

Survive or Die? Italian Firms and a Decade of Tougher Competition

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Abstract

Firms' survival is a crucial element to assess a country's competitiveness. This paper addresses the issue of business demography of Italian affiliates, using an original database, obtained by matching and merging two firm level datasets: ICE-Reprint and AIDA over a long period (2000 - 2008). With data on characteristics and budgets of Italian companies, and exploiting the information on number of employees, sales, and country of destination from the census of foreign affiliates of Italian firms, we simultaneously investigate the effect of size, technology, geographical areas of destination and local networks on firms' survival probability. The analysis covers a decade of important transformation for the global economy as well as Italian firms and allows us to single out the elements increasing the probability to survive - size, number of affiliates per area e per sector and, low distance - assessing whether there are differences between manufacturing and services.

KEY WORDS: : Business Demography, Survival, Competitiveness, Internationalization

JEL classification: C41, L11, L25, F21

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1 Introduction

A recent and increasing literature has pointed out the importance of firms' survival, as well as turnover, entry of new firms, start up, incubators etc. for growth and competitiveness of a country (see for instance Bartelsman et al., 2003, Bartelsman et al. 2004). A different strand of literature emphasizes that firms involved in international activities through export or FDI are "different" from purely domestic firms in several respect, productivity, wages, skill intensity (see for all Mayer and Ottaviano, 2008). In this paper we draw on these two so far unrelated strands of the literature and assess the relationships among firms' characteristics and their competitiveness by analyzing demographic dynamics and survival of Italian firms' affiliates. More specifically, we show how the probability of survival is related to firms' size, technological level (in line with Agarwal e Audretsch, 2001) but also to firms' presence in foreign markets as foreign direct investors (in line with Bernard et al.).

We rely on an original dataset obtained by matching and merging two firm level datasets: ICE-Reprint and AIDA over a long period (2000 - 2008). With data on characteristics and budgets of Italian companies, and exploiting the information on number of employees, sales, and country of destination from the census of foreign affiliates of Italian firms, we simultaneously investigate the effect of size, technology, geographical areas of destination and local networks on firms' survival probability. The analysis covers a decade of important transformation for the global economy and for Italian firms which had to adapt to a more competitive environment. Against this background we single out the elements increasing the probability to survive. After a brief overview of two strand of the literature (Gibrat's Law and business demography on the one and internationalization on the other hand), we sketch the econometric techniques used and then present the empirical results. We conclude by drawing some policy implications.

2 A Sketch of the Literature

Back in 1931, Robert Gibrat proposed an explanation for skew size distributions in a number of different environments, ranging from biology to astronomy. In particular, describing manufacturing industries, he showed that the firms' size distribution is well approximated by a Log Normal: "the probability of a given proportionate change in size during a specified period is the same for all firms in a given industry - regardless of their size at the beginning of the period" (Mansfield,

1962, p. 1031). This regularity is known as the Law of Proportionate Effect or Gibrat's Law.

Until the 1970s this Law was popular, not only because it was coherent with dynamic patterns of manufacturing firms in different countries but also because of its compatibility with different theoretical models. However, empirical testing soon became controversial, and theoretical models started developing different lines of research (cf. Santarelli et al, 2006), the most promising of which emphasized the existence of a strong relationship between the likelihood of survival and firm size. "Because small firms have a lower likelihood of survival than their larger counterparts, and the likelihood of small firms' survival is directly related to growth, firms' size is found to be negatively related to growth, thereby refuting Gibrat's Law" (Agarwal and Audretsch, 2001, pp 22). Hence, the greater is the "size at entry" in a given industry, the higher the likelihood of survival of new entrants. On average, therefore, smaller firms have a lower probability of survival; however those who survive grow proportionately faster than larger firms (Jovanovic, 1982; Evans, 1987; Hall, 1987, Agarwal and Audretsch, 2001). Furthermore, "entry appears to be relatively easy, but survival is not" (Geroski, 1995), so that turnover can be high, especially in highly competitive markets.

