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Entrepreneurship, start-up size and selection:
Why do small entrepreneurs fail?

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Abstract
Firm demography has received considerable attention in recent years. There are numerous theoretical and empirical studies that shed light on the dynamics of firm survival and growth. These studies show that new firms start small, small firms are less likely to survive, and small firms grow faster conditional on their survival. These stylized facts on firm dynamics triggered the examination of determinants of survival. The studies in the literature treat start-up size as exogenous to survival. However, in this paper, we develop a counter argument and build up a simple two-period model to analyze the behavior of an entrepreneur. The main implication of our model is that the start-up size and the survival probability are determined simultaneously by the rational decision of the entrepreneur before entry, and, therefore, the start-up size will be an endogenous variable in the survival model. Then we test our model's implication studying the survival process in the Turkish textile industry. We show that the entrepreneur determines the entry size taking into account the risk of failure, and that decision leads to the observed correlation between the entry size and survival probability.

Keywords: Entrepreneurship, firm dynamics, start-up size, endogeneity

JEL codes: M13, L25, L67, D21

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1. Introduction

By the application of basic concepts from population ecology and evolutionary ideas from biology to economics, firm demography has emerged as a growing area of research within industrial organization. Studies in this area have shed considerable light on entry and exit behaviors and survival of firms. The striking implications of the empirical studies on entry and exit behaviors have triggered the investigation on dynamics of firm survival and made it the main focus of research recently undertaken in the field. This issue has attracted considerable attention, particularly due to the puzzling observed facts about firm dynamics that (1) high entry rates are associated with high exit rates, (2) entrants start small, and (3) small firms are less likely to survive. In an evolutionary way of thinking, these stylized facts imply that there is a dynamic selection process through which a few of the entrants manage to survive and contribute to economic development. It appears that entry is relatively easy, but survival is not (Geroski, 1995).

Many researchers, in an attempt to answer the question of "What makes start-ups survive?" examined the post-entry performance of start-ups and empirically tested the effect of firm and industry specific characteristics on survival. Among the firm specific variables most of the emphasis is placed on the firm size. Several rationales are put forth to link size and the probability of survival. It is claimed that in industries characterized by substantial scale economies a larger start-up size increases the likelihood of survival, since the cost disadvantage facing a firm operating at a sub-optimal level of output will decrease. Also, the abilities of an establishment to attract financial resources and to cope with changing market environment are considered to be reflected in firm size. Due to lack of financial resources, start-ups may be established at a smaller size than they would be and such firms cannot compete for a long time with their larger counterparts that exhaust scale economies. Furthermore, in the event of an unforeseen shock while a large firm may choose to contract to cope with the changing conditions, a smaller one may be left with only one choice and forced to exit the market. In the literature, based upon these views, it is posed that size should matter for survival. Most of the empirical studies, each focusing on a different country, show a positive relationship between start-up size and likelihood of survival (Mata and Portugal, (1994), Audretsch and Mahmood (1995), Santarelli (1998), Audretsch, Houweling, Thurik (2000), Segarra and Callejon (2002), Disney, Haskel and Heden (2003)). However, Wagner (1994) in his study on German manufacturing industry found no clear-cut nexus between start-up size and probability of survival. Similarly, Audretsch, Santarelli and Vivarelli (1999) analysing Italian manufacturing industry and Santarelli and Vivarelli (2002) using data on electric and electronic engineering in Italy found no significant evidence to link start-up size with survival. On the other hand, Mata, Portugal and Guimarães (1995), Fotopoulos and Louri (2000a) and Geroski, Mata and Portugal (2003) point to current size as a better proxy for post-entry efficiency on the grounds that it reflects skills and abilities accumulated through the learning process subsequent to entry. Mata, Portugal and Guimarães (1995), Nurmi (2004) and Geroski, Mata and Portugal (2003), use both initial size and current size in their models. Nurmi (2004) and Mata, Portugal and Guimarães (1995) found current size to be a better predictor of exit than initial size. However, in the light of their results, Geroski, Mata and Portugal (2003) mention that founding conditions matter more than current conditions for survival. They further argue that in most cases the size of the effects of founding conditions on survival persists without much of attenuation for several years after the founding of the firm.

In all those studies, firm size is treated as exogenous to survival. However, in this paper, we criticize this approach and by contrast argue that start-up size should be taken as endogenous. We raise this claim on the grounds that the entrepreneur determines the size of a start-up taking into account the risk of failure and the observed correlation between the entry size and survival probability is driven by this fact. We build up a simple two-period model to analyze the behavior of an entrepreneur. The main implication of our model is that the start-up size and the survival probability are determined simultaneously by the rational decision of the entrepreneur before entry, and, therefore, the start-up size will be an endogenous variable in the survival model.

We test our model's implication using firm level data on Turkish textile and clothing industries covering the time span 1993-2000. We first estimate a start-up size model and an exit/hazard model. Then we re-estimate the exit/hazard model using the explanatory variables of the start-up model as instruments for the start-up size variable. It turns out that neither the start-up size nor the age of the firm has any impact on survival. Hence, we suggest that the impact found in the previous models could arise due to the endogeneity bias.

Our study deals with an issue that has long been discussed in industrial organization literature from a different perspective introducing a new approach. To our knowledge it is the first attempt to show the endogeneity of start-up size to survival empirically in the literature.[1]

This study is organized in six main sections. An overview of the study with emphasis of novel aspects is provided in the first section. The second section presents the theory of noisy selection by Jovanovic (1982) and the model that puts forth the rationale for the endogeneity of start-up size to survival. The next section provides an overview of the Turkish textile industry. It is followed by a section which introduces the models and explains the variables used in the empirical analysis. Then, the fifth section reports the estimation results. Finally, the last section draws the main conclusions, and points to major caveats.

2. Endogeneity of start-up size

An explanation that gained broad acceptance in the literature with regard to small size of start-ups is that entrepreneurs are unsure about their relative efficiency and how others value the new idea upon which the new firm is established. That is, entrepreneurs establish their firm small in size to be able to cope with the risk arising from uncertainty and to decrease the sunk cost in case of failure. The argument finds its starting point in the classical work of Jovanovic (1982). In his pioneering study Jovanovic (1982) presents a model in which no entrepreneur knows his true cost. The entrepreneur discovers his actual cost through actual experience in the market and decides to stay in or exit the market. The ones who have low true costs stay in the market and grow whereas the ones who face higher costs exit the market. Then, survival is shaped by a process of selection through which efficient firms grow and survive; inefficient ones decline and fail. This process of noisy selection, as Jovanovic (1982) call, characterized by pre-entry uncertainty and post-entry learning forms the basis to question the deterministic approach that links start-up size to survival. Entrepreneurs are uncertain about their relative efficiency, managerial capabilities and how others value the new idea. Hence they face a risk arising from

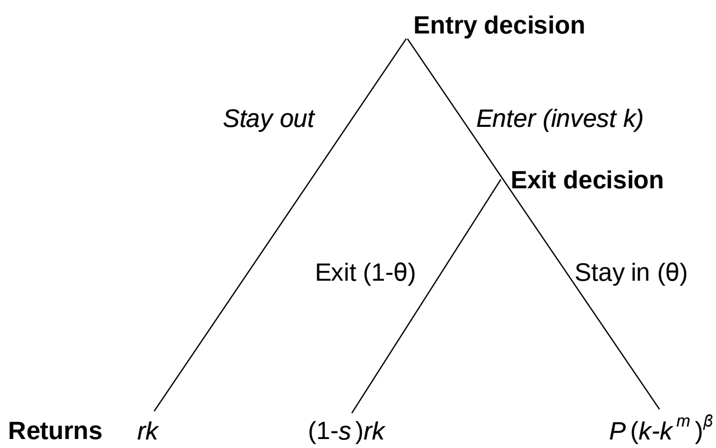
[1] In a recent study, Thompson (2005) shows that the dependence of survival on age is eliminated after controlling for heterogeneity in firm quality, i.e., survival is positively related to age because of selection bias.

uncertainty and information asymmetries. In order to internalize that risk, they form their investment decisions based upon their *ex ante* uncertainty of *ex post* realizations. In this way of thinking, start-up size determined by the priors of entrepreneur is endogenous to survival.

