Entry, Growth and Survival of Manufacturing Firms

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ABSTRACT. This paper examines the interactions between entry size, growth rate, and probability of survival of firm. Standard microeconomics states that firm growth stems from relative efficiency differentials and that growth positively affects the likelihood of survival. Therefore, the selection hypothesis is unable to explain how a wide number of small newly born firms can survive at length even without growth and how an even larger set of firms with a higher than average growth rate exits the market in the first few years after the foundation. It is shown that one way out of these apparent paradoxes is to relax the hypothesis of a one-to-one link between initial relative efficiency and survival, and then develop a model based on different entry modes and growth patterns of the newly born firms.

1. Premise

The relationship between entry mode, growth, and probability of survival of the firm remains one of the most remarkable issues of industrial demography. Numerous works have underlined the existence of a negative correlation between size and growth[1] and age and growth,[2] while other contributions have argued a positive relationship between size and survival and growth and survival.[3] There is therefore no satisfactory explanation for the economic mechanism that influences such relationship.

There are in fact two elements that appear particularly uncertain: a) the identification of the factors that influence the growth of a newly founded firms; b) the evaluation of the role that the entry size and the conditions of initial efficiency play in the survival. This study aims to make a contribution in this direction.

The main point of this work can be synthesized thus: if, as current economic theory maintains, the growth of the firm is based on the presence of differentials of efficiency with regard to competitors and the growth influences significantly the survival, how can we explain the numerous cases of firms that begin small and survive without growth and the even more numerous cases of firms with a higher than average rate of growth, that do not however survive after the first few years of activity?

The work is sub-divided in two main parts: in the first part, paragraph 2, the most important interpretative schemes of the phenomenon are discussed and the elements of partial innovation introduced in the analysis are illustrated. In the second (paragraphs 3—8) an attempt is made to verify the hypothesis concerning the link between size, growth and survival.

2. Size and entry mode

According to the traditional microeconomic framework, at birth the firms are characterized by different endowment of efficiency, but by a single path of growth. Indeed it is foreseen that the most efficient firms increase their size and rapidly succeed in controlling a market share large enough to minimize the probability of failure. The less efficient firms, on the other hand, don't grow, they progressively lose the initial market shares and then are forced to leave the industry. The highest likelihood of survival is linked to the firms that develop higher growth rates: in synthesis firms grow because they are efficient and survive because they grow.

The model developed by Jovanovic (1982) appears to be a useful representation of the

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process described above. This model leaves out, as we know, the diversity of the initial sizes of the firms. Indeed it is taken for granted that the process of entry is simultaneous for all the productive units. In addition, the entrants are of an infinite number and with size close to zero. The firm is oriented towards a traditional goal to maximize the profits

$$\max_{q_{jt}}(p_t q_{jt} - c(q_{jt})x_{jt}^*) \quad (1)$$

where q_{it} represents the output of the firm and x_{jt}^* is a random variable that suggests the degree of inefficiency of the single firm defined on the basis of the information elaborated before the start-up of the same firm and therefore before x_{jt}^* can effectively be verified and compared with that of their competitors. If the profits P_{jt} turn out to be higher than $\bar{P}_i$ (average industry profit) this means that x_{jt}^* is exceptionally low. In the next period the firm is, therefore, induced to evaluate $x_{jt+1}^* < x_{jt}^*$ with the outcome of increasing the output and accelerating the growth.

The following considerations are derived:

a) in the phase succeeding start-up, independently of when the interfirm comparisons are realised, the population of firms is subdivided into efficient and inefficient firms. The efficient ones can be identified on the basis of their capacity to yield an above average profit;
b) growth is a function of the profit differentials and is strictly correlated with the level of efficiency reached by the single firm;
c) firms that do not grow are inefficient units in comparison with the others and are at constant risk of being excluded from the industry since the growth of the efficient firms is based on reducing the market shares owned by the former;
d) newly founded firms grow more than older ones. Indeed older firms have already carried out sequential adjustments and the variation of $x_t^*$is already stabilized.

Starting from the prescriptions of the examined model, we can conclude that the survival (S_{ji}) appears unaffected by initial size, but it is heavily conditioned by growth.

If the most efficient enterprises do not grow, in fact, it means that the market isn't able to perceive the advantages provided by the most efficient units and, therefore, mechanisms of economic selections are shown to be paralyzed.