A vast number of recent empirical studies, covering different time periods and countries, finds that size increases the likelihood of survival in the more technological advanced industries, but not in traditional sectors. Most of these studies are consistent with theories of industry evolution (Agarwal and Gort, 1996, Agarwal, 1998, Audretsch, 1995) and with the theory of strategic niches (Caves and Porter, 1977; Porter, 1979). According to the latter, firms remain small because they occupy product niches that are not easily accessible or profitable for their larger counterparts. A different strand of the literature has emphasized firms' heterogeneity and focused on the existence of substantial differences between domestic and internationalized firms. In this paper, in line with Giovannetti et al. (2010), we show that there is a strong heterogeneity also between the internationalized firms, specifically the affiliates of Italian firms. Our purpose is to link the literature on survival with that on internationalization strategies. To the best of our knowledge there are few studies, if any, that look simultaneously at the role of size, technology and localization on firms' survival rates of affiliates.

3 Survival Analysis

To analyze whether the likelihood of survival is invariant to firm size, international involvement and technological intensity we use the Analysis of Duration (Lancaster, 1990) that allows us to estimate the length of the time until failure. The variable of interest in the analysis of survival is the length of time that elapses from the beginning of some events either until "their" end or until the end of the analysis. Observations will typically consist of a cross section of durations $t_1, t_2, \dots, t_n \in T$, where T is a random variable (discrete or continuous), and for this type of data the analysis of duration allows one to estimate the probability that the event "failure" occurs next period. In this paper the dependent variable is the span of survival and is calculated as the difference between time t and the firm's set up year while the "failure" event includes winding-up, failure or end of activity (Agarwal and Audretsch, 2001). The process observed may have started at different points in time and, because its length is not constant over time, the random variable T is unavoidably censored. Let T be a random variable with a cumulative probability

$$F(t) = \int_0^t f(s)ds = Pr(T \geq t) \quad (1)$$

where $f(t)$ is the continuous probability distribution. We are interested in the probability that the period is of length at least t , which is given by the survival function

$$S(t) = 1 - F(t) \quad (2)$$

and the probability that the phenomenon will end the next short interval of time, Δ , is

$$l(t, \Delta) = Pr(t \leq T \leq t + \Delta | T \geq t). \quad (3)$$

The Hazard Rate, i.e. the rate at which spells are completed after duration t , given that they last at least until t , is:

$$\lambda(t) = \frac{f(t)}{S(t)} \quad (4)$$

To measure the effect of different regressors (in our case entry size and technological level) on the survival probability of the phenomenon, we estimate the parameter λ using Maximum Likelihood by the Cox Proportional Hazard Regressions. The hazard function $h_i(t)$ of a firm i is expressed as:

$$h_i(t) = h_0(t)exp(x_i\beta) \quad (5)$$

$h_0(t)$ being an arbitrary and unspecified baseline hazard function representing the probability of failure conditional on the fact that the firm has survived until time t , x_i is a vector of measured explanatory variables for the i -th firm and β is the vector of unknown parameters to be estimated. Negative coefficients or risk ratios less than one imply that the hazard rate decreases and the corresponding probability of survival increases. Life-table analysis, estimating the survival rate at time s , where s is defined as the fraction of the total number of firms that survived at least t years, can also be used to show firms survival and failure rates. Life tables give the number of firms that die conditional on their age, i.e. they represent the probability of failure given that the firm has survived t years. To check for significance of differences between groups, tests of homogeneity are usually run (in the following we use the nonparametric Log-Rank, Wilcoxon, Tarone-West and Peto-Peto-Prentice tests). At each failure time t , the test statistics is obtained as a weighted standardized sum of the difference between the observed and expected number of exit in each of the k -groups. The null hypothesis is no difference between the survival functions of the k -groups. The weights functions used determine the test statistics (see Klein and Moeschberger, 2003).