Another approach that may help to grasp the essence intuitively is the idea of "size signaling one's beliefs of his/her own productivity" posed by Frank (1988). He argues that each entrepreneur has beliefs about his/her own productivity and based on that decide the entry size. Then, "the scale of initial operation offers evidence as to the beliefs held by the entrepreneur" (Frank, 1988). These discussions in the literature pave the way for us to raise the counter-argument of endogeneity of start-up size to survival.

We use a simple two-period model to analyze the behavior of an entrepreneur. At the beginning of the first period, the entrepreneur makes the entry and size decisions simultaneously. In other words, she chooses the optimum firm size (measured by the value of capital stock) that maximizes expected profit, and enters to the market if the expected profit is positive. If she enters, she makes investment which is assumed to be completed instantaneously. At the beginning of the second period, i.e., after the investment is made, she observes her productivity, and stays in the market if it is profitable to do so. Otherwise, she exits. The entrepreneur's decision problem is summarized in Figure 1.

Figure 1. Entrepreneur's entry and exit decisions



The entrepreneur is expected to earn rk if she opts for staying out where r is the interest rate (or, the cost of capital), and k the value of capital stock. If she decides to exit after the investment is made, her return will be equal to $(1 - s)rk$ where s is the proportion of sunk costs, because she can earn the interest on only the salvaged part of the capital. In other words, the entrepreneur risks sk to learn about her productivity.

If the entrepreneur stays in the market after investment, she will earn revenue from her output q which is produced according to the following production function with one input:

[1] $$q = P(k - k^m)^b$$

where P is the productivity parameter (the P parameter can also capture price effects of product quality), k the capital stock ($k > k^m$), k^m the minimum capital needed for start-up, and b the elasticity parameter ($0 \leq b \leq 1$).[2] k^m is introduced to have variable returns to scale. If k^m is equal to zero, the production function exhibits decreasing returns to scale for all output levels.

The entrepreneur does not observe the productivity level before the investment is made. She knows the distribution of P and observes its value after she makes investment. P is assumed to be drawn from a normal distribution with mean a ($a > 0$), and standard deviation s. The s parameter measures the degree of risks in the market.

If the entrepreneur decides to make investment in the first period, she will stay in the market in the second period if $P(k - k^m)^b$ is greater than $(1 - s)rk$. Thus, the expected profit function at the beginning of the first period is as follows:

[2] $$\mathrm{E}[p] = q\ \mathrm{E}[P](k - k^m)^b + (1 - q)(1 - s)rk - rk$$

where q is the probability of survival, i.e., the probability of staying in the market in the second period. E[.] is the expectation operator. If the expected profit is nonnegative, the entrepreneur will make the investment.

Since the entrepreneur will stay in the market in the second period if it is profitable to do so, the probability of survival, q, is defined by

[2] The price of the product is normalized to 1.

[3] q = Pr [$P(k – k^m)^b$ $_3$ $(1 – s)\ rk$] , or

q = Pr [P $_3$ $((1 – s)\ rk)/\ (k – k^m)^b$]

Note that if s = 1 (all investment is sunk), the entrepreneur will stay in the market for any non-negative value of P because she cannot recover any part of investment by exit. If s = 0, then all entrepreneurs will invest in the first time period, because it is costless to experiment with investment.[3] Therefore, sunk costs of investment will deter entry (or, experimentation), but it will also reduce the exit probability.

The exit condition defines the critical value for productivity, P^c:

[4] $P^c = ((1 – s)\ rk)/\ (k – k^m)^b$

The expected value of productivity conditional on staying in the market (i.e., conditional on $P \geq P^c$) is defined as follows:[4]

[5] $E[P|\ P \geq P^c] = a + s\ \varphi[(P^c – a)/s]\ /\ (1 – \Phi[(P^c – a)/s])$

where φ[.] and Φ[.] are probability density and cumulative distribution functions for the standard normal distribution.

Thus, the optimum level of investment (and, therefore, the maximum profit) can be found by substituting [5] into equation [2], and taking the derivative of equation [2] with respect to k.

If we assume that there is no risk of failure (q = 1), then we get the usual condition that states that the value of the marginal product of capital will be equal to its cost:

[6] $dq/dk = r$

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[3] Equation 2 can be re-written as follows: $E[p] = q\ \{E[P](k – k^m)^b – (1 – s)rk\} – srk$. Since $E[P](k – k^m)^b \geq rk$ conditional on survival, the expected profit will be non-negative for any case in which s = 0.

[4] This is simply equal to the mean of a normal distribution truncated at P^c. For derivation, see Greene (2003: Section 22.2).

If the survival probability is endogenously determined as explained above, then the profit maximizing level of capital stock is defined by the following first order condition:

$$[7] \quad d\theta q/dk = \beta q\, \mathrm{E}[P](k - k^m)^{b-1} + (dq/dk)\mathrm{E}[P](k - k^m)^b + (d\mathrm{E}[P]/dk)\theta(k - k^m)^b$$
$$= r\,[1 - (1 - q)(1 - s) + (dq/dk)(1 - s)k]$$

The first term at the left hand side of the equation is the expected marginal product of capital. The second term shows the effect of firm size on survival probability. Finally, the last term captures the effect of firm size on expected productivity level *conditional* on survival. The right hand side of the equation is the cost of capital that is reduced by the amount $(1 - s)$ that can be recovered in the case of exit that will occur with $(1 - q)$ probability.

Since $\mathrm{E}[P]$ is defined as conditional on $P \geq P^c$, $\mathrm{sign}(d\mathrm{E}[P]/dk) = \mathrm{sign}(dP^c/dk)$.

$$[8] \quad dP^c/dk = r(1 - s)[(1 - b)k - k^m]/(k - k^m)^{1+b}$$

Thus, for small firms ($k \approx k^m$), the critical value of productivity will decline by size, but beyond a certain threshold (when $k > k^m/(1{-}b)$) the value of productivity necessary for survival will increase by size. Similarly, the expected productivity will first decline (until $k = k^m/(1{-}b)$), and then will increase by size. The opposite is true for the survival probability because of the fact that $\mathrm{sign}(dq/dk) = -\mathrm{sign}(dP^c/dk)$. In other words, for a given distribution of productivity, the probability of survival will first increase (until $k = k^m/(1{-}b)$), then will decrease by firm size. Thus, there will be a bell-shaped relationship between the survival probability (conditional on entry) and the firm size for a given productivity distribution. The survival probability will reach the maximum level when $k = k^m/(1{-}b)$ which is the point where average productivity of capital is equal to marginal productivity.