On the other hand, whenever the selective mechanisms are active, the relationship between growth and survival in the examined model can be depicted as:

$$S_{ji} = s(G_{ji}) \quad (2)$$

with

$$G_{ji} = -g(D_i^* - D_{jit}) \quad (3)$$

where growth (G_{ji}) is an inverse function of the difference between the initial size (D_{jit}) and the minimum optimal size of the industry (D_i^*). Only the firms with $D_{jit} >= D_i^*$ can be rated efficient and they are therefore able to activate the mechanism of size growth.

As it has been noted (Frank, 1988; Bates, 1990), in general the work by Jovanovic presents realistic elements. Nevertheless, in regard to the analysis of the start-up phase (the first 4—5 years of life), parts of the conclusion that are implicit in this model seem unable to satisfactorily explain the link between growth and survival.

The following are the weakest features:

a) unlike the prescriptions of the analytical scheme described above, a larger number of firms, that are born small, survive at length even without growth in size;
b) although size evolution of the firms is characterized by uneven trends (high increases are followed by same high decreases), this unevenness is often harmless to its survival. This kind of trend isn't encompassed in the model examined;
c) in many cases the check for efficiency in the newly born enterprise is long-lasting and sometimes extends over a multiyear period. Especially in the industries characterised by high fixed costs, it is expected that the initial profits may remain very low or even negative even long term. In such circumstances a firm is likely to be forced to postpone the control of its own relative efficiency. Meanwhile it must behave as if it provides positive (minimum) differences of competitiveness relating to the other firms in the industry and is thus stimu-

lated to grow: it carries through plant investments, widens the distributive network and increases the level of output. In the start-up phase, therefore, growth does not seem to be a one-to one signal of efficiency.

Those objections can be overcome if the initial hypothesis of a single path of development of the newly founded firms is relaxed. This first hypothesis may be replaced with a second that prescribes that a proportion of newly built enterprises, although born with sub-optimal size and are probably inefficient, can overcome this disadvantage during a limited period of time and survive.

Very briefly, the initial scheme should be widened until it takes in at least two firm typologies:

1) the first corresponds to an entry mode in which the firm starts with size very close to that considered optimum and then increases in function to the level of the profits yielded. Firms founded according to the hypothesis of self-employment (Creedy and Johnson, 1983; Storey and Jones, 1987) are also included in this typology. They therefore are essentially characterized by very low minimum optimal size and by rapidly decreasing returns or by non-monotonicaly increasing cost functions.

No significant role is attributed to growth in the survival model corresponding to this entry mode. Indeed it is predicted that very small firms too can survive if they have sufficient endowments of efficiency (at least of technical nature) and do not have to undergo a contraction of demand that would reduce the absolute number of the firms that could remain active in the industry without suffering losses. The survival model in this case can be synthesised in the following terms:

$$S_{ji} = s(E_{ji}/E_i^*, M_i) \qquad (4)$$

where E_{ji} and E_i^* are indicators of the technical competitiveness (technical efficiency) of the firm and of the industry respectively, where M_i represents the trend of demand. In the present work this typology will be defined "firms with initial optimal size" (O-D);

2) the second typology is made up of firms with high starting costs and that choose to operate at an remarkably high optimal minimum size. In this entry mode, however, the presence of constraints regarding initial capital availability or the need to plan growth strategy over time have resulted in a noteworthy sub-optimal entry size. In such circumstances the probability of survival (S_{ji}) appears affected by variables partially different from that of the first typology. Indeed:

$$S_{ji} = s(G_{ji}, E_{ji}/E_i^*, 1 - (D_{ji}^*/D_{jit+1})) \qquad (5)$$

with

$$G_{ji} = g(D_{ji}^* - D_{jit}) \qquad (6)$$

where D_{ji}^* = minimum optimal size of the firm j and D_{jit+1}) the size reached at the end of the start-up phase. Growth (G_{ji}) plays a determining role and, unlike the standard hypothesis, it appears to be a direct and not an inverse function of the difference between the initial sizes and the optimum sizes. In this typology growth does not point out a high endowment of initial efficiency, but it is merely an indicator of a progressive reduction of the difference of inefficiency present at the moment of the birth of the firm. The probabilities of survival, therefore, tend to be maximum in coincidence with the minimum value of the difference between the optimum size (D_{ji}^*) and the final size (D_{jit+1}). This typology is named "firms with initial sub-optimal size" (SO-D).