4 The Data

We match and merge two different datasets (AIDA and ICE-Reprint) for the period 2000-2008. AIDA provides standard data on budgets of Italian companies, while the ICE-Reprint database is the census of foreign affiliates of Italian firms and provides information on number of employees, sales and sectors (for both investors and affiliates), as well as country of destination and "affiliates' birth year" (for details, see Mariotti and Mutinelli, 2005). Hence, our consolidated dataset provides information on firms' processes of internationalization, economic performance, innovative capacity and growth for 9552 investors and 32467 affiliates for the period 2000-2008. While in previous work (Giovannetti et al. 2010a, 2010b, 2011) we have used merge data, we have now constructed a long panel that allows us to "follow" the investors¹.

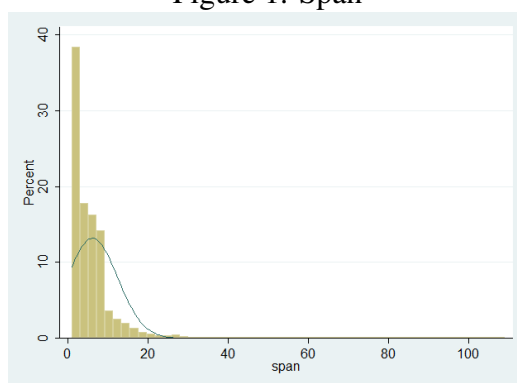
The independent variable (span of survival of Affiliates) is calculated as:

$$S_t = A_t - A_0 + 1 \tag{6}$$

¹The complex merging procedure and cleaning of the database can be discussed with the authors.

where A_t is the year corresponding to the balance sheet at year t and A_0 is the affiliates' birth year. S_t represents the "failure" variable on which the exit probability is worked out, it is a censored variable because the exit from the market can happen during or before 2008 due to winding-up, failure or end of activity. Hence, we can avoid biased estimates by distinguishing firms that failed during 2008 from those still alive in 2008 that are no longer included in the dataset as a result of falling outside the sample frame. Fig. 1 shows the span of the Italian affiliates: on average they survive roughly 6 years (in line with Italian firms, see Giovannetti et al. 2011) in international markets.

Figure 1: Span



The explanatory variables are impact of affiliate's size, distance of country of destination from Italy, number of affiliates per investor per area, number of affiliates per sector per investor and, a dummy variable that is one when the investor and the affiliate operate in the same sector.

Size is generated from affiliate's total sales. Because of the high skewness of the Italian firms' distribution, we use 4 equally represented classes. By following the procedure introduced by Geweke, Marshall and Zarkin (1986) to avoid inconsistency problems in the axioms at the basis of the discrete Markov Chains theory (Fractile Markov Chains), we define a number of classes n such that the proportion of the population (asset size of the firms) in each class j , for each t , is constant and equal to $n-1$ instead of using the common procedure of considering equally sized classes. This allows us to avoid classifying most firms as "small" and have a more realistic representation of our sample. As for distance, we consider three main areas for Italian investors: EU countries (with represent on average), OECD countries and Rest of the Word. Finally, the dummy variable "same tech" allows

to account for the fact that firms have different technology and R&D intensities. More precisely, we group manufacturing firms into four groups: high, medium-high, medium-low and low technology, according to OECD (2009), we did not split services and agriculture firms, which are respectively in group five and six. The dummy is one if the affiliates and the investor are in the same group and zero otherwise.

Table 1 summarizes standard statistics of our variables.

Table 1: Summary statistics

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|--|-------------|------------------|-------------|-------------|----------|
| Affiliate's size | 1.676 | 0.9 | 1 | 4 | 141179 |
| N. Affiliates per area | 12.01 | 27.85 | 1 | 282 | 163893 |
| N. of affiliates per sector per investor | 23.729 | 58.996 | 1 | 558 | 124241 |
| Manufacture | 0.647 | 0.478 | 0 | 1 | 159443 |
| Same tech | 0.549 | 0.498 | 0 | 1 | 163893 |