It is instructive to look at the relationship between the risk factor (the standard deviation of the productivity distribution, s), and the probability of survival, θ, which is equal to $\Pr[P \geq P^c]$ (see Equation 3). Thus, $\theta = 1 - \Phi[(P^c - a)/s]$. Differentiating this equation with respect to s shows that $d\theta/ds$ is positive if $\alpha < P^c$, and negative if $\alpha > P^c$. Thus, there is indeed no monotonic relationship between the survival probability and the risk factor.

Figure 2. Expected profits and firm size

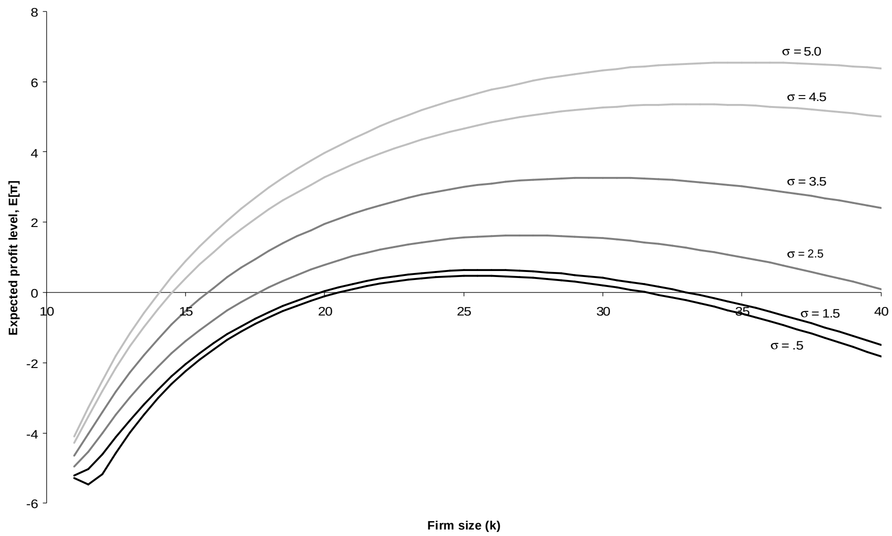
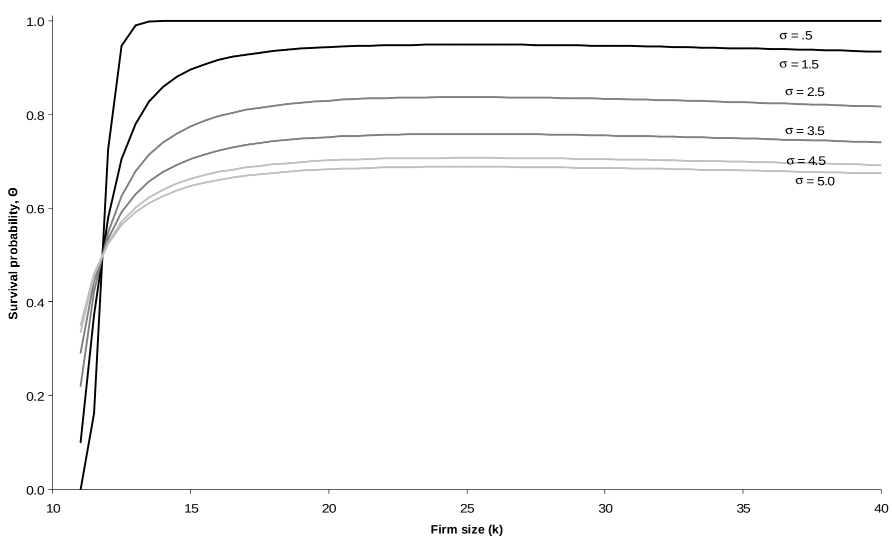


Figure 3. Survival probability and firm size



Since there is no closed-form solution for equation 7, we found solutions numerically for a certain set of parameters.[5] Figure 2 shows the relationship between expected profits and

[5] Parameter values are as follows: Mean productivity, $\alpha = 6$, the proportion of sunk costs, $s = .4$, the cost of capital, $r = 1.2$, the capital elasticity parameter, $b = 0.6$, minimum level of capital, $k^m = 10$.

firm size for a number of risk factors. The expected survival probabilities by firm size for the same values of risk factors are shown in Figure 3.

For the parameter set used here, the optimum firm size is equal to 25 if there is no risk (s = 0). As it can be seen in Figure 2, the profit maximizing level of capital (the optimum firm size) increases by the risk factor. In other words, the model predicts that large firms will be established if the risks in the environment increases when all other conditions including the mean of the productivity distribution are the same.[6] Moreover, there is a negative correlation between the risk factor and survival probability except for very small firms (see Figure 3), and the survival probability increases up to the risk-free optimum size (k = 25).

The analysis so far did not take into account any capital constraint. It was assumed that the entrepreneur had sufficient resources or she could borrow from the bank without any limit. However, if this is not the case, the entrepreneur has to establish a firm smaller than the optimum (profit maximizing) size, if it is still profitable to do so. If there are various sub-markets with different mean productivity/risk factor (α/s) combinations, a capital constrained entrepreneur will enter into a sub-market in which she could make the maximum profit given her resources and ability to borrow.

Assume that the entrepreneur has an initial wealth of z, and can borrow at most lz from the bank ($l > 0$). The entrepreneur is capital constrained if $(1 + l)z < k^*$ where k^* is the optimum size in the sub-market with the highest profit. In such a case, the entrepreneur will enter into the market where she can make more profit with her total resources, $(1+l)z$.

Figure 4 depicts expected profit curves for two sub-markets: sub-market A has a higher mean productivity and lower risk factor than sub-market B.[7] If the total resources available to the entrepreneur are less than 20 units ($(1 + l)z < 20$), she will enter into sub-market B in which the survival probability is much lower. This strategy is rational because the returns conditional on survival are also high in a risky market whereas the option to exit sets a lower bound for losses that are further reduced by small entry size. However, an

[6] As may be expected, sunk investment ratio (the s parameter) has a negative impact on the optimum firm size. However, conditional on entry, the survival rate is expected to be higher if the sunk costs are larger, as also verified empirically by Fotopoulos and Louri (2000b) and Gschwandtner and Lambson (2002).
[7] Note that the optimal firm size is higher in sub-market B than in sub-market A.

entrepreneur without any binding capital constraint will enter into sub-market A with an optimum sized firm ($k^* = 27.5$) and enjoy higher (expected) profits and higher survival probability (see Figure 5).