Each Typology is characterized by several elements, but for the moment we shall underline only the following:

a) whenever we circumscribe the analysis to a competitive arena limited by a defined and temporary stable number of firms, we note that in the O-D typology it is the endogenous factors (differentials of efficiency) that condition the likelihood of exit of the firms, while in the SO-D typology the variables of exogenous nature acquire a particular importance. Indeed the access to the capital market, the availability of additional financial resources, the degree of reactivity of demand to product innovation, the market power of direct competitors represent in this last typology factors of central importance for the improvement of the planned path of development and therefore

exercise a direct influence on the survival probability of the firm;

b) we note that, as a result of this, initial size steadiness is a factor that considerably increases the risks of failure of the firms of the SO-D typology, while in the firms with entry mode of model O-D represents a non critical variable. In other words, in the SO-D typology the growth appears as a condition of survival, while in the O-D typology it turns out to be a generic indicator of the presence of competitive advantages.

3. The methodology

The hypothesis depicted in the preceding paragraphs will be verified on the basis of a sequence of analytical insights applying different statistical approaches. The tests will be computed by using a data base that files information collected during a survey on the causes of "infant mortality" of manufacturing enterprises.[4] The data base gathers informations from 242 small business (less than 50 employees) founded between 1983 and 1985. 54.5% of the examined units is constituted by firms that ceased in 1990, the remaining part of the universe is made up of firms that, on the same date, proved to be active.

For both sets of firms a structured interview was submitted. The interview was mainly similar for the two kinds of firms and it aimed to obtain information dealing with the motives behind the building of the firm, the initial size, the market structure, the competition strategies adopted and the principal features of differentiation regarding direct competitors.[5]

From the comparison of the behavioral and structural characteristics of the ceased and surviving enterprises, we were able to acquire elements to verify the hypothesis explained in the preceding paragraph. Particular attention will be paid to the following variables:

- NADD = average size of the firm in the first two years of activity (in terms of employees);
- NMAX = the highest size reached by the firm in the first 5 years of life;
- NDOM = the minimum size valued as optimal with regard to the characteristics of the relevant market chosen in the start-up phase of the firm.

4. Initial size and survival

Several works, focused on verifying empirically Gibrat's law, argue that the probability of ceasing and exiting from the market depends on firm size: on the basis of different checks, indeed, it is ascertained that the smaller enterprises record a higher probability of failure than the bigger ones (Mansfield, 1962; Contini and Revelli, 1987; Evans, 1987a). Adding to the analysis the variable age of the firm, we reach less general outcomes. The evidence collected in this work seems to show that, in the phase immediately succeeding the foundation, the initial size has a weak influence on the probability of the firms survival. The relationship become significant only in regard to the time and only at the end of the first start-up period. These conclusions are reached by observing the outcome of a Kolmogorov-Smirnov test of homogeneity of the distributions concerning several size proxies of the ceased and the survived firms (see Table I).

The result of the analysis allows us to underline the following:

a) in addition to the initial size (NADD), the variables representing the minimum optimal size (NDOM) and the difference between the

TABLE I
Size indicators and survival rate
(Kolmogorov—Smirnov Test)

	K-S Z
NADD	0,833
DEVDOM1	0,927
NDOM	1,279
NMAX	2,113***
DEVDOM2	1,608***
GROWTH	2,171***

** = P (2-tailed) < 0,05
*** = P (2-tailed) > 0,01
no. observations = 242

Key:
NADD = Initial size (no. employees in the first two years of activity)
DEVDOM1 = Difference between initial size and minimum optimal size (%)
NDOM = Minimum optimal size (no. employees)
NMAX = Final size (no. employees)
DEVDOM2 = Difference between final size and minium optimal size (%)
GROWTH = Size growth (Var. no. employees)

latter and the starting-up size (DEVDOM1) show a weak influence on the likelihood of survival too;

b) as it is foreseen in numerous models, growth is positively correlated with the permanence in activity of the firm;

c) the value of the difference between the final size and the optimal size (DEVDOM2), unlike the variable computed on the basis of the starting size, appears significant. Linking this outcome with the insignificance of the optimal size, it can temporarily state that survival is influenced by the capacity of the firm to rapidly shorten the distance between the initial size and final size, regardless of the absolute values of the distance as well as of the optimal size.

More generally it can be noted that the statistically insufficient significance of the initial size and of the initial-optimal size difference seems to indicate the presence of various start-up technical and organizational configurations. Those configurations, nevertheless, don't appear to condition in an univocal manner the survival probability of the firm. On the other hand, the mode and the speed of the growth or the ability of the firm to minimize the distance between effective and optimal sizes seem to be more important. This conclusion is strengthened by the verification that the estimated minimum optimal size in the start-up phase doesn't represent a variable which identifies satisfactorily the firms that survive from the ones that failed.

These results are consistent with the hypothesis of existence of a plurality of initial growth paths and with the typological model depicted in the first paragraph.

