Strategic Management Journal
Strat. Mgmt. J., **31**: 510–529 (2010)
Published online EarlyView in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/smj.823
Received 18 March 2008; Final revision received 26 October 2009

FOUNDING CONDITIONS AND THE SURVIVAL OF NEW FIRMS

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We analyze the effects of founding conditions on the survival of new firms. Based on arguments from several theoretical perspectives, namely economics, organizational ecology, and the resource-based view of the firm, we develop hypotheses that relate the survival of firms to the conditions confronted by firms at each moment and to those prevailing at the time of founding. We develop an empirical model that allows the effects of founding conditions to be transitory and estimate how long such effects last. The results of estimating such a model indicate that founding effects are important determinants of exit rates. Moreover, in most cases, their effect on survival seems to persist with little attenuation for several years following the founding of the firm. Overall, our findings suggest that there is no absolute superiority of any of the aforementioned theoretical perspectives over the others, and there are important elements in all of them to explain the survival of firms.

INTRODUCTION

The notion that the conditions in which a firm is born may have a substantial effect on its performance is one that has received attention from different perspectives. While studies inspired mainly in the organizational ecology literature emphasize the impact that environmental conditions at the time of founding may exert upon the survival of firms (Romanelli, 1989; Hannan, 1998; Ranger-Moore, 1997; Mitchell, 1994; Henderson, 1999), other studies have focused on the impact that those strategic choices at the time of founding may have upon the performance of firms. Eisenhardt and Schoonhoven (1990) showed that founding teams exert permanent effects upon the performance of firms, Cooper, Gimeno-Gascon, and Woo (1994) found that the initial stocks of financial and human capital were good predictors of firm performance, including survival, while Kimberly (1979) concluded that environmental conditions, the founder's personality, and the initial strategic choices exert an enduring effect on the behavior of organizations.

However, in many cases, founding and subsequent conditions can be similar. By definition, structural conditions do not change rapidly, and a tendency for organizations to stick with their strategies may hinder their rapid change (Miller and Chen 1994; Kraatz and Zajac, 2001). Failing to account for the effect of current conditions may lead one to draw the misleading conclusion that founding conditions are responsible for the observed variation in performance.

In this paper we develop a model that enables us to test the importance of both founding and subsequent conditions upon the survival of firms. Our hypotheses are based mainly on an economic view, but they also incorporate insights

Keywords: survival; new firms; founding conditions; entrepreneurship
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from organizational ecology and the resource-based view of the firm. Furthermore, while the literature has developed the hypothesis that founding conditions matter, to our knowledge there is no study that has analyzed how long the effect of these founding conditions upon survival may persist. Our analysis specifically allows for the effect of founding conditions to gradually vanish over time, and we are able to provide estimates of the degree to which the effect persists. Our results suggest that firm strategies, market conditions, and macroeconomic conditions are all important determinants of survival. We further find that, in general, observed founding values of these variables matter more than current values and, in most cases, the magnitude of the impact of founding effects on survival does not diminish rapidly over the first five to 10 years of a new firm's life. Our results do not allow us to claim absolute superiority of one of the aforementioned theoretical perspectives over the others. They suggest, instead, that an eclectic approach, combining elements from the different views, may be important to fully explain the survival of firms.

Our study has implications for managers and policy makers alike. For managers our results mean that a great deal of care should be taken in preparing the founding of a firm. The choices made at inception have long-lasting effects and may not be easy to undo. For policy makers, the results are important because they suggest that the kind of support needed by struggling young firms would have to be tailored, cohort by cohort, to the circumstances of their birth.

The paper proceeds as follows. In the next section, we outline the basic issues that we will be concerned with and develop our basic hypotheses about which effects should matter for survival. This is followed by a discussion of the data that are the basis of our empirical analysis, and by a presentation of the empirical model that is used to analyze the data. The results of such analysis are then presented and the implications of the results for the different theoretical perspectives are discussed. The last section of the paper offers concluding remarks.

THE ISSUES

In this section we will develop the specific hypotheses to be tested in this study. The general hypothesis underlying the study is that even after controlling for current conditions, founding conditions may have a long-lived impact upon survival. Our analytic foundation will be based on economic arguments and these arguments will be presented first. This view will then be supplemented by arguments from the organizational ecology perspective on the effects of the environment and from the resource based-view on the firm-specific determinants of survival. By the end of the section we will have presented, for each factor affecting survival, the rationale for expecting the survival of firms to be related to current and founding conditions.

Before going into the specific hypotheses to be developed, however, let us clarify that when we say that founding conditions may have a long-lived impact upon survival, we mean that the effect persists for a number of years; not necessarily forever. The estimation of the longevity of each specific effect is an empirical issue, and will be left to the section in which our estimation strategy is discussed.

An economic view of entry and survival

Firm size

One of the most robust empirical findings of the literature of firm survival is that large firms experience higher survival probabilities than their smaller counterparts (Dunne, Roberts, and Samuelson, 1989; Audretsch and Mahmood, 1994; Mata and Portugal, 1994; Mitchell, 1994; Haveman, 1995; Sharma and Kesner, 1996). Economists offer several reasons why this may be so.