Figure 4. Expected profits and firm size, sub-markets A and B

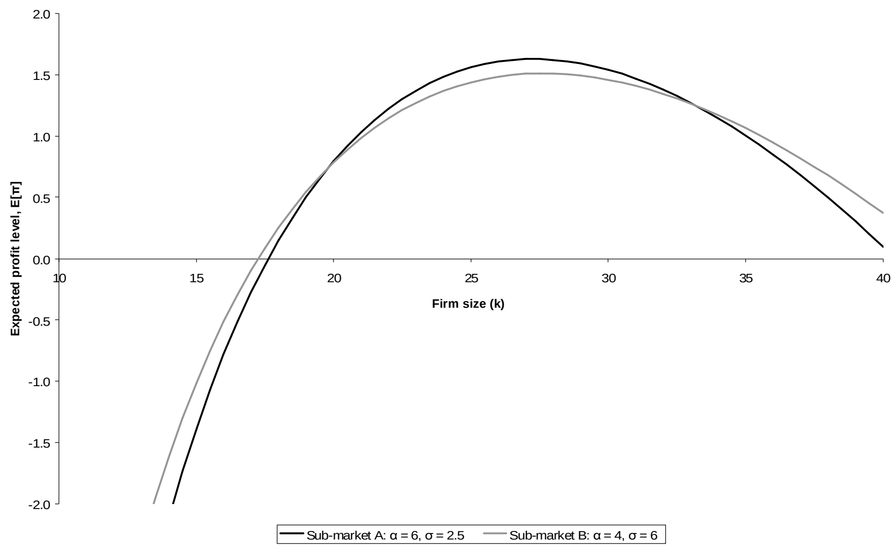
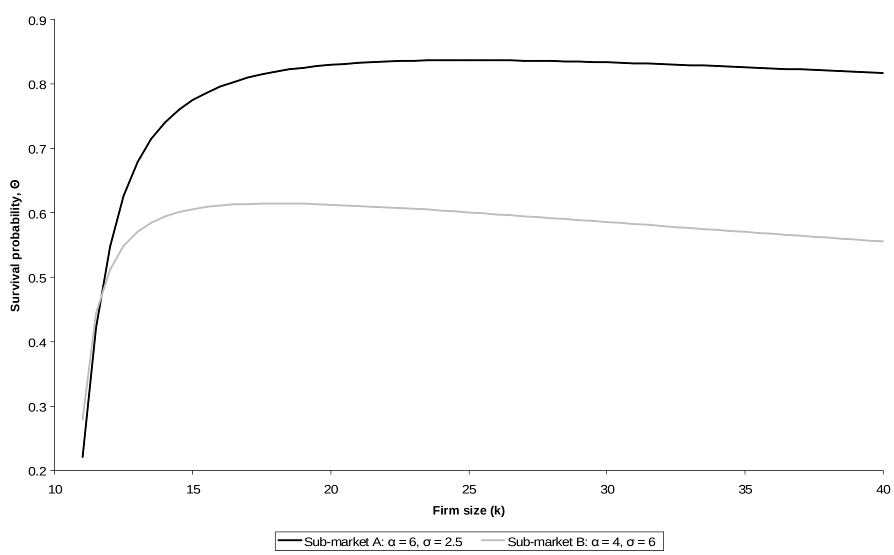


Figure 5. Survival probability and firm size, sub-markets A and B



The simple model used here shows that capital constraints can lead to a positive correlation between start-up size and survival probability. A capital constrained entrepreneur may prefer to enter into a market with a high risk factor. The start-up size and the survival probability are determined simultaneously by the rational decision of the entrepreneur before entry, and, therefore, the start-up size will be an endogenous variable in the survival model.

3. Entry and exit in the Turkish textile industry

The Turkish economy achieved considerably high growth rates in the 1960s and 1970s under the "import-substitution" industrialization strategy. This period of growth ended after a severe balance of payments crisis in the late 1970s. On January 24, 1980, the Turkish government announced a stabilization program based on an outward-oriented trade strategy and foreign trade, product, and, later, capital markets were liberalized to a large extent (for a comprehensive overview of the Turkish economy, see Kepenek and Yentürk 2005).

As in many other developing countries, the textile and clothing industries have played an important role in the process of industrialization of Turkey. Sümerbank, a state-owned conglomerate, was established in 1933 to develop a number of industries, including the textile and clothing industries, and it had a leading role in the sector until the late 1970s. However, as a part of the new market-oriented economic policies adopted in the 1980s, Turkish governments have curtailed investment by state-owned textile companies, and started the process of privatization in 1996. As a result, the share of state-owned establishments in textile employment declined sharply from 18 percent in the early 1980s to 2 percent in 2000. There is a similar trend in the clothing industry in the 1990s: the share of state-owned establishments in clothing employment declined from 3.9 percent in 1988 to 1.5 percent in 2000 (for details, see Eruygur, Özçelik and Taymaz, 2004).

The share of textiles in manufacturing value added increased gradually from 13 percent in 1981 to 16 percent in the second half of 1990s (hereafter, we use "textile" to refer to both textile and clothing industries). As a labor-intensive industry, employment share of textiles showed a significant increase, from 22 percent in the early 1980s to 33 percent in the late 1990s.

The textile industry was behind the export boom in the 1980s. Export revenue from textile products jumped from $ 0.9 billion to $ 9.9 billion (11 fold) in 15 years (from 1980 to 1995), and its share in total export revenue doubled (from 27 percent to 40 percent) in the same period. Much of this increase is accounted for by the clothing sector. Since the early 1990s, there seems to be no increase in the share of textile exports. Incidentally, the proportion of exports to GNP has also remained almost constant since the early 1990s. This may indicate that the limits of textile-based export growth have been reached in the early 1990s.

In this study, we analyze the determinants of start-up size and survival in the Turkish textile industry for the period 1993-2000. The study is focused on the textile sector because it accounts for the largest share of manufacturing employment. Moreover, as a dynamic industry with many entrants and exits, it provides a good case for this type of analysis.

The textile industry, with relative low entry and exit costs, has a high firm-turnover rate (the proportion of entrants and exits to total number of firms in a given year). Table 1 summarizes the data on the number of firms in the textile industry since 1992. There were, on average, 3300 textile firms employing 10 or more people in Turkey. The average number of entrants per year is slightly higher than the number of exits (445 vs 417) so that there is a gradual increase in the number of firms in the period under investigation.[8] In our empirical analysis, we use the data on only new firms established after 1992 when the Census of Manufacturing Industries was undertaken. The total number of new firms and exits by new firms are also shown in Table 1. Because of high turnover ratio, the new firms established after 1992 accounts for the majority (60 percent) of all textile firms operating in 2000.

[8] The total number of firms ("total") at time *t* refers to the number of firms operating in any time period during year *t*. The number of exits ("exits") and entrants ("entrants") refer to the number of firms that exit or enter, respectively, during year *t*. Thus, by definition, "total" at time *t* is equal to "total" at time *t-1 minus* exits at time *t-1 plus* entrants at time *t*. The equality is not satisfied in Table 1 because of missing observations.

Table 1. Number of firms in the sample
(Textile industry, ISIC 32, Rev.2)

	All firms			New firms	
	Total	Exit	Entry	Total	Exit
1993	3133	456	329	329	70
1994	2976	307	271	523	80
1995	3140	414	516	941	193
1996	3334	493	628	1355	277
1997	3610	404	697	1798	277
1998	3832	578	584	2115	385
1999	3414	381	221	1911	247
2000	3388	306	316	2006	212

As may be expected, the survival rate for small entrants is much lower than the rate for large entrants. Table 2 presents the data on Kaplan-Meier survivor functions for small and large entrants. New firms are classified into "small" and "large" categories by their start-up sizes. Those firms that employed less than the geometric mean of the sample (48 employees) are defined as "small".