5. Firm typology and growth

The findings reached in the preceding paragraph suggest further verifications of the analytical capacity of the typologies discussed above. This verification can be carried out by examining how the scheme is able to bring out significant differences within the studied population of firms. With the purpose of minimizing the arbitrariness in the definition of the classification criteria for the typology building, it is been judged useful to entrust the firms classification with a cluster analysis with no prefixed centers. To apply this method to group the cases contained in the already described data base,[6] variables representing the initial size (NADD), the difference between initial size and minimum optimal size (DEVDOM1) and the relative rate of growth (GROWTH2) are chosen.

The best result in terms of maximum distance among centers has been obtained at the level of four clusters.

The analysis of the final centers provides noteworthy elements of evaluation of the characteristics of the enterprises and it seems to confirm the initial hypothesis. The single clusters represent, indeed, particular specifications of the two principal typologies and they appear clearly distinct with regard to the variety of the conduct and to the final outcome of the process of growth of the firms.

The characteristics of the elaborated groups can be synthesized as following:

Cluster 1: collects the firms that show little difference between initial and optimal size. The starting size appears very low, even if it proves higher than average, and it is subject to moderate variations in the course of time: in many cases growth turns out to be very close to zero. On the basis of indirect elements, it can be observed that in this cluster the minimum optimal size results to be relatively low too. This evidence leads us to consider the examined cluster as belonging to the S-O typology. Cluster 1 identifies, therefore, the firms born with a size very close to the expected optimal level and with firm building motives linked with the hypothesis contained in the self-employment models;

Cluster 2: This group also refers to the typology S-O. The interval between the initial and the final size appears limited even if on an average it seems to be higher than the value recorded by the firms of the preceding cluster. Besides, in this case too, the optimal size approximates very moderate values. Unlike cluster 1, the growth rate turns out to be positive even if the variations appear small. It is probable, therefore, that this cluster groups the firms induced to grow, not only by the need to complete or to balance the internal structure by acquiring further resources, but also by incentives stemming from the market or from the exploita-

tion of some remarkable efficiency differential with regard to the direct competitors;

Cluster 3: unlike the preceding groups, this cluster aggregates the firms that are characterized by a very high minimum optimal size and, on the other hand, by a low entry size or a size very different from the values considered optimal. These elements allow us to attribute the cases classified in cluster 3 to the SO-D typology. Indeed the inadequate initial size and the need to cover a development path connotated by high growth rates are specific features of this typology. Cluster 3 identifies the firms born with sub-optimal size that are unable to grow at a sufficient speed to cancel or to reduce significantly this constitutive disadvantage: indeed the growth rate appears low, even if higher than the rate recorded by the firms grouped in the first two clusters;

Cluster 4: gathers the enterprises that are, from the point of view of the conditions of start-up, very similar to the firms identified in cluster 3, but, unlike these, they set off at so high growth rate that the final sizes appear to be a very close proxy of optimal size. The firms of this cluster belong to the SO-D typology too.

Through the cluster analysis, characteristic elements of the firm's behavior related to their attitude toward survival can be verified. As shown in Table II, the growth in size turns out to be remarkably high in the firms belonging to the SO-D typology in comparison with the performances of the firms classified in the first typology. The most outstanding evidence, however, stems from the comparison of the conducts of the two groups of firms belonging to the SO-D typology and it concerns the reduction of the interval between effective and final size: indeed, in the case of the firms of cluster 4, the process of approach to the optimal size tends to be depleted in the first few years of activity. On the other hand, for the enterprises of cluster 3 the distance to cover remains remarkably wide and, after the entire period of observation, the values of this variable appear higher than that of the firms of the preceding cluster.

The difference of conducts influences the survival probability. In the case of the firms of the S-O typology, the incidence of failure on the total

TABLE II
Size indicators and firm typologies

	O_1-D Cluster (1)	O_2-D Cluster (2)	SO_1-D Cluster (3)	SO_2-D Cluster (4)	F
NADD	3,78	4,07	2,38	2,58	4,454***
NDOM	4,21	7,41	11,23	10,71	14,918***
NMAX	4,12	5,84	3,35	9,08	13,088***
GROWTH	0,09	0,46	0,52	2,72	82,402***
DEVDOM2	0,07	0,23	0,60	0,15	68,346***
BARFIN	0,49	0,61	0,68	0,79	3,140**
TSURV	0,51	0,60	0,30	0,86	7,891***

** = Significance level 5%
*** = Significance level 1%
No. observations = 242

Key:
NADD = Initial size (no. employees in the first two years of activity)
NDOM = Minimum optimal size (no. employees)
NMAX = Final size (no. employees)
GROWTH = Size growth (Var. no. employees)
DEVDOM2 = Difference between final size and minimum optimal size (%)
BARFIN = Level of financial barriers (Dummy: 1 = medium high; 0 = low)
TSURV = Firm state indicators (Dummy; 1 = active; 0 = ceased)

is almost equivalent to the data base average, while in the typology SO-D the values of the ratio turn out to be heavily split: the survival probability of the firms that reach the optimal size appears very high (86%), but that percentage decreases to a very low level when the enterprise cannot approach the efficient size (30%).

