are compared no only among themselves but also between themselves and incumbent firms (*I*). In the last Column, COH means that the relative performance is controlled by the cohort.

Table 6a reports relative profitability indexes for the different population of firms. At the firm level, profitability is measured by the ratio of operating-cash flow on sales. At the population level, relative indexes correspond to the un-weighted average of the relative individual indexes.

While the profitability of entrants as a whole (E) apparently follow a regular catching-up process towards the profitability level of incumbents firms (1 means equal performance), the pictures changes radically when one discriminates between the two sub-populations of successful entrants (SE) and failing entrants (FE).

Table 6. Relative performances by the number of years after entry (ratios)

Table 6a. Relative Profitability

Years	E/I	SE/I	FE/I	FE/SE	FE/SE (COH)
1	*-21.285*	*-9.944*	*-29.302*	*-25.990*	*-0.938*
2	0.536	0.931	0.257	0.268	0.068
3	0.608	0.878	0.303	0.413	0.210
4	0.805	0.884	0.649	0.618	0.349
5	0.908	0.921	*0.848*	0.687	0.241
6	0.898	0.898			
7	0.930	0.930			
8	*0.997*	*0.997*			
9	*1.042*	*1.042*			
10	*1.033*	*1.033*			

Table 6b. Relative Employment

Years	E/I	SE/I	FE/I	FE/SE	FE/SE (COH)
1	0.470	0.514	0.438	0.783	0.753
2	0.485	0.534	0.450	0.795	0.729
3	0.539	0.555	0.520	0.904	0.777
4	0.552	0.569	0.520	0.891	0.807
5	0.562	0.573	0.515	0.877	0.736
6	0.574	0.574			
7	0.586	0.586			
8	0.632	0.632			
9	0.660	0.660			
10	0.677	0.677			

E= entrants; I = Incumbents, SE= surviving entrants, FE = failing entrants, COH: by cohort
Numbers in *italics* indicate non-significance at 5% level

On the one hand, successful entrants catch up quite instantaneously to the profitability level of incumbent firms. On the other hand, failing entrants also catch up but at a much slower rate. Note that the mechanism underlying the catching up process of the FE population is clearly due to a selection process (i.e. the exit of the least profitable firms within 3 years after entry). Unsuccessful entrants that survive until age 4 and 5 do not exhibit similar weak relative performances (65 and 88 % of the profitability of incumbent firms respectively). This suggests that those firms were catching up, not falling behind, but this process wasn't strong or fast enough to allow them to survive to the competition of the rest (young surviving firms and incumbents).

Table 6b reports the relative employment levels of the different population of firms. Once more, the dynamics of E/I is a catching-up dynamics. Note however, that new entrants remains relatively small compared to incumbent firms even 10 years after their

entry. This feature is quite consistent with the existing literature on post-entry performance especially the one focusing on European countries. In contrast, successful US entrants are characterised by much higher growth rates after entry (see Bartelsman, Schivardi and Scarpetta, 2005 for a recent comparative analysis of firm demography between Europe and US).

If we now consider the sub-population of SE and FE, two main results emerge. First, it appears that initial size of failing entrants is significantly smaller than the initial size of successful entrants. This may indicate that failing entrants suffer somehow from their relative smaller size and that this occurs despite their size disadvantage does not translate into a productivity disadvantage relative to their incumbent counterparts. Note, nonetheless, that the relative smallness of FE relative to SE is positively correlated with a productivity disadvantage. The second important result is that FE experience lower growth rates compared to SE but still follow a catching up process towards the employment level of incumbent firms. Once more, this leads us to conclude that FE do not survive mainly because they do not grow fast enough to struggle efficiently against their incumbent counterparts.

In summary, the analysis of post-entry performances on French manufacturing goods industries reveals that market selection processes are complex. They do not simply resume to a natural selection process[14] according to which new entrants exit when they reveal themselves not able to reach the minimum productivity level required to become an incumbent firm. Moreover, different competitive games seem to co-exist between the different actors in the market. Specifically, while the competition between entrants and incumbents clearly involve something else than a pure selection mechanism (i.e. a selection only based on productivity differentials), the competition among entrants themselves seems to be more directly tied to differences in productive efficiency.

5. Pre-exit performances of mature firms.

In this Section, we take advantage of the time series dimension of our data set in order to investigate about the pre-exit performance of mature firms. If exit cohorts exhibit lower performance than their surviving counterparts in the year of market exit, one can wonder about how this phenomenon is achieved, i.e. how exit cohorts performance evolve in the years prior to exit. Griliches and Regev (1995) pointed out the existence of what they called a "shadow of death" effect which refers to the observation that a performance gap between exiting and surviving firms exists in the years before the exiting year.