Table 2. Kaplan-Meier survivor functions for small and large entrants

Age (year)	Proportion of survived entrants at age t	
	Small entrants	Large entrants
0	1.000	1.000
1	0.784	0.857
2	0.662	0.754
3	0.576	0.689
4	0.508	0.629
5	0.429	0.574
6	0.366	0.518
7	0.327	0.496

Notes: Survivor functions are calculated by using all available observations.
Log-rank test for equality of survivor functions, $\chi^2(1)$: 31.25

The data indicate that only one third of small entrants can survive up to age 7, whereas the same proportion for large entrants is much higher (one half). Moreover, the log-rank test rejects strongly the equality of survival functions for small and large entrants. Thus, as found in many other studies, the start-up size seems to matter for survival. Small start-ups are likely to live shorter.

4. Models of start-up size and survival

The descriptive analysis indicates that there are significant differences between survival rates for small and large start-ups. However, as explained in the previous sections, this correlation could be generated by other factors that determine simultaneously the start-up size and survival probabilities. In order to take into account the effects of other factors on survival, we need to model both the determinants of the start-up size and the survival process.

There are a number of recent studies that analyze the determinants of start-up size. Because of the lack of data *prior* to start-up, many empirical studies have focused mainly on industry-specific variables. In early econometric studies on this issue, Mata (1996) found that industry characteristics such as economies of scale, growth and turbulence, and entrepreneurs' characteristics such as age and education have a significant impact on start-up size in Portuguese manufacturing. In a follow-up study, Mata and Machado (1996) employed a quantile regression approach, and found that scale economies and turbulence are more important for large start-ups. Görg, Strobl and Ruane (2000) replicated Mata and Machado's analysis for Irish manufacturing, and obtained similar results. They specially found that industry size and growth affects large, but not small entrants. In a recent study, Görg and Strobl (2002) studied the impact of the presence of foreign multinationals on start-up size of domestic entrants, and concluded that the presence of foreign multinationals has a negative impact on the start-up size of domestic entrants. Arauzo-Carod and Segarra-Blasco (2005) have also found that various industry characteristics (market structure, industry growth, etc.) generate different barriers on the initial size of the entrants

There are a few studies that focus on entrepreneurs' characteristics. Colombo, Delmastro and Grilli (2004) studied a sample of 391 young Italian firms operating in high-tech industries in both manufacturing and services. Their findings confirm that the human capital of founders plays an important role in explaining the start-up size. Furthermore, the specific component of human capital associated with industry-specific professional knowledge and managerial and entrepreneurial experiences is found to have a greater positive impact on the initial firm size than the generic component, proxied by education and general (i.e., non-industry-specific) working experience. They suggest that the effect of human capital on start-up size is twofold. “On the one hand, founders with greater entrepreneurial talent and greater confidence in the prospects of the new venture start operations at greater scale, all being equal. On the other hand, more educated, better qualified, and probably wealthier individuals suffer to a lesser extent from financial constraints associated with imperfections in capital markets that otherwise hinder achievement of the ‘optimal’ start-up size.” Segura, Garrigosa and Vergés (2005) also investigated the effects of entrepreneurs’ characteristics in the case of 182 Spanish start-ups. They found gender and employment status of the entrepreneur has a statistically significant impact on the start-up size: female founders start with larger firms than their male counterparts, whereas unemployed founders tend to start small.

In our analysis, we use the data from the Annual Survey of Manufacturing Industries conducted by the State Institute of Statistics in Turkey. It covers all public establishments and private establishments employing 10 or more people. Unfortunately, there is no information about pre-entry conditions and entrepreneurs’ characteristics in the database. Since we use the data for a specific industry, the variation in industry variables is limited. Therefore, we use the data at the geographical (province) level to model the determinants of start-up size in the Turkish textile industry.

There are currently 81 provinces in Turkey. However, in almost half of these provinces, no new textile firm was established in the period 1993-2000. Figures in the appendix show the regional distribution of textile firms, entrants and exits. All provinces are grouped into five categories in terms of their share in the average number of firms operating, entering and exiting in the period 1993-2000. Textile firms are concentrated in a few regions. It is possible to identify three clusters, around i) Istanbul (Istanbul, Bursa and Tekirdag), ii) Izmir (Izmir, Denizli, Manisa and Usak), and iii) Adana (Adana and Gaziantep). About 75 percent of textile firms are located in only four provinces (Istanbul, Izmir, Bursa and Denizli). Three main non-metropolitan textile provinces, Denizli, Bursa and Gaziantep, have higher entry intensity, i.e., these regions have attracted more textile firms in the 1990s whereas the metropolitan provinces, Istanbul and Izmir, account for the highest share of existing textile firms in Turkey, but have negative net entry rates. These regions are losing ground in textile production. The geographical differences in entry and exit conditions are exploited in our model on the determinants of the start-up size.

We use variables related to market risk, ownership type, wealth of the region, government's policies, size of the regional industry, local conditions and macroeconomic conditions to explain the start-up size.

The only firm-level variable we could use in the model is related to the type of ownership at the time of entry. The FDUM variable takes the value one if the firm was foreign-owned[9], and zero otherwise. Foreign (multinational) firms are likely to have more resources, and therefore, they are expected to have larger start-up size (Nurmi, 2004).

The level of market risk is one of the main determinants of the start-up size. We use a proxy variable for market risk: the proportion of employees in failed firms (exits) in total number of employees in the same province and in the same industry (RPFAIL).[10] The lagged value of this variable is used in the model to avoid any contemporaneous correlation with the error term. If entrepreneurs tend to establish large firms in risky sub-markets, after controlling for all other variables, we expect a positive coefficient for this variable.[11]

There are two variables related to the wealth of the region. The first one, DEPOSIT, is equal to the total value of bank deposits in the province, whereas the LOAN variable measures the value of loans provided by banks in the province.[12] The DEPOSIT variable can be used as a proxy for the wealth accumulated in the province. Thus, we expect a positive impact of the deposit variable on the start-up size, after controlling for other factors such as the size of the province, because wealthy entrepreneurs are less likely to be capital constrained. The LOAN variable, after controlling for the wealth effect, may indicate the availability of external funds for entrepreneurs. The availability of external funds may ease the entry barriers for small entrepreneurs, and thus facilitate the creation of small start-ups.[13]

[9] The firm is defined as "foreign" if at least 10 percent of its shares are owned by foreign agents.
[10] Industry is defined at the ISIC (Rev. 2) 4-digit level. There are 12 4-digit industries in the textile sector (ISIC 32).
[11] Mata and Machado (1996) and Görg, Strobl and Ruane (2000) used a similar variable (the product of employment shares in firms that enter or exit industry), and found a positive impact of this variable on start-up size. However, they suggest that this variable which is used as proxy for market turbulence provides an indirect measure of sunk costs. Assuming that entrants are risk averse, they expect the lower are sunk costs, the higher will be the start-up size of new entrants.
[12] All nominal variables are deflated by the GDP deflator index. All level variables are used in log form.
[13] Cetorelli and Strahan (2005) show that "… banking competition in local U.S. markets has been associated with a greater number of establishments, a smaller average establishment size and a greater share of small establishments across the whole size distribution. … banks with market power erect an important financial barrier to entry to the detriment of the entrepreneurial sector of the economy, probably to protect the

The effects of government's policies on start-up size are tested by using two variables: PINVEST is equal to the value of public investment in the province whereas INCENTIVE is the value of private investments that would benefit from the investment incentives scheme. Although the effects of these variables are not obvious, they may increase the demand for domestic production, and hence, encourage large-scale entry.