The evidence described above allows us to develop some integrative observations:

a) unlike the prescriptions of the traditional theory, size steadiness (non-growth) does not appear directly correlated with the increase of the exit probability. Unsuccessful size expansion brings out remarkable effects on survival only for those enterprises starting with sub-optimal endowments. In the other firms the impact of the growth turns out to be neutral;
b) the irrelevance of the initial size on the firm survival rate is confirmed;
c) the hypothesis that, within the different firm typologies, the growth and the initial efficiency depend on dishomogeneous factors is strengthened.

6. Factors influencing the growth

As underlined above, a qualifying aspect of the proposed interpretative model concerns the heterogeneity of the variables conditioning the growth of the firms in the single typologies. Elements to confirm this thesis have been collected in the preceding paragraphs: in this paragraph a closer verification is attempted.

The analytical path chosen relies on estimating an identical growth function for the two distinct typologies of firms. The function is computed using a stepwise method in order to enter the independent variables.

The model employed is defined as following:

$$\begin{aligned} LnVar_i = {} & b_0 + b_1 LnD_i + b_2 COMPP_i + \\ & + b_3 FIN_i + b_4 COMPING_i + \\ & + b_5 DINMKT_i + u \end{aligned} \qquad (7)$$

where

LnVAR = Logarithm of the difference between the initial and the final size (number of employees);
LnD = Logarithm of the difference between the optimal size and the initial size;
COMPP = Level of price competitiveness (Dummy: 1 = > = than the competitors; 0 = < than the competitors);
FIN = Initial endowment of financial resources (Dummy: 1 = > = than the competitors; 0 = < than the competitors);
COMPING = Level of non price competitiveness (Dummy: 1 = > = than the competitors; 0 = < than the competitors);
DINMKT = Market trend (Dummy: 1 = increasing or steady; 0 = decreasing)

In the equation the size growth is measured by the variation of the employees in the examined period. The right side of the equation is formed by (partially) exogenous variables (capital availability; market trend) and by endogenous variables (price and non price competitiveness).

There are two general hypotheses to verify:

a) it is foreseen that in the first typology the set of variables that explain the differentials of the growth rate among the firms is not identical to the set of variables that explain the phenomenon in the second typology;
b) it is expected that in the O-D typology the performances of the firms are affected by endogenous variables and that in the SO-D typology, on the other hand, the growth path of the firms is mainly conditioned by exogenous factors.

The results of the estimates are shown in the Table III. The tests appear satisfying on strictly statistical grounds as well as on the verification of the hypothesis.

The importance for the O-D typology of price and non price competitiveness (respectively COMPP e COMPING) is confirmed. These variables underlie a size growth fed by competitive advantages on the grounds of technical efficiency or on that of differentiation strategies.

These variables are not included in the equation concerning the second typology. In the SO-D typology the tests set off the influence of the availability of financial resources (FIN)[7] and of the

TABLE III
Difference between initial and final size: regression results (b-values) (t-values are given in parentheses)

	O-D Typology (1)	SO-D Typology (2)
LnD	0,523[a] (8,107)	0,279[b] (2,294)
COMPP	0,136[b] (2,227)	—
FIN	—	0,314[b] (2,572)
COMPING	0,122[c] (1,858)	—
DINMKT	—	0,275[b] (2,266)
R^2a	0,294	0,215
F	23,920[a]	5,944[a]

[a] = Significance level 1%
[b] = Significance level 5%
[c] = Significance level 10%

demand trend (DINMKT) on the growth. In the SO-D typology, then, in coherence with initial hypothesis, the size growth appears strictly dependent on external factors or nevertheless on variables not univocally linked to the presence of differentials of technical efficiency.

In both the typologies, as was expected, the size development is influenced by the need to approximate to the initial size to that considered optimal: the variable LnD, indeed, is present in the first and in the second equation.