Let us start the discussion by Table 7 which displays the relative TFP performance of

14) Also called *pure selection* in terminology is used by Baldwin and Rafiquzzaman (1995).

exiting cohorts as, instead of employment growth rates, we are considering TFP as a more informative performance indicator.

The reference population in each Column are firms of more than five years that are in the data base on the overall period (from 1990 to 2001). Then, each line of numbers expresses the evolution of the relative TFP difference between each exit cohort (from 1990 to 2001) and that population of incumbents.

Table 7. Pre-exit Performance of Exiting Firms (relative TFP)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1990	*-0.014*											
1991	-0.026	-0.044										
1992	-0.031	-0.038	-0.032									
1993	*-0.014*	-0.037	*-0.019*	*-0.016*								
1994	*0.006*	*-0.008*	*-0.008*	-0.024	-0.023							
1995	*-0.004*	*-0.005*	*-0.015*	*-0.021*	-0.034	-0.024						
1996	0.013	*0.018*	*0.016*	*0.007*	*-0.003*	*-0.008*	-0.037					
1997	*-0.001*	*0.005*	*0.006*	*-0.007*	-0.027	-0.042	-0.042	-0.044				
1998	*0.004*	*0.000*	*-0.009*	*-0.018*	*-0.016*	*-0.021*	-0.029	-0.056	-0.065			
1999	*0.017*	*0.012*	*-0.001*	*0.004*	*-0.008*	*-0.003*	*-0.015*	*-0.024*	-0.039	-0.051		
2000	*0.005*	*-0.011*	*-0.012*	*-0.015*	-0.025	*-0.024*	-0.036	-0.024	-0.037	-0.056	-0.057	
2001	*0.029*	*0.024*	*0.005*	*0.007*	*0.008*	*-0.003*	*-0.014*	-0.031	-0.037	-0.035	-0.036	-0.045

Numbers in *italics* indicate non-significance at 5% level

There are two major results. The one is that all exit cohorts are less performing than the surviving firms far beyond the exit year. Except the 1996 exit cohort for which that lower performance is appearing only three years before the exit date, that relative TFP differential occurs far before the exit date (even ten years before for the 2000 exit cohort). The other is that this observation is significant in most of the cohorts not only at the exit date but in the years prior to exit. Moreover, that gap tends to gradually increase when we get closer to the exit date. In that respect, as far as TFP is concerned, we found the existence of a shadow of death effect in almost all exit cohorts. These results are quite similar to those exhibited in Kiyota and Takizawa (2007).The hypothesis that exiting firms perform lower productivity than the surviving ones not only the year of the exit but also some times before exit is almost confirmed over the overall period (1990-2001).

Now, let us improve that result by adding in the discussion two other performance indicators, size and profitability. Here, we pooled the exiting firms and develop a population analysis comparing their relative performance to the surviving firms (again the more-than five years firms in the sample).

A remarkable feature occurs which is the quite continuous decrease in the relative performance of exiting firms for each of the performance indicators in use. Relative TFP is gradually decreasing along the 10 years period before the exit date; it becomes negative

Table 8. TFP, Profitability and Size differences by number of years prior to exit

Prior to exit (in Years)	TFP (log)	P (lev)	S (lev)	LP (log)
10	*0.015*	*0.990*	*1.101*	-0.070
9	*0.004*	0.902	*1.030*	-0.063
8	*0.003*	0.910	*0.950*	-0.053
7	*-0.002*	0.853	*0.901*	-0.048
6	*-0.003*	0.797	*0.911*	-0.055
5	-0.006	0.799	0.834	-0.055
4	-0.009	0.750	0.793	-0.066
3	-0.017	0.645	0.737	-0.089
2	-0.026	0.548	0.665	-0.109
1	-0.033	0.391	0.621	-0.119
0	-0.036	0.235	0.564	-0.122

Numbers in *italics* indicate non-significance at 5% level

seven years before the exit date even if this result is only significant five years before the exit date (bold numbers). Relative profitability and size are continuously decreasing and those indicators are significant 9 years and 6 years before the exit date, respectively. Moreover, the magnitude of relative profitability is quite higher than the ones of the two other performance indicators, and that magnitude also increases during the five years period prior to exit. As such, the evolution of firm profitability is probably the most relevant indicator to rely on firm exit mechanisms. Contrary to other contributions (see Van der Wiel, 1999), we found a remarkable similar trend among the three performance indicators in use to corroborate for the existence of a shadow of death effect from our data set. Finally, note that relative labour productivity is always negative. This can be thought of as an indication of a systematically weaker capital intensity of exiting firms, despite this could also be due to some composition effects, as we are discussing about a population of inter-sectoral firms.