One such reason is that larger firms are more likely to be closer to the minimum efficient scale needed to operate efficiently in a market, and are therefore less likely to be vulnerable than smaller firms that operate further up the cost curve (Audretsch and Mahmood, 1994). Large firms may be larger than some small firms, not because the two necessarily want to operate at different scales, but because their access to funds are different (Fazzari, Hubbard, and Petersen, 1988). Those that experience the greatest cash constraints will, thus, be forced to operate at a smaller scale. Even if this does not push smaller firms into a cost disadvantage via economies of scale, it will put them in a tougher position to survive unexpected, temporary difficulties than competitors with better access to funds (Zingales, 1998). By the same token,

DOI: 10.1002/smj

large firms are also typically more diversified than smaller firms, and this may improve their survival prospects by reducing risk and keeping alive options in one market should activities go sour in another. Finally, larger firms may be more efficient, not because they operate at a different point on the cost curve, but because they may have different managerial capabilities. Better capabilities translate into lower costs at any given size, and these lower costs lead firms to choose to operate at a large scale (Lucas, 1978). The observed size of firms is thus a consequence of their superior ability. All of these reasons suggest that current size is likely to be related to the survival of firms, and we therefore predict that:

Hypothesis 1: Larger firms have lower probabilities of exit.

In the standard economic model of the evolution of firms and industries (Jovanovic, 1982), current firm size is the only information that matters for predicting survival. In this model, firms start with no prior knowledge about their efficiency. As time goes by and firms observe their performance in the marketplace, they gradually learn about their efficiency. Those firms that are observed to be successful grow, while those less lucky contract. Current size at any given moment incorporates all of the firms' histories and nothing further is required to predict survival. The critical feature that makes initial decisions irrelevant in Jovanovic's (1982) model is that all adjustments are instantaneous. Expectations about efficiency are identical at start-up and, therefore, all firms start with identical sizes. Expectations are then fully adjusted at every round and the subsequent capacity and production decisions are also fully updated in conformity with these expectations. While these assumptions of the model allow focusing on what is central in the analysis, they are unlikely to hold true in reality.

At inception, firms have different beliefs about their ability to compete, and these beliefs underlie their choice of entry size. Frank (1988) argues that firms that enter at larger scales are those that have more optimistic *ex ante* expectations of success. Consequently, they are apt to endure poor performance for a longer time. Larger firms will also be able to suffer losses for longer periods than smaller ones, if their initial sizes were determined by the relative severity of cash constraints. Furthermore, while the liquidity constraints argument was initially established with relation to mature firms (Fazzari *et al.*, 1988), the impact of cash constraints should be greatest during the earliest ages of firms, when information asymmetries are more severe and firms were still unable to develop a reputation (Diamond, 1989). The effect of initial decisions may also persist because strategic decisions frequently involve the deployment of resources that cannot be reallocated later, that is, those that are sunk. When investment costs are sunk, there may be little point in reversing a decision, as costs cannot be recovered. Therefore, even if it proves to be clear that a given decision was not a wise one, *ex post* the firm's best option may nevertheless be to stick with it (Dixit and Pindyck, 1994). Finally, even if a firm finds it better to adjust, it may be optimal to do it gradually. This may be because when sunk costs are involved, it may be better to wait until the uncertainty is resolved (Cabral, 1995), or because the required resources may not be available to the firm in sufficient amounts, a point that was emphasized by Penrose (1959). Writing in the context of the growth of firms, Penrose argued that lack of managerial resources would put limits on the ability of firms to expand and that once firms are in a given position, it may be difficult to change this position rapidly. Indeed, firms are observed to converge gradually to their desired size (Bogner, Thomas, and McGee, 1996).

Even if initial firm size is not at all important once all the adjustments are complete, the fact that firms adjust gradually toward their desired size makes it relevant to know their departing point as well as their current position. If there are adjustment costs in the process of firm growth, the current size of growing firms will be an underestimate of the firm's desired size. Thus, the fact that a firm has grown in the past signals that it has been performing well and that it would wish to be larger than it currently is. Consequently, it should have lower exit probabilities than its current size alone indicates (Mata, Portugal, and Guimarães, 1995). Therefore we predict that:

Hypothesis 2: Firms that had larger initial size have lower persistent probabilities of exit.

The macroeconomic environment

The environment in which entry occurs affects the likelihood of survival in more than one way.

DOI: 10.1002/smj

The overall state of the economy is one condition that has long been indicated by economists as an important force driving firms out of business. When times are tough, established firms may face difficulties and the competitive pressure from new firms may lead them to exit. The first reason why current macroeconomic conditions may matter is because current conditions change expectations about the future. If the state of affairs in a market today is taken as an indication of a future adverse state of affairs, firms may decide to exit in response to an unfavorable change in current conditions. Unfavorable current macroeconomic conditions may also lead firms to exit if they suffer from cash constraints and cannot secure the funds required for survival, even though they would wish to remain active despite these adverse conditions.

Recent research, however, indicates that this effect may be less important than has been previously believed. Heterogeneity among firms may insulate established firms from the replacement threat posed by new firms (Bertin, Bresnahan, and Raff, 1996). Recessions also affect the rate of new firm creation. By reducing the rate of new firm creation, recessions alleviate the pressure exerted upon established units (Caballero and Hammour, 1994). In fact, studies focusing on the relationship between entry and macroeconomic conditions (Highfield and Smiley, 1987; Mata, 1996) found a stronger correlation than those focusing on exit and survival (Boeri and Bellmann, 1995; Ilmakunnas and Topi, 1999). The results of these recent studies thus suggest that it is precisely the newest firms that are more likely to suffer in recessions. New firms are more likely to suffer from cash constraints than established ones (Cabral and Mata, 2003), as they have not had the time to develop legitimacy in financial markets (Diamond, 1989). As cash is typically scarcer during recessions than in times of prosperity, recessions are particularly likely to affect the newest firms. All of these reasons lead us to hypothesize that:

Hypothesis 3: Unfavorable current macroeconomic conditions decrease the probability of survival.