The elaborated verifications seem to demonstrate, hence, not only the existence of a plurality of growth paths in the first few years of life of the enterprise, but also that these paths can be changed by the action of heterogenous and sometimes exogenous (to the firm) factors.

In the next paragraph, we will see how growth, together with other variables, affect the survival likelihood of the firm in the single typologies.

7. Firm typologies and survival probability

On the basis of the initial hypothesis, it is foreseen that the size growth shows a different power of conditioning the survival in the case of the firms belonging to the first and second typology.

Indeed in the SO-D typology a quick development represents the most significant constraint to survival: in these circumstances growth indicates the progressive overcoming of the initial shortcomings that forced the firm to carry out suboptimal size choices. In the O-D typology, on the other hand, the growth underlies processes of adjustments of the structure or is correlated to decisions to widen the start-up size threshold and to move toward a higher size than the initial optimal one.

For the purpose of verifying this hypothesis a discriminant function of the survival for each firm typology is estimated.[8] In addition to growth proxies, other variables capable of bettering the predictive capability of the function are introduced into the equation. In this direction, therefore, proxies of the technical efficiency, of the market trend and of the level of the financial barrier are added. The variables employed in the analysis are shown with more details and with the expected sign in the Table IV.

TABLE IV
Independent variables employed in the discriminant analysis of survival (the expected signs in parentheses)

Growth proxies	LnVAR	(+)
	LnDOM	(−)
Technical efficience proxies	COMPCOST	(+)
	TECIMP	(+)
Market trend proxy	DINMKT	(+)
Entry financial barriers proxy	BARFIN	(+)

Key:
LnVAR = Logarithm of the difference between initial and final size (no. employees)
LnDOM = Logarithm of the difference between minimum optimal size and final size (no. employees)
COMPCOST = Level of production costs competitiveness (Dummy: 1 = > = than competitors; 0 = < than the competitors)
TECIMP = Plant technological level (Dummy: 1 = > = than competitors; 0 = < than the competitors)
DINMKT = Market trend (Dummy: 1 = increasing or steady; 0 = decreasing)
BARFIN = Level of financial barries (Dummy: 1 = medium high; 0 = low)

In this case too, the estimation procedure is stepwise. This method determines the eventuality that the set of variables explaining the O-D typology is different from that of the SO-D.

The results of the estimations allow us to develop the following observations (see Tables V—VIII):

TABLE V
Discriminant analysis of firm survival in the O-D typology. Prediction of group membership (Classification matrix)

Actual groups	Predicted group membership (0)	(1)
Ceased (0)	68,4%	31,6%
Active (1)	38,5%	61,5%

Percent of grouped cases correctly classified 64,6%

TABLE VI
Discriminant analysis of firm survival in the O-D typology. Standardized coefficients of the discriminant function

	Function 1
COMPCOST	0,521
TECIMP	0,447
BARFIN	0,756
DINMKT	0,224

Key:
COMPCOST = Level of production costs competitiveness (Dummy: 1 = > = than competitors; 0 = < than the competitors)
TECIMP = Plant technological level (Dummy: 1 = > = than competitors; 0 = < than the competitors)
BARFIN = Level of financial barriers (Dummy: 1 = medium high; 0 = low)
DINMKT = Market trend (Dummy: 1 = increasing or steady; 0 = decreasing)

TABLE VII
Discriminant analysis of firm survival in the SO-D typology. Prediction of group membership (Classification matrix)

Actual group	Predicted group membership (0)	(1)
Ceased (0)	84,0%	16,0%
Active (1)	33,3%	66,7%

Percent of grouped cases correctly classified 74,6%

TABLE VIII
Discriminant analysis of firm survival in the SO-D typology. Standardized coefficients of the discriminant function

	Function 1
LnVAR	0,945
LnDOM	−0,415
BARFIN	0,271
TECIMP	0.334

Key:
LnVAR = Logarithm of the difference between initial and final size (no. employees)
LnDOM = Logarithm of the difference between minimum optimal size and final size (no. employees)
BARFIN = Level of financial barriers (Dummy: 1 = medium high; 0 = low)
TECIMP = Plant technological level (Dummy: 1 = > = than competitors; 0 = < than the competitors)

1) it is argued that the size growth does not represent a generalized constraint to survival: growth proxies indeed determine an outstanding influence on the firms of the second typology, while they are completely absent from the discriminant function concerning O-D typology. With regard to the SO-D typology this outcome can be evaluated as a confirmation that the growth, in the start-up phase of a newly founded firm, is able to reduce the exit risks. The increase of the survival probabilities is not linked to the presence of differentials of efficiency with regard to the competitors, but it stems mainly from the fact that the firm, employing internal and external resources, is able to cover a balanced development path aimed at eliminating the inefficiency constraints arising from a startup sub-optimal size structure;