5 The Results

Table () summarizes the main results. We run the model for the all sample, as well as separately for manufacturing and services to account for the possible differences in probability of survival of Italian affiliates. As can be seen, and in line with the existing literature (Mayer and Ottaviano, 2008) the larger the size of the affiliates the more likely the survival. On the other distance makes it more difficult to stay in international markets. This result is in line with the gravity model of international trade and investment, which points to the cost and difficulties of managing very distant affiliates. However, distance seems to affect less services which often do not need face to face relationship (Baldwin, 2006) and sometimes can be off-shored by broad-band. The positive effect of an higher number of affiliates per area seems to suggest a network effect². To belong to the same technology group seems to decrease the probability of exit only in the case of services. For the all sample the hazard ratio is not significant, while for manufacturing it seems to

²We run regressions, available on request, with non linear effects number of affiliates per area and per sector; the numerical values and significance of all coefficients of our model are unchanged. The hazard ratios of the two squared terms are significant but they seem to suggest a neutral effect on the probability of exit (they are not significantly different from one).

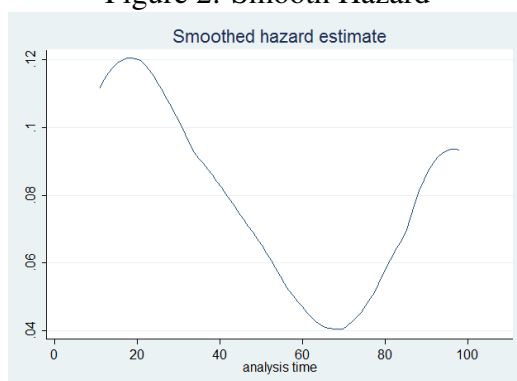
suggest that the probability to survive is lower if affiliates and investors are in the same technology sectors. This could be due to the nature of idiosyncratic shocks hitting the manufacture sectors³.

| VARIABLES | (1) All Sample | (2) Manufacture | (3) Services |
|--|---------------------|---------------------|---------------------|
| size_partecipata | 0.829*** (0.007) | 0.807*** (0.008) | 0.876*** (0.012) |
| distance | 1.040*** (0.007) | 1.053*** (0.010) | 1.020* (0.012) |
| num. of affiliates per area | 0.999** (0.000) | 1.001 (0.001) | 0.998*** (0.001) |
| num. of affiliates per sector per investor | 1.001*** (0.000) | 0.999*** (0.000) | 1.002*** (0.000) |
| same tech | 0.994 (0.012) | 1.032* (0.017) | 0.881*** (0.026) |
| Observations | 121,122 | 74,519 | 46,603 |

Robust se in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 2: Smooth Hazard



³We are currently running regressions for the different groups of manufacturing.

6 Conclusions

To survive in an increasingly competitive environment requires a mix of internationalization strategies. In this paper, with the help of an original database, we assess which variables increase the probability of affiliates' survival. Putting together different strands of existing literature, we find that larger affiliates resist better to tougher competition, to have a network of affiliates both in the same area and/or sector reduces the probability to close down. As expected, faraway countries are more difficult markets. Finally, for affiliates and investors to be in the same sectors only helps service firms.

Our results suggest the importance of sectoral analysis which allows us to single out the different characteristics to be exploited in the policies.

7 Appendix: The Database

The database is constructed starting from AIDA and ICE-Reprint for the period 2000-2008. AIDA provides standard data on budgets of Italian companies, while the ICE-Reprint database is the census of foreign affiliates of Italian firms and provides information on number of employees, sales and sectors (for both investors and affiliates), as well as country of destination and "affiliates' birth year". The ICE-Reprint database is an annual survey, in which investors are identified with fiscal code and other relevant identification variables (name, address, sector at 2-digit level, etc.). The information is derived mainly from newspapers, webpages, firms' communication to Chambers of Commerce or Consob (if they are quoted in Milan Stock Exchange). This means that often data are not comparable year by year, there are missing values as well as changes in the nature of firms or their location or the governance. With complex and detailed screening of the data we corrected mistakes and imprecision, dropping the firms for which we were not confident when there are contrasting information and trying to make the relevant variables more homogeneous. The cleaning of the data also required to double check the fiscal code or VAT code of each individual investor.

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