The studies mentioned above focused on the effect of current business conditions upon entry and exit. Macroeconomic conditions prevailing at the time of entry may also affect survival. Highfield and Smiley (1987) showed that periods of high firm creation follow periods of relatively depressed conditions. Individuals who are unemployed are known to be more likely to create new firms than those who have jobs (Evans and Leighton, 1989), but firms created by unemployed also face a higher probability of failure (Pfeiffer and Reize, 2000). This suggests that it may be relevant to account for the macroeconomic conditions at the time of entry. If the decisions made when firms are created persist to a certain extent, firms being created during downturns may end up with inferior resources that will have a long-lasting effect upon their chances of survival.

Hypothesis 4: Unfavorable macroeconomic conditions at founding persistently decrease the probability of survival.

The competitive environment: market concentration and entry

Economists also see firms' survival as being related to the structure of the specific markets in which entry tales place. The standard microeconomic textbook argument is that competitive markets exert a strong disciplinary effect and drive inefficient firms out of the market. Markets in which there is market power are the only ones in which inefficiencies may arise, and where firms operating in suboptimal positions may survive. This leads us to hypothesize that:

Hypothesis 5: Current industry concentration facilitates survival.

The available evidence relating the survival of firms to industry concentration seems, however, rather inconclusive. Audretsch and Mahmood (1994) reported a negative and statistically significant effect of market concentration on the survival of new firms, but Romanelli (1989), Mata and Portugal (1994) and Huyghebaert and Van de Gucht (2004) found that conventional concentration measures have an insignificant impact upon survival.

The actual effect of concentration upon survival is likely to be more complex than described above, as recognized by the industrial organization literature. On the one hand, this literature argues that market concentration facilitates collusion, thus creating room for excess profits and making it easier to survive. On the other hand, in highly concentrated markets incumbents have higher profits

DOI: 10.1002/smj

to defend and coordination among them is easier. Incumbents may, as a result, be more likely to retaliate against entrants (Bunch and Smiley, 1992). However, for reaping the benefits of being in a highly concentrated market, established firms may not maintain an aggressive behavior in a permanent fashion. Entrants that manage to survive their earliest days in the market may be accepted into the club of incumbents and become protected by the umbrella effect of concentration.

To the extent that the collusive argument holds, entry and survival during the first years should be particularly difficult in highly concentrated industries. The argument implies that this effect should not be long-lived, as concentration protects established firms. As soon as entrants become part of the established set of firms, the protective umbrella of concentration should dominate and protect them. This leads us to the prediction that:

Hypothesis 6: Concentration at founding decreases the probability of survival during the first years only.

Another element of the competitive structure of a market emphasized by economists is the extent of entry in that market. Industrial organization economics arguments emphasize that entry barriers are exit barriers, and that the magnitude and irreversibility associated with investments, which deter entry, also hinder exit (Eaton and Lipsey, 1980). Evolutionary economists, on the other hand, argue that there are distinct stages in the industry evolution, and that each stage exhibits different entry and exit rates. In the entrepreneurial regime (Winter, 1994), the kind of knowledge needed to fuel innovation lies outside the industry and new firms need to be created in order for innovations to be possible. At the same time, no standards exist in the industry, and firms compete by experimenting with new ideas. Many of these ideas are unsuccessful, and those firms that promoted them are forced to exit. With the emergence of dominant designs (Suárez and Utterback, 1995), industries enter the routinized regime in which innovations are more of an incremental type and come from established firms. Fewer firms enter, but fewer exit as well (Gort and Klepper, 1982).

Overall, there is plenty of evidence that industries where entry is easy are also those where exit is more likely. Dunne, Roberts, and Samuelson (1988) found that there is a very strong positive correlation between the flows of entry and exit across markets, and many studies (surveyed in Siegfried and Evans, 1994) have reported similar findings for the determinants of entry and exit. Mata and Portugal (1994) observed that this is due, in large part, to the early exit of entrants in industries characterized by high entry flows, a finding that was confirmed by Huyghebaert and Van de Gucht (2004). High entry rates increase competition, which makes survival more difficult. Therefore, we hypothesize:

Hypothesis 7: Current entry rates decrease the probability of survival.

The effect of the competitive environment as viewed by organizational ecology

Much of what was just said about the environment may be reinterpreted in the light of organizational ecology models. In this formulation, population density (the count of the number of firms in the market) is the most important determinant of how favorable market conditions are for new entrants. At low levels of density, an increase in the number of firms operating in a market translates into increased legitimacy and favor survival while, after a certain threshold, further increases in the number of firms lead to increased competition which leads to increased mortality (see, e.g., Hannan and Carrol, 1992).

While changes in competition in one period should affect all organizations in essentially the same way according to the original density argument, this was further extended to suggest that density at the time of founding could have imprinting effects upon organizations (Stinchcombe, 1965), and thus have delayed effects upon their survivability (Carroll and Hannan, 1989). There are two reasons for this effect. The first is that firms founded under such conditions may suffer from a '*liability of scarcity.*' Organizations created in unfavorable circumstances are unlikely to be anywhere near their optimal structural configuration and, in addition, may not be able to find the right kind of resources, make the correct organization-specific investments, or design the right kinds of routines. The second argument, '*tight niche packing,*' suggests that new firms founded in crowded market conditions can get pushed into unpromising niches, which may be transitory or may just

DOI: 10.1002/smj

lead them to develop knowledge and routines that are so specialized they will never be able to subsequently reposition themselves into more favorable parts of the market.