The number of firms and the number of employees in the same industry and province (RN and REGLL, respectively) are used to control for the size of the regional industry. If more firms are located in a certain region because of urbanization and localization externalities, then the RN and REGLL variables may capture the effects of these externalities, and have a positive impact on the start-up size. The growth rate of regional/industrial output, REGGR, is used in a similar way to capture the dynamic effects of clustering and localization.

There are three variables used to test the characteristics of local conditions on start-up size. The average wage rate in the same industry/province, RW, is used to test the effects of skill requirements on start-up size, because higher wages are paid for skilled employees. If skilled labor is used in capital intensive processes with high start-up investment, the wage rate may have a positive impact on start-up size. The subcontracting relations are known to be important in the textile industry (see Taymaz and Kılıçaslan, 2005). Therefore, we use two variables, the share of subcontracted output in total industry/province output (SOUTPUT) and the share of subcontracting input in total inputs used by the industry/province (RSINPUT) to measure the effects of subcontracting relations. Since subcontracting is used to reduce sunk costs and risks of investment, the existence of a strong regional network of subcontracting could facilitate the creation of large firms, i.e., the subcontracting variables can have a positive impact on start-up size.

Finally, there are time dummies that are used to capture the effects of macroeconomic conditions on the start-up size.

To sum up, the model for start-up size can be defined as follows:

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profitability of their existing borrowers." Unfortunately we do not have the data on the regional structure of the financial sector in our database that would enable us to test this effect.

$$[9] \quad \text{ENTRYL}_{irs\tau} = \alpha_0 + \alpha_1\text{RPFAIL}_{rs\tau\text{-}1} + \alpha_2\text{FDUM}_{irs\tau} + \alpha_3\text{DEPOSIT}_{rs\tau} + \alpha_4\text{LOAN}_{rs\tau} + \alpha_5\text{PINVEST}_{rs\tau} + \alpha_6\text{INCENTIVE}_{rs\tau} + \alpha_7\text{RN}_{rs\tau} + \alpha_8\text{REGLL}_{rs\tau} + \alpha_9\text{REGGR}_{rs\tau} + \alpha_{10}\text{RW}_{rs\tau} + \alpha_{11}\text{RSOUTPUT}_{rs\tau} + \alpha_{12}\text{RSINPUT}_{rs\tau} + T_\tau + \varepsilon_{irs\tau}$$

where subscripts ***i***, ***r***, ***s*** and τ denote firm, region (province), industry (at the ISIC 4-digit level), and entry time, respectively. T_τ's are time dummies, and ε the error term. $\text{ENTRYL}_{irs\tau}$ is the start-up size (measured by (log) number of employees) of firm ***i*** that is established in industry ***s*** in province ***r*** at time τ.

The entry size (ENTRYL) is the main variable under investigation in the survival model. The empirical studies mentioned in the first section suggest that large start-ups have higher survival probability. We also interact the entry size with firm age (ENTRYL*AGE) to check if the effect of entry size is persistent. Moreover, the AGE variable is included in the model to control for the age dependence of survival.

The survival model includes a number of control variables. First, the growth rate of the firm in the last year, LGR, is used to control for the effects of demand conditions. The LGR variable is measured as the logarithmic growth rate of employment from time ***t-1*** to ***t***. Firms in sub-markets with rapidly growing demand are expected to have higher survival probability. Since one may expect that foreign firms may have higher survival probability than domestic firms thanks to their prior experience and superior technologies, the survival models includes foreign ownership dummy, FDUM. The share of the number of hours worked in the second and third shifts in total number of hours worked (SHIFT23) is a proxy for demand conditions and process characteristics. Those firms that are faced with a substantial order will tend to operate more intensively in the second and third shifts. Thus, we expect that these firms will have higher survival probability because they are less likely to be constrained by the lack of demand. Average wages paid by the firm relative to other firms in the same province/industry (RELW) is a proxy for the quality of labor employed by the firm. If those firms that employ skilled labor are more likely to survive, then the RELW variable will have a positive impact on survival probability. The model also includes the relative productivity (firm's labor productivity[14] relative to the average of firms operating in the same province/industry). More productive firms are expected to live longer. Finally,

[14] Labor productivity is defined as real value added per employees.

the survival model includes a province/industry level variable, the entry rate (ENTRATE, the proportion of entrants in total number of firms). If the "revolving-door" hypothesis is correct, the exit probability will be higher when more firms enter into a given regional market. Thus, the survival model (or, to be more specific, the exit/hazard model) is defined as follows:

$$[10] \quad \text{EXIT}_{irst} = \beta_0 + \beta_1\text{ENTRYL}_{irs\tau} + \beta_2\text{AGE}_{irst}{*}\text{ENTRYL}_{irs\tau} + \beta_3\text{AGE}_{irst} + \beta_4\text{LGR}_{irst} + \beta_5\text{FDUM}_{irst} + \beta_6\text{SHIFT23}_{irst} + \beta_7\text{RELW}_{irst} + \beta_8\text{RELLP}_{irst} + \beta_9\text{ENTRATE}_{rst} + T_t + \varepsilon_{irst}$$

where subscripts i, r, s, t and τ denote firm, region, industry, time, and entry time, respectively. T_t's are time dummies. EXIT_{irst} is the exit status of the firm i operating in region r and sector s at time t. If the firm exits from the market at time $t+1$, then EXIT_{irst} takes the value one, otherwise it is equal to zero. $\text{ENTRYL}_{irs\tau}$ is the size of the firm at time of entry, τ.

5. Determinants of start-up size and survival: Estimation results

Some summary statistics are provided in Table 3. There are about 27000 plant-year observations in the database for the period 1993-2000 (on average, 3350 plants per year), and more than 3500 new plants were established in the same period. Since we do not observe plants established before 1993, the average entry size for the whole population is not available. For those plants established after 1992, the average start-up size is only 28 employees. Relative labor productivity and wages at the time of entry (and exit as well) are quite lower than the average (which is equal to zero by definition).

A comparison between region/sector-level variables for the whole population and new firms suggests that entry is geographically more concentrated. Although the average regional-sectoral entry rate for the whole population is 0.133, it is much higher for entrants (0.269). There seems to be no significant difference in terms of other region-sector characteristics.