2) whenever the entry size is not very different from the optimal one, like the case of the firms grouped in the O-D typology, the survival is threatened by factors correlated with production cost competitiveness (COMPCOST) and to plant technological level (TECIMP);

3) it can be noted finally that the financial entry

barriers (BARFIN) represent in both typologies an outstanding factor conditioning the survival probabilities. The importance of such variable and the sign of the relationship can be interpreted as a meaningful check of several hypothesises already discussed at length in the industrial economics and demography literature. A high level of economic commitment and of financial investment yields entry autoselection:[9] in fact, in the correspondence of a high level of initial fixed costs, only the projects with a high certainty of success are favored, while those with a higher risk tend to be postponed or completely excluded. In addition, in the phase following the entry, a high level of financial investment turns out to be a barrier against the entry of new competitors and, at same time, constitutes a high barrier to exit (Caves and Porter, 1976; Eaton and Lipsey, 1980; Shapiro and Khemani, 1987). Finally several self-employment models (in particular Creedy and Johnson, 1983) suggest relationships between variables that appear to be consistent with the evidence above illustrated.

8. Conclusions

In the present work a picture of the development process of the firm in the phase immediately following foundation is attempted. In addition, the link between growth and survival is examined.

The proposed interpretative scheme to analyze these relationships partially moves away from the assumptions of several currently available entry models. The partial innovations we introduce concern: a) the relaxation of the hypothesis of an one-to-one relationship between relative efficiency, growth, and survival of the firm in the start-up phase; b) the introduction of two distinct modes of entry and continuance in the industry that are determined by outstandingly different groups of variables influencing growth and survival of the firms.

Such an approach has the advantage of being able to overcome some of the shortcomings of many standard microeconomic models provided by the literature. The recognition of the non uniqueness of the growth path of newly born firms, indeed, allows us to explain apparent paradoxes, like size stability in the long run of many very small enterprises. In addition, this scheme is able to integrate some interpretations for the causes of the non proportionality of firm growth assessing how size expansion does not always stem from a higher efficiency in comparison to the competitors, but arises sometimes from the need to reach a satisfying level of efficiency starting from a sub-optimal condition. Such a theoretical approach, finally, underlines that the efficiency concept useful in analyzing the dynamic and the survival probabilities of the firms in the first few years after the foundation must be able to incorporate exogenous (to the firm) variables. Besides, each level of efficiency is mostly influenced by constraints of an allocative rather than a strictly technical nature: if it wasn't so, it could not be explained why temporarily suboptimal firms continued to be active.

Although within the limits of explorative research, the evidence gathered in this work seems to provide some initial suggestions on the characteristics of a workable design of industrial policy supporting newly founded enterprises.

The ascertainment of the existence of a remarkable differentiation of the entry modes and of the conduct of the firms in the phase immediately following birth shows the need for an equivalent articulation of industrial policies. Indeed measures effective to correct the specific market failure of one firm typology can turn out inadequate or even misleading if applied to another.

In this direction, it is advisable, with regard to the first typology, considering the prevalent influence of endogenous variables on the survival probabilities, to leave to the selective mechanisms of the market the role of verifying the firm efficiency and eventually to decree its exit. In the second typology, the exogenous factors show a remarkable influence on survival and is foreseeable that the firms can suffer from some market incompleteness or from divisibility constraints. In this case, selective industrial policy measures are likely to yield an increase of the aggregate efficiency of the industrial system.

Notes

[1] On the debate on the relationship between size and growth and on the characteristics of the size distribution of the firms see Simon and Bonini (1958); Hymer and Pashigian (1962);

Mansfield (1962); Singh and Whittington (1975); Lucas (1978); Kumar (1985); Hall (1987); Evans (1987a).

[2] See Evans (1987b) and Contini and Revelli (1991).

[3] See Mansfield (1962); Contini and Revelli (1986); Evans (1987a); Audretsch (1991).

[4] The survey was promoted by Formaper. The geographical boundaries of the research were the district of Milan. The analyzed firms were capital or persons companies randomly pulled from the records of Chamber of Commerce of Milan.

[5] For further details on the methodological aspects of the survey see Arrighetti (1991a).

[6] The cluster analysis is applied to the totality of the enterprises contained in the data base, regardless of its "status" (active or dead).

[7] On the importance of the financial variables on conditioning the development and the survival of newly born firms see Carlesi (1990), Bates (1990) e Arrighetti (1991b).