The notion of 'crowding,' which lies at the core of the arguments, suggests that it is population density relative to market size that matters most, and this introduces a broader range of factors that might be important determinants of how favorable environmental conditions are for a particular cohort of firms (see Nunez-Nickel and Fuentes, 2004, for a survey of studies that analyze the demise of organizations within the organizational ecology tradition and discuss the different variables that have been suggested as complements to the initial density). As we work with several industries with quite different structures rather than with the evolution of a single industry over time, the use of industry concentration as a proxy for the degree of competition in the market is particularly appropriate.

An extension of the ecological argument relative to the competitive effect of the environment was advanced by Swaminathan (1996), who argued that unfavorable founding conditions may lead to a quick and immediate shake-out of 'unfit' firms, leaving those that survive their first year (or so) with a high average fitness level. A cohort that has experienced such a *'trial by fire'* is likely to have lower failure rates, meaning that adverse founding conditions and immediate selection may be followed by lower (not higher) exit probabilities for firms in that cohort. This view contrasts with the prediction from economics and leads us to expect that:

Hypothesis 8: Industry concentration at founding increases the probability of survival during the first years only.

Organizational ecology arguments agree with those of economics, that markets with high entry rates are those in which the highest exit rates are to be expected. The organizational ecology argument is that large entry flows increase density in the market, and one should therefore expect high exit rates as a consequence. However, organizational ecology also offers arguments to support a permanent effect of founding entry rates upon survival. Indeed, both the tight niche packing and the resource scarcity are likely to be particularly relevant when entry rates are high, as entrants are more likely than established firms to be direct competitors to other entrants. Therefore, we hypothesize:

Hypothesis 9: Entry rates at founding persistently decrease the probability of survival.

Firm resources as a determinant of survival

If market processes select the most able organizations, those firms that possess valuable knowledge or skills should be in a better position to survive than those lacking such assets. In particular, if firms' current sizes cannot be taken as a complete summary of the entire firms' histories, then an explicit account of these resources is warranted. The resource-based view of the firm has long stressed that the ability of firms to survive and compete successfully is largely determined by the extent to which firms develop firm-specific assets that cannot be imitated by competitors and that provide the basis for their competitive advantage (Wernerfelt, 1984; Barney, 1991). Also, recent studies on entry, post-entry penetration, and survival show that the ability to develop and exploit such assets is crucial for the post-entry performance of firms (Burgelman, 1994; Bogner, *et al.*, 1996; Chang, 1996). A number of authors have pointed out that human capital, rather than physical capital, provides the basis for sustained competitive advantage (Youndt *et al.*, 1996), as 'physical technology, whether it takes the form of machine tools or robots in factories...or complex information management systems..., is by *itself* imitable' (Barney, 1991: 110, italics in original). Indeed, assets that constitute the basis for superior performance cannot be imitable or tradable, and knowledge assets are one of the few classes of assets that are not tradable (Teece, 1998). Besides this direct effect of human capital upon productivity, and thus survival, a high stock of human capital in the firm may also be a consequence of some other intrinsic firm ability, as high-quality firms find it easier to attract highly skilled employees. Earlier studies have found human capital to be a good predictor of survival (Mata and Portugal, 2002; Cooper *et al.*, 1994; Gimeno *et al.*, 1997).

Hypothesis 10: Firms employing more skilled labor have lower probabilities of exit.

What makes human capital difficult to imitate or trade is that the knowledge it embodies is, for the

DOI: 10.1002/smj

most part, tacit. Tacit knowledge is more difficult to transfer than explicit knowledge, and the higher the qualifications of labor the greater the complexity and tacitness of the knowledge it embodies (Simonin, 2004). McEvily and Chakravarthy (2002) found that the more complex and tacit knowledge is, the greater is the protection that it offers from imitation of the firm's major product improvements by their competitors.

Tacit knowledge, on the other hand, is best transferred through rich communication rather than through more explicit media (Nadler, Thompson, and Van Boven, 2003) and in contexts in which there exist strong ties between members of the groups (Uzzi, 1997), because strong ties are more likely to be governed by the norms of reciprocity (Argote, McEvily, and Reagans, 2003). The transfer of knowledge is, therefore, likely to be hindered in a context in which there is rapid labor turnover, as reported by Hatch and Dyer (2004). They found that firms with high labor turnover significantly underperform their competitors, thus suggesting that it takes time before the accumulated knowledge can be transferred between the firm and the new hires. Burton and Beckman (2007) found that when the first holder of a new functional position in a firm has an atypical working experience, the subsequent holders of these positions experience shorter tenures than would otherwise be expected. They interpreted this finding as evidence of imprinting at the job level, which corroborates the argument that it may be difficult to transfer knowledge within the firm if high labor turnover is observed. All the problems associated with the difficulty of transfer of knowledge are likely to be aggravated if the qualitative composition of labor changes from start-up to the development stages, and if labor becomes significantly more or less skilled.

Another problem with changing the labor skill composition, or with changes in another highly tacit asset, is that the observed changes may overstate the true change that goes on deeply in the firm. Knowledge in an organization is embedded in its individual members, but also in the organization rules, routines, cultures, structures, and technologies (Argote *et al.*, 2003), some of which may not change as fast as new members enter and old members exit the firm. Improvement of labor skills may thus not be accompanied by contemporaneous changes at all levels that determine the actual performance, and those rules, routines, cultures, structures, and technologies that were created as a consequence of initial human resources decisions may last even if these decisions are changed.