Moreover, those results are quite stable and robust. Table 9 provides the same information than the previous ones but the reference population is changed. Instead of using the overall mature firms in the sample, we apply a non parametric matching method similar to Almus (2002) and compare exiting firms only to the sub-set of their most similar surviving counterparts. Actually, we match firms according to the following start-up characteristics: initial firm size, year of entry, industry classification at the 4digit, legal form and the initial number of establishments.

The previous results are essentially affected in two ways. First, the matching method essentially improves the magnitudes in the decrease of performance of exiting firms, especially of their relative TFP growth rates. Second, it improves the significance of the results, at least for relative TFP and profitability. Relative size is not affected as far as the significance of that indicator is concerned.

At this stage, further discussion is needed about the relative importance of market

Table 9. TFP, Profitability and Size differences by number of years prior to exit (with matching)

Prior to exit (in Years)	TFP (log)	P (lev)	S (lev)	LP (log)
10	-0.044	0.839	*1.219*	-0.176
9	-0.057	0.802	*1.146*	-0.167
8	-0.065	0.761	*1.015*	-0.154
7	-0.080	0.706	*0.946*	-0.163
6	-0.089	0.671	*0.946*	-0.176
5	-0.105	0.664	0.822	-0.191
4	-0.127	0.619	0.747	-0.221
3	-0.142	0.527	0.680	-0.254
2	-0.161	0.445	0.613	-0.287
1	-0.177	0.308	0.564	-0.311
0	-0.194	0.206	0.529	-0.326

Numbers in *italics* indicate non-significance at 5% level

selection. With regard to our performance indicators, it is noteworthy to emphasise how relative TFP to incumbents is not actually useful to discriminate between the population of failing and successful entrants in their post-entry behaviours. However, relative TFP gaps are significant as far as the pre-exit behaviours of exiting firms is concerned. Therefore, TFP can be thought of as a necessary but not sufficient condition to be fulfilled in order to stay on the market and further structural characteristics have also to be considered as far as explaining the market selection process is at central stake. In other words, market selection cannot be fully explained through a pure productive efficiency analysis.

Moreover, the existence of a quasi-systematic shadow of death effect can be interpreted in a twofold perspective: either it means that market selection is not effective enough and allows firms to survive whereas they should have left the market or, that market selection is efficient but allows firms to anticipate that they need to leave the market so as they react gradually and adjust downward especially their employment level before actually leaving the market (Almus, 2002). Therefore, in the next Section, we focus the discussion about selection mechanisms as regards firms' structural characteristics.

6. Conclusion

In this paper we study how market selection mechanisms have been working on French manufacturing goods markets over the last decade. We investigate this issue under the hypothesis that the competitive challenges a firm have to face, may change along the different stages of its life. On the one hand, young new entrants face the challenge to reveal themselves productive enough and/or able to learn fast enough in order to survive to the reactive strategies of larger and more powerful incumbents firms. On the other

hand, mature firms face the challenge to continuously renew their productive capabilities, i.e. to adapt themselves to new productive environment. Mature firms which will reveal themselves no more productive enough and/or not able to adapt fast enough will loose market shares, shrink and eventually exit the market.

Our empirical investigation led us to the following results. In accordance with most of the industrial dynamics literature, we found that, exiting firms, as a whole, display below-average performance levels and are significantly smaller than their surviving counterparts. We nonetheless found key distinguishable features of exit patterns in discriminating between young and mature firms. We found that young exiting firms do not display productivity disadvantage relative to incumbent firms. They nonetheless display a small but significant productivity gap compared to their surviving counterparts. By contrast, mature exiting firms display a large and significant productivity disadvantage relative to their surviving counterparts. This gap widens the year of exit but emerges several years prior to their exit. More precisely, we find the existence of a "shadow of death" effect for each performance indicators in use (relative TFP, profitability and size).

This later result may reveal that, as far as mature firms are concerned, French markets select against persistent bad performers and not against temporary looses of efficiency. Interestingly, this stylised fact can however be given two opposite interpretations. On the one hand, this may reveal that markets are well-functioning as they evaluate firms on a medium-run horizon and not on a too short-run horizon. On the other hand, this may reveal a kind of inertia if market selection processes work in favour of established firms and against new entrants, in the sense that the later ones are more heavily sanctioned than the former ones. We finally conclude that micro data from French manufacturing industries show average behaviour consistent with a common view of market selection mechanisms favouring the most efficient firms. However, the institutions that help markets to rightly operate this selection process may be more severe for young firms compared to mature firms.

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