[8] The dependent variable is represented by an indicator of the status of the firm (dummy: 1 = active; 0 = ceased).

[9] On the relationship between market contestability and firm exit see Virarelli (1991).

References

Arrighetti, A., 1991a, *Meccanismi di selezione e fattori influenti sulla mortalità delle imprese industrali*, mimeo, Milano: Formaper.

Arrighetti, A., 1991b, 'Mortalità delle imprese e l'ipotesi di selezione naturale', *Economia e politica industriale* **72**(3), 57—83.

Audretsch, O. B., 1991, 'New-Firm Survival and the Technological Regime', *Review of Economics and Statistics* **73**(3), 441—450.

Bates, T., 1990, 'Entrepreneur Human Capital Inputs and Small Business Longevity', *Review of Economics and Statistics* **72**(4), 551—559.

Carlesi, A., 1990, *Il problema finanziario nell'economia della nuova impresa*, Torino: Giappichelli Editore.

Caves, R. and M. Porter, 1976, 'Barriers to Exit', in Masson R. and D. Qualls (eds.), *Essays in Industrial Organization in Honor of Joe Bain*, Cambridge (Mass.): Ballinger, pp. 39—69.

Contini, B. and R. Revelli, 1986, 'Natalità e mortalità delle imprese italiane: risultati preliminari e nuove prospettive di ricera', *L'Industria* **7**(2), 195—232.

Contini, B. and R. Revelli, 1987, 'Process of job Creation and job Destruction in the Italian Economy', *Labour* **1**(3), 121—144.

Contini, B. and R. Revelli, 1991, 'Pattern di espansione e di contrazione occupazionale delle imprese italiane', *L'Industria* **12**(4), 535—564.

Creedy, J. and P. S. Johnson, 1983, 'Firm Formation in Manufacturing Industry', *Applied Economics* **15**, 177—185.

Eaton, B. C. and R. G. Lipsey, 1980, 'Exit Barriers are Entry Barriers: the Durability of Capital as a Barrier to Entry', *Bell Journal of Economics* **11**, 721—729.

Evans, D. S., 1987a, 'The Relationship between Firm Growth, Size and Age: Estimates for 100 Manufacturing Industries', in Bresnahan T. F. and R. Schmalensee (eds.), *The Empirical Renaissance in Industrial Economics*, Oxford: Basil Blackwell.

Evans, D. S., 1987b, 'Tests of Alternative Theorieis of Firm Growth', *Journal of Political Economy* **95**, 657—674.

Frank M. Z., 1988, 'An Intertemporal Model of Industrial Exit', *Quarterly Journal of Economics*, May, 333—344.

Hall, B. H., 1987, 'The Relationship between Firm Size and Firm Growth in the U.S. Manufacturing Sector', in Bresnahan T. and R. Schalensee (eds.), cit.

Hymer, S. e Pashigian P., 1962, 'Firm Size and the Rate of Growth', *Journal of Political Economy* **52** 556—569.

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

Kumar, M. S., 1985, 'Growth, Acquisition Activity and Firm Size: Evidence from the United Kingdom', *Journal of Industrial Economics* **34** 327—338.

Lucas, R., 1978, 'On the Size Distribution of Business Firms', *Bell Journal of Economics* **9**, 508—523.

Mansfield, E., 1962, 'Entry, Gibrat's Law, Innovation and the Growth of the Firms', *American Economic Review* **52**, 1023—1051.

O'Neil, H. M. and J. Duker, 1986, 'Survival and Failure in Small Business', *Journal of Small Business Management*, January, 30—37.

Romanelli, E., 1989, 'Environments and Strategies of Organization Start-up: Effects on Early Survival', *Administrative Science Quarterly* **34**, 369—387.

Shapiro, D. and R. S. Khemani, 1987, 'Determinants of Entry and Exit Reconsidered', *International Journal of Industrial Organization* **5**, 15—26.

Simon, H. and C. P. Bonini, 1958, 'The Size Distribution of Firms', *American Economic Review* **48**, 607—617.

Singh, A. and G. Whittington, 1975, 'The Size and the Growth of the Firms', *Review of Economic Studies* **42**, 15—26.

Storey, D. J. and A. M. Jones, 1987, 'New Firm Formation — a Labour Market Approach to Industrial Entry', *Scottish Journal of Political Economy* **34**(1), 37—51.

Vivarelli, M., 1991, 'Natalità e mortalità delle piccole imprese: un modello interpretativo', *L'Industria* **12**(3), 467—481.