Studies analyzing the impact of initial conditions on subsequent performance have focused mainly on founders (Eisenhardt and Schoonhoven, 1990; Cooper *et al.*, 1994; Kimberly, 1979; Nelson, 2003) and detected a persistent influence of founders' characteristics, namely their human capital. The evolution of these characteristics was not accounted for, possibly because in most cases the characteristics that were analyzed are not amenable to change. Our sample allows us to analyze the impact of the whole stock of human capital in the firm, and we hypothesize that:

> *Hypothesis 11: Firms that employed more skilled labor at founding have persistent lower probabilities of exit.*

THE DATA

The data used in this paper were obtained from an administrative source that has been complied by the Portuguese Ministry of Employment since 1982. The data have two characteristics that make them particularly suitable for the analysis of firm entry and survival. First, all firms employing paid labor are legally required to register, regardless of industry, size, or legal form. The source does not cover the self-employed who do not employ any other persons, but aside than these, it provides a comprehensive overview of the economy. Second, they have a longitudinal dimension. All firms are required to report every year and are identified by a unique number, which allows individual firms to be followed over time. We worked with the original raw data files from 1982 to 1995, which include over 100,000 firms in each year.

As we worked directly with raw files, we were able to compute entry and survival measures ourselves. This could be done easily because firms are identified by numbers, which are assigned sequentially when firms first report to the survey. New firms were identified by comparing firms' identifiers with the highest identification number in the file in the previous year. To avoid the inclusion of false entries, we use information on the admission dates of the workers to exclude firms whose worker with the longest tenure exceeded two years. This enabled us to track 118,070 new firm start-ups

DOI: 10.1002/smj

during the period 1983–1993. These starting and ending dates were chosen on the basis of the available data. We started in 1983 because our data begin in 1982 and we need to know the largest number in the previous year file. We stopped in 1993 because, as we are interested in measuring lifetime survival, we need to have data on a later date (but see below).

The time of exit is found by identifying the moment when firms cease to report. With such a large database, there are inevitably some coding errors in the files. To be on the safe side in identifying exit with such a database, we performed some data editing upon the original data file. In particular, we required that a firm be absent from the file for at least two years in order to be classified as a closure. A temporary exit may occur for a number of reasons other than cessation of activity, a very likely reason being that the data were not received in the Ministry of Employment before the date when the recording operations were closed. Accordingly, we edited the status of firms that were temporarily absent from the files for one year. That is, firms that were in the files in years $t-1$ and $t+1$ were considered to be active in year t even if they were not actually in the file. The firm's record was amended for that year, employment being imputed as the average of employment in years $t-1$ and $t+1$. Therefore, for a closure to be recorded in $t-1$, a firm has to be absent from the file in t and $t+1$. For this reason, in our subsequent analysis we use data only until 1993, although our data files go until 1995. Data from 1995 are used only to check the presence of the firm in 1994, and the last year for which we can identify an exit is 1993.

Exit in this study is defined as firm closure. While our data source is comprehensive, it also has its own limitations, which constrains our ability to distinguish between different modes of exit. We cannot, for example, distinguish between voluntary exit and bankruptcy, or identify those cases in which a firm changes ownership but continues doing business with its original legal identity. Therefore, our analysis refers to the timing in which an economic unit ceases to do business. A more important concern is probably the case of mergers, in which an independent legal entity might disappear without the corresponding disappearance of the business unit. While there are no published data on mergers for Portugal, the Firms Register file reveals that less than one percent of the total number of liquidations is due to merger/acquisition, therefore suggesting that our inability to trace mergers in our dataset is not likely to have an impact upon our results.

Our data end in 1993 for all firms, regardless of their starting time, meaning that the maximum potential age that individual firms can reach is different for each cohort. Whereas firms from the 1983 cohort can reach a maximum of 11 years of life, those from the 1991 cohort can reach, at most, two years. An obvious consequence of this is that, while the exit rates for the first cohort are estimated using data from 10 years, the survival rates of subsequent cohorts are estimated using fewer years. In particular, our estimates for the exit rate after 10 years are produced solely with data from the 1983 and 1984 cohorts.

Table 1 shows the number of firms in each cohort and the survival rates in each of the years subsequent to entry. Data constraints (explained below) forced us to exclude the cohort of firms created in 1990. The remaining cohorts display comparable patterns in terms of survival, one-third of the total number of firms leaving during the second and third years of life, and only one-third remaining active after nine years.

For each firm in our sample, we computed measures of size and a proxy for their stock of human capital. The most serious shortcoming of our database is perhaps that the only reliable measure of the size of firms available is the firms' number of employees (the data were originally designed to collect information on the labor market). Therefore, firm size is measured here by employment (number of workers). To proxy the firms' human capital, we computed the proportion of college graduates among each firm's labor force. For each firm, these variables were computed for every year they appear in the data. Because there is no information available for the workforce for the 1990 survey, human capital variables were interpolated for this year (taking the average value for 1989 and 1991). For firms that were created in 1990, there is no reasonable way of estimating these variables and, consequently, these firms were excluded from our analysis. We also computed the Herfindhal index of concentration and the entry and exit rates, defined as the total number of entrants/exitors divided by the total number of firms in the (five-digit) industry, as proxies for the competitive conditions of the markets in which