Table 3. Descriptive statistics
(average values for the period 1993-2000)

Label	Description	All firms	New firms	
			Entry time	Exit time
Firm-level variable, new firms				
ENTRYL	Entry size (log employment)	n.a.	3.333	3.125
LGR	Growth rate (log)	0.030	n.a.	-0.039
RELLP	Relative labor productivity	0.000	-0.109	-0.269
RELW	Relative wage rate	0.000	-0.147	-0.138
SHIFT23	Share of 2nd and 3rd shifts in hours worked	0.125	0.088	0.054
FDUM	Dummy for foreign firms	0.014	0.009	0.006
Region/sector-level variables				
ENTRATE	Entry rate	0.133	0.269	0.151
RPFAIL	Share of employment in exits (last year)	0.067	0.080	0.076
RN	Total number of establishments (log)	6.988	6.799	7.045
RSINPUT	Subcontracted input ratio	0.075	0.073	0.079
RSOUTPUT	Subcontracted output ratio	0.171	0.191	0.181
RW	Average wage rate (log)	4.186	4.120	4.129
REGLL	Average establishment size (log)	3.851	3.799	3.765
LOAN	Bank loans (log)	11.192	11.130	11.201
DEPOSIT	Bank deposits (log)	11.741	11.616	11.721
PINVEST	Public investment (log)	8.011	8.045	8.010
INCENTIVE	Value of investment incentives (log)	10.743	10.945	10.771
n	Number of observations	26827	3563	3340

Note: Entry size for firms established before 1993 is not available.
Growth rate for entrants (for entry year) is not available by definition.

Table 4 reports estimation results for the determinants of start-up size. Column (1) includes all observations whereas columns (2) and (3) exclude regions-sectors with less than 5 observations in order to focus on industrially developed regions. All regressions include time dummies, the coefficients of which are not reported. It is found that the exclusion of small provinces does not change estimation results to a large extent.

The variables in the start-up model usually have expected effects. Foreign ownership is also one of the main determinants of start-up size: foreign firms start, on average, 90 percent larger than the domestic ones. The lagged value of the proportion of employees in failed firms (exits) in total number of employees in the same province/sector has a positive and statistically significant impact on start-up size. Everything else being equal, new firms established in high-risk markets tend to be larger.[15]

[15] The analysis in Section 2 suggests that entry into different sub-markets and start-up size decisions are conditioned by capital constraint. The DEPOSIT variable is used to capture the effects of capital constraint but it may not be a good indicator for capital constraint at the firm-level. Therefore, the results for the RPFAIL should be interpreted cautiously.

Table 4. Determinants of start-up size, 1993-2000
(dependent variable: log start-up size)

	All obs		Excluding small provinces			
	Coeff	Std Dev	Coeff	Std Dev	Coeff	Std Dev
RPFAIL	0.601	0.217 **	0.664	0.242 *	0.568	0.245 *
FDUM	0.875	0.206 **	0.898	0.199 **	0.902	0.198 **
DEPOSIT	0.203	0.072 **	0.204	0.071 **	0.205	0.072 **
LOAN	-0.246	0.100 *	-0.280	0.095 **	-0.287	0.093 **
PINVEST	0.061	0.046	0.066	0.036	0.071	0.032 *
INCENTIVE	0.068	0.054	0.080	0.048	0.077	0.047
RN	0.048	0.028 *	0.074	0.024 **	0.075	0.024 **
REGLL	0.487	0.057 **	0.556	0.058 **	0.557	0.053 **
RSOUTPUT	0.166	0.082 *	0.235	0.072 **	0.258	0.076 **
RSINPUT	0.428	0.272	0.139	0.267		
REGGR	0.101	0.045 *	0.060	0.052		
RW	0.108	0.069	0.040	0.059		
n firms	3392		3215		3215	
n provinces	41		28		28	
F-stat	61.76 **		415.34 **		340.55 **	

Robust standart errors. All models include time dummies.
** (*) statistically significant at the 1% (5%) level, two-tailed test.

Finance variables have also significant coefficients. The variable that is used as a proxy for regional wealth, DEPOSIT (the value of deposits), has a positive impact on start-up size, whereas the value of loans provided by regional branches of the banking system (LOAN) allows for entry by small entrepreneurs. These findings may indicate that capital constraints play an important role in determining the size of start-ups. Public investment and investment incentives have a positive but statistically insignificant impact on start-up size.[16]

Urbanization and localization externalities may increase expected productivity that, in turn, has a positive impact on average start-up size. Two variables, the number of firms (RN) and the number of employees (REGLL) in the same province/sector, are used to control for the urbanization and localization externalities, and they are found to have significant impact on start-up size. New firms established in industrially concentrated regions tend to be larger. Moreover, subcontracting relations, especially the extent of the provision of subcontracted output, has a positive impact on start-up size, possibly through its cost and risk-sharing effects. Regional growth and wages seem to have no impact on start-up size.

[16] The coefficient of the public investment (PINVEST) is statistically significant at the 5 percent level only in the last regression.

Table 5. Determinants of exit
(dependent variable: exit status, 1 exit, 0 survival)

	Cox proportional hazard estimates		Probit estimates			
			Exogenous entry size		Endogenous entry size	
	Coeff	Std Dev	Coeff	Std Dev	Coeff	Std Dev
ENTRYL	-0.267	0.087 **	-0.242	0.049 **	-1.239	0.664
AGE*ENTRYL	0.063	0.029 *	0.040	0.018 *	0.340	0.257
AGE			-0.186	0.062 **	-1.219	0.877
LGR	-0.654	0.086 **	-0.607	0.060 **	-0.724	0.081 **
FDUM	-0.614	0.416	-0.270	0.216	-0.155	0.232
SHIFT23	-1.056	0.221 **	-0.673	0.101 **	-0.459	0.127 **
RELW	-0.651	0.089 **	-0.318	0.051 **	-0.245	0.060 **
RELLP	-0.122	0.040 **	-0.111	0.021 **	-0.097	0.023 **
ENTRATE	0.156	0.342	0.110	0.214	0.049	0.230
n	6594		6594		6594	
n provinces	28		28		28	
Smith-Blundell test of exogeneity $\chi^2(2)$					9.80 **	

All models include time dummies. Cox proportional hazard model is stratified by ISIC 4-digit industries.
** (*) statistically significant at the 1% (5%) level, two-tailed test.

The exit model is estimated for the sample of firms that were established after 1992. Two estimation methods were used: the Cox proportional hazard model and the probit model. Column (1) of table 5 presents the estimation results for the Cox proportional hazard model. The AGE variable is not included in the model, because the Cox proportional hazard model includes a non-parametric baseline hazard for each time period (age). Column (2) reports the estimation results for the (pooled) probit model.

The results from the two models are almost the same. As may be expected, the start-up size (ENTRLY) has a negative impact on exit probability, i.e., large start-ups are more likely to survive, and the impact of start-up size on exit declines over time (positive coefficient for the AGE*ENTRYL interaction), and the impact of start-up size disappears in about 4-6 years. It is also found that survival depends on the age of the firm. Young firms have higher hazard (exit) probability. Moreover, those firms that grow faster, work longer, pay higher wages and achieve higher productivity are more likely to survive. Interestingly, foreign ownership does not have a direct impact on survival probability. Entry rate has also statistically insignificant coefficient: the "revolving-door" hypothesis is not accepted by the data on the Turkish textile industry.

The probit model is re-estimated by using instrumental variables for the start-up size variable (column 3 of Table 5).[17] Since the Smith-Blundell test of exogeneity rejects

[17] The instruments are those variables used in the start-up size model in Table 4.

strongly the exogeneity of start-up size, the instrumental variable model is used to have consistent estimates. [18] It turns out now that neither the start-up size nor the age of the firm has any impact on survival. The impact found in the previous models could arise due to the endogeneity bias. In other words, we observe a positive correlation between the start-up size and survival probability, but these two variables are determined by a common set of parameters. After controlling for endogeneity, the start-up size itself does not have statistically significant impact (at the 5 percent level) on survival.