DOI: 10.1002/smj

Table 1. Survival rates

Cohort	Firms	Survival rates after × years (%)									
		1	2	3	4	5	6	7	8	9	10
1983	7829	75	65	56	49	44	40	37	34	32	30
1984	6752	77	63	51	44	41	37	35	32	30	
1985	6594	75	64	57	51	46	42	39	36		
1986	8811	80	70	62	56	51	48	44			
1987	10 880	81	71	63	57	52	48				
1988	13 356	82	71	63	57	52					
1989	15 633	80	70	63	58						
1990											
1991	16 161	81	71								
1992	15 909	80									

Table 2. Independent variables: descriptive statistics

	Mean	Standard deviation	Correlations					
			Size	College	Entry rate	Concentration	GDP growth	Exit rate
Size	4.460	9.424	1					
College	0.018	0.099	0.031	1				
Entry rate	0.182	0.064	0.003	0.017	1			
Concentration	0.017	0.060	0.058	0.060	0.235	1		
GDP growth	2.953	2.913	0.043	−0.012	0.222	0.001	1	
Exit rate	0.106	0.034	−0.047	−0.067	0.384	−0.034	−0.07	1

the firms in our sample operated. Finally, we also use gross domestic product (GDP) growth to characterize the macroeconomic environment at the time of entry and at each moment thereafter. GDP growth is available from official sources (descriptive statistics in Table 2).

All of these variables exhibit a considerable degree of persistence over time (Table 3). Correlations between the values of each independent variable at the time of founding and the same variable later in time are always positive and significant. They are, however, clearly different from one, thus indicating that there is a significant amount of divergence between conditions prevailing at the time of entry and those prevailing at later moments.

Table 3. Correlations between the values of the independent variables at founding and at later times

	Size	College	Entry rate	Concentration	Exit rate
1 year	0.810	0.648	0.821	0.776	0.606
2 years	0.680	0.498	0.747	0.643	0.572
3 years	0.548	0.406	0.727	0.602	0.559
4 years	0.550	0.332	0.694	0.572	0.479
5 years	0.523	0.328	0.680	0.549	0.402
6 years	0.487	0.339	0.638	0.541	0.415
7 years	0.449	0.362	0.621	0.557	0.377
8 years	0.430	0.424	0.574	0.521	0.260
9 years	0.483	0.364	0.562	0.553	0.272
10 years	0.513	0.322	0.451	0.536	0.254

THE EMPIRICAL MODEL

We are interested in estimating the probability that firms exit when they reach a certain age. For those firms that have not exited at the end of our period of analysis, we do not have information on how long they survive. This is known in the statistical literature as right censoring, and for those firms we know only that they survive longer than the age they had when we cease to observe them. Thus, in our analysis of the survival of new firms, we need to employ a statistical model that is capable of accommodating such incomplete durations. Although a variety of such models exist, we

DOI: 10.1002/smj

employ a semiparametric hazard model, because such models enable us to characterize the exit process more rigorously than is possible with the conventional approaches, such as probit or logit analysis. In particular, this methodology enables us to study how the exit rates evolve over time and the way in which such rates are affected by both firm and sectoral characteristics, as well as by the macroeconomic environment.

As explained above, our data on the duration of firms come from an annual survey. This means that we know only whether or not a firm is active on the date of the survey and, therefore, our measured durations are grouped into yearly intervals. For firms that exited during the survey period, all we know is that their durations are expressed in increments of one-year length. For those that were still operating at the end of the survey period, the relevant information is that their duration exceeded the lower limit of the last observed duration. Such a sampling plan is properly accommodated in the framework of discrete duration models, a rigorous exposition of which can be found in Lancaster (1990).

Thus, the statistical model that we work with is a semiparametric discrete proportional hazard model, which can be formally represented by

$$\log\ h(t|x) = \lambda_t + \beta x,\ \text{for } t = 1, \ldots, k, \qquad (1)$$

where the left hand side variable is simply the logarithm of the hazard rate (that is, the log of the probability that the firm exits at time t, given that it survived until $t-1$). The parameters λ_t identify the baseline hazard function providing the (log of) yearly exit rates for a firm whose covariates denoted by the vector x assume a zero value. β is, of course, a vector of regression coefficients.

Different specifications of Equation 1 can be written depending on the beliefs about what causes exit. One of the simplest versions of Equation 1 that is possible to write is a model where x is a vector of variables that describe the current idiosyncratic and market conditions facing every firm that operates in the same market, which we will denote by x_t.

$$\log\ h(t|x_t) = \lambda_t + \beta x_t. \qquad (2)$$

There are, however, two sources of heterogeneity that may cause exit, which need to be considered: current heterogeneity among firms, that is, the one based on differences that exist in period t; and heterogeneity that accrues from differences that existed at the moment when firms were created, that is, from conditions prevalent in period $t = 0$. Heterogeneity induced by differences in founding conditions includes those conditions that are cohort specific, that is, which take a common value for all firms in the same cohort, such as macroeconomic or industrywide factors and those that are specific to each firm. Using x_0 to denote founding conditions, regardless of whether they are firm or cohort specific, inclusion of these variables generalizes Equation 1 to

$$\log\ h(t|x_t,\ x_0) = \lambda_t + \beta x_t + \gamma x_0. \qquad (3)$$

In this equation, γ is the set of parameters to be estimated that measure the impact of founding conditions on survival conditional upon the effect that current conditions, x_t, have on survival. If founding effects are not important, then $\gamma = 0$, while if current conditions do not matter, then $\beta = 0$. A useful reparameterization of Equation 3 is

$$\log\ h(t|\Delta x_t,\ x_0) = \lambda_t + \beta \Delta x_t + \theta x_0, \qquad (4)$$

which expresses the probability of exit as a function of the initial conditions (x_0) and of the changes in these conditions from birth to the current period ($\Delta x_t \equiv x_t - x_0$). Clearly, $\theta \equiv \beta + \gamma$, so the test that $\gamma = 0$ becomes a test that $\theta = \beta$.

Equations 3 and 4 provide a framework in which to assess whether founding conditions matter ('*is* $\gamma \neq 0$*? or is* $\theta \neq \beta$?'), but it does not enable us to assess whether the effects of founding conditions are temporary or permanent. To do this, we must extend Equation 4 to allow θ to vary systematically over time. A simple way of achieving this is to express θ as a constant plus a term that is linear in age ($\theta = \eta + \delta t$) (Disney, Haskel, and Heden, 2003). This yields

$$\log\ h(t|\Delta x_t,\ x_0) = \lambda_t + \beta \Delta x_t + (\eta + \delta t)\ x_0, \qquad (5)$$

or, if we make it explicit that this specification implies an interaction term between initial conditions and age

$$\log\ h(t|\Delta x_t,\ x_0) = \lambda_t + \beta \Delta x_t + \eta x_0 + \delta t x_0. \qquad (6)$$

With this specification, if $\delta = 0$ Equation 6 is identical to Equation 4, with $\theta = \eta$, and we conclude that the effect of founding conditions on survival is permanent. If δ turns out to be different from zero, we expect it to be negative, larger values of δ (in absolute value) implying shorter duration of the effects.

One disadvantage of this specification is that, as t grows larger, the sign of one specific effect in x_0 can change, as δt may become greater than η in absolute value. A convenient alternative is to multiply the regression coefficient by a power function, $\theta = \sigma\phi^{(t-1)}$, which generalizes Equation 4 to:

$$\log\ h(t|\Delta x_t,\ x_0) = \lambda_t + \beta\Delta x_t + \sigma\phi^{(t-1)}x_0. \quad (7)$$

The speed of erosion of the effect of initial conditions is measured in this specification by the parameter ϕ. If $\phi = 1$, Equation 7 is identical to Equation 4 with $\sigma = \theta$, and we conclude that the effect of founding conditions on survival is permanent. The smaller ϕ is, the faster the erosion of the effects of initial conditions will be. If $\phi = 0$, then the effects of initial conditions disappear almost instantly; that is, after the founding period, initial conditions do not matter. In contrast, if $\sigma = 0$ initial conditions do not matter at all. Unlike in Equation 6, the effect of founding conditions will gradually approach zero as t increases, but will never change sign, which seems to be a desirable property for our empirical model. We will use Equation 7 as our preferred specification for testing the persistence of the effect of founding conditions, using Equation 6 as a robustness check.

To sum up, Equation 7 forms the basis of a model of the determinants of survival odds that allows for two drivers of exit: market conditions and firms heterogeneities, measured both at founding and at current time.

RESULTS

In this section we present our empirical results. Before presenting and discussing the results, however, let us call the reader's attention to the fact that all our regressions also include the exit rate in the industry as a control variable. The exit rate in an industry is defined as the number of exitors in year t − 1 expressed as a proportion of the total number of active firms in the industry in that year. As the dependent variable in our models is the probability of exit confronted by newly created firms, the exit rate will control for all other industry factors that are not included in the regression and that affect exit. We also include a set of 30 region dummies to control for regional effects that may affect survival. Later in the paper, we will discuss the possibility that some unobserved heterogeneity still remains and will report the results of controlling for it.

Table 4 presents our benchmark regression results. The results in Table 4 are based on Model 2, relating the exit of firms to current conditions. The estimates (of the βs in the model) show that current values of the five independent variables—firm size, human capital, the entry rate into the firm's industry, the concentration ratio, and current GDP growth—are all relevant determinants of survival, in both substantive and statistical senses. Large firms that have more human capital and those that are located in industries with low entry rates or high concentration are more likely to survive. In addition, firms also experience a higher likelihood of survival during periods of macroeconomic growth. Of these relationships, that associated with concentration is the only one that may cause concern. The results indicate that firms that enter in highly concentrated industries are likely to benefit from a price umbrella established by dominant firms. Without any further qualifications, this would imply that these industries would become less and less concentrated over time, a finding that does not fit well with what is known about the persistence of concentration (Davies and Geroski, 1997). Given the nature of our discussion about the effect of concentration, however, the results for this variable are better appreciated in the regressions that follow.