Before concluding the paper, two issues that need further analysis should be mentioned. First, the results of the Smith-Blundell test depend on the set of instruments. We have used a set of variables that are highly correlated with the endogenous variable (see Table 4) and are exogenous in the survival model because all but one of them are defined at the region/sector-level. However, it would be better to include instruments on *ex ante* characteristics of start-ups/entrepreneurs as well to control for the effects of, for example, capital constraint. Because of the lack of data, we could not use firm- and entrepreneur-level instruments. Second, the start-up size variable has a statistically significant coefficient at the 0.7 percent level when it is treated as exogenous, but its level of significance rises to 6.2 percent when it is treated as endogenous as suggested by the Smith-Blundell test.[19] Since the number of observations is quite high, we tend to use lower levels of significance, and conclude that its impact is statistically insignificant. However, its coefficient, as the coefficients of AGE*ENTRYL and AGE variables, are much higher (in absolute values). Therefore, the result is sensitive to the significance threshold chosen by the researcher.

6. Conclusions

The main motivation for this study is the fact that entrepreneurs, as the economists do, know that creating a new business is a risky activity that is very likely to end up in failure. They take into account the risks, and enter into certain markets where they could earn profits. They determine their entry size depending on the resources they have and the risks

[18] For the Smith-Blundell, the residuals from the regressions of suspected endogenous variables on a set of instruments are added into the main model. Under the null hypothesis of exogeneity, these residuals should have no explanatory power.
[19] Dropping the AGE*ENTRYL interaction does not change the results qualitatively.

in these markets. Those who start small are more likely to fail, not because they are small, but because these markets are likely to be more profitable for small-scale entry.

Our empirical analysis shows that treating the start-up size as endogenous or exogenous may make a big difference for estimation results of survival models. The findings of this study provide a weak support for the hypothesis that start-up size in endogenous in the survival model. Thus, further research examining different sectors and countries is called for because the analysis presented here have important implications for the entrepreneurship policy. If small firms have higher exit probabilities because of the factors not related to their (start-up) size, then policies that help small firms to survive longer will not be effective. They can even distort entry choices. However, as this study implies, if entrepreneurs start small because of capital constraints, then the policy should aim at easing these constraints so that entrepreneurs would be able to establish larger firms. Governments should pay more attention to *ex ante* conditions surrounding entrepreneurs. It could be too late to intervene after the establishment of a firm.

Before concluding the paper, we should mention a few caveats. First, this study is restricted to a certain sector (the textile industry) in Turkey. There are a number of studies that document that economies of scale are either weak or do not exist at all in textile production (see, for example, Parmar and Singh, 2003; Diewert and Fox, 2004; Taymaz, 2005). However, in those sectors in which economies of scale are significant, the start-up size may have a positive impact on survival probability even if the endogeneity bias is taken into account. Therefore, policy implications may differ for those sectors. Second, there could be country-specific factors (entry and bankruptcy regulations, etc.) that affect the creation of new firms, and, hence, the links between start-up size and survival. Finally, the major shortcoming of our data was the lack of information on entrepreneurs who established new firms. The start-up model and the instruments used in the survival model for start-up size should include variables on *ex ante* characteristics of entrepreneurs (experience, human capital, wealth, etc.) so that the conditions that determine the start-up process could be rigorously analyzed.

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Appendix. The distribution of textile firms, entrants and exits in Turkey, 1993-2000

Figure A1. Regional distribution of textile firms

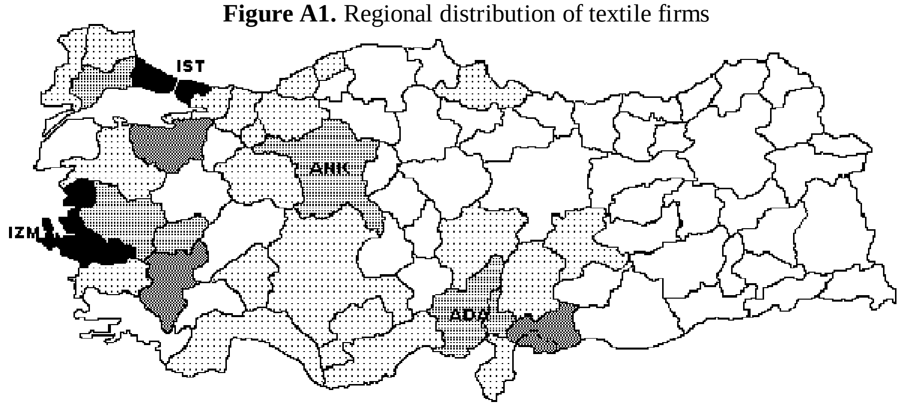


Figure A2. Regional distribution of entrants

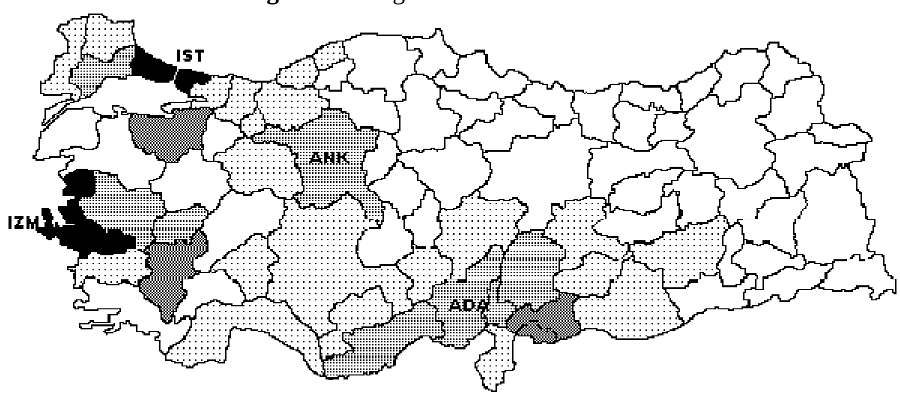
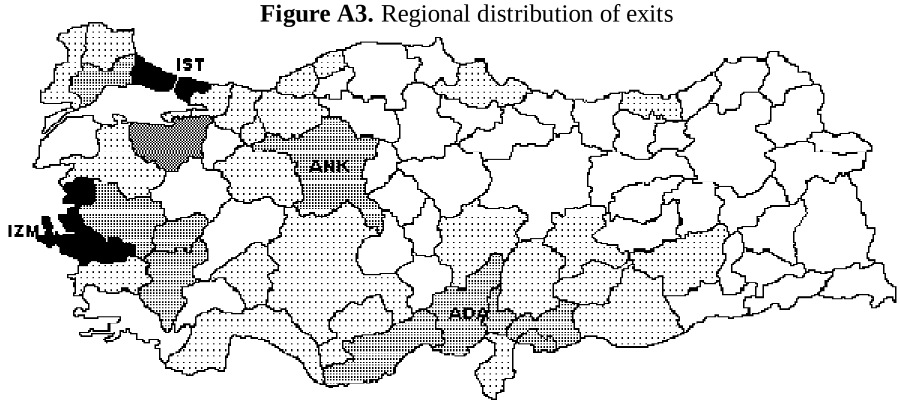


Figure A3. Regional distribution of exits



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