Further results are shown in Table 5. The table shows three sets of regression estimates based on Equations 4 to 7. Column 1 shows estimates of Equation 4, which is a model in which both initial

Table 4. Regressions results (N=118070)

Variable	Coef	SE
Size	−0.393	0.005
College	−0.374	0.052
Entry rate	0.427	0.082
Concentration	−0.343	0.079
GDP growth	−0.041	0.002
Exit rate	3.497	0.121
LL	−158 763	

Table 5. Regression results (N=118070)

Variable	Column 1		Column 2		Column 3		Column 4	
			Exponential decay		Linear decay		Exponential decay	
	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Size								
Initial	−0.336	0.005	−0.354	0.007	−0.353	0.007	−0.366	0.008
Decay			0.966	0.008	0.011	0.003	0.997	0.009
Change	−0.623	0.009	−0.616	0.009	−0.618	0.010	−0.655	0.009
College								
Initial	−0.472	0.054	−0.510	0.067	−0.507	0.064	−0.524	0.067
Decay			0.912	0.069	0.031	0.025	0.965	0.056
Change	−0.006	0.075	0.042	0.079	0.029	0.081	0.038	0.081
Entry rate								
Initial	0.643	0.085	0.693	0.095	0.684	0.097	0.764	0.099
Decay			1.028	0.048	0.003	0.037	1.063	0.040
Change	0.104	0.111	0.287	0.121	0.204	0.121	0.273	0.126
Concentration								
Initial	−0.415	0.071	−0.988	0.096	−0.649	0.094	−0.856	0.103
Decay			−0.007	0.164	0.183	0.031	−0.021	0.195
Change	−0.235	0.147	0.107	0.135	0.154	0.155	0.116	0.143
GDP growth								
Initial	−0.049	0.002	−0.050	0.002	−0.050	0.002	−0.052	0.002
Decay			0.979	0.026	0.002	0.001	0.992	0.025
Change	−0.031	0.002	−0.030	0.003	−0.028	0.003	−0.028	0.003
Exit rate	3.239	0.105	3.418	0.115	3.310	0.125	3.757	0.140
Gamma variance							0.283	0.056
LL	−158 292		−158 253		−158 263		−158 242	

and current effects are included (if the estimates of $\theta = \gamma$ in Column 1, then Equation 4 reduces to the null hypothesis, Equation 2). Column 2 shows estimates of Equation 7, which allows the effects of initial conditions to decay over time. Column 3 shows estimates of a regression identical to Column 2 except that the linear specification is used for the decay parameter (Equation 6).

Column 1 shows what happens when initial conditions are added to the equation. In the case of all five variables, the hypothesis that $\theta = \beta$ is rejected, either variable by variable or for all five independent variables taken together. Therefore, it is not reasonable to simplify the regression shown as Column 1 to the one displayed in Table 4; that is, there is a clear indication that the null hypothesis (that solely current conditions matter) is inadequate. Column 2 shows what happens when θ is allowed to decay over time, and it is clear that one should not simplify the regression shown as Column 2 to Column 1; that is, the hypothesis that the effect of initial conditions is permanent is soundly rejected. Overall, the hypothesis that the effects are persistent is rejected. The computed chi-squared statistic is 78, well above the critical value for a test with five degrees of freedom, with a five percent significance level (11.1). The basis for this inference lies largely with the coefficient of concentration, which implies a rapid decay, but also with the effect of initial size. Although the estimate of this effect is fairly close to unity, it is also quite precisely measured, and the t-statistic for the null hypothesis (that this effect is permanent) is above four. The hypotheses that the effect of GDP growth, entry, and human capital are permanent cannot be rejected.

Robustness

The rest of Table 5 gives some information about how robust these results are to alternative specifications. The first concern is about our specification of the decay parameter. In Column 3, we report the results of using a linear specification as discussed in Equation 6. Remember that, while for the exponential specification the decay parameter

would be one in the case of complete persistence, the corresponding value of the parameter for total persistence is now zero. Inspection of Column 3 reveals that all the qualitative results remain unchanged. All those coefficients that were previously statistically significant remain significant and the point estimates are very nearly the same, except perhaps in the case of the initial effect of entry. The results for persistence are persistent themselves. The hypothesis of full persistence, that was previously not rejected for GDP, college, and entry, is still not rejected for these three variables. In Column 2 the results indicate that the effect of initial concentration does not persist at all. By construction, the linear specification does not allow one to test the hypothesis of no persistence at all. However, using the parameter estimates in Column 3, one estimates that the sign of the effect of initial concentration reverses before the fourth year of life. The corresponding time to reversion estimates for the other variables are 32, 18, 49, and 11 years for size, college, entry, and GDP growth, respectively.

Column 4 deals with the concern that there may be unobserved heterogeneity in our data. While our covariates include a set of variables that are plausibly related to the survival of firms, we acknowledge that our dataset has limitations, and that there may be factors also affecting survival that we are not able to observe. Unobserved heterogeneity is a concern because if the factors that are not explicitly included in the model are correlated with those included, the estimated effects of the latter may be biased. We attempt to control for industry-specific variables of this sort by including that past exit rate in the industry as a control variable. Different industries have different overall probabilities of exit and the past exit rate in the industry is included in order to account for all these factors. There may remain, however, some firm-specific heterogeneity, for example, because firms differ in their intrinsic quality. This 'quality,' not being observed in the data, may affect some of the choices made by firms, and therefore the results obtained for the variables included in the regression might partially reflect the effect of this 'quality.' While we cannot observe 'quality,' we can model the presence of this unobserved heterogeneity assuming the presence of a firm-specific random effect, which is often assumed to be distributed according to a gamma distribution for computational convenience (Han and Hausman, 1990). Column 4 shows the results when this approach is followed, which show no major changes relative to Column 2. Most of the coefficients are slightly larger than in Column 2 and the hypothesis that they are equal to one cannot be rejected (except, of course, for concentration that remains not different from zero). The qualitative message of the data, however, does not really change, thus suggesting that, even if some unobserved heterogeneity may exist, this heterogeneity does not lead to very different estimates.

From our estimated coefficients, we can calculate the relative magnitude of the founding effects a few years after founding. Based on the most conservative results from Column 2 in Table 5, we calculate that after 10 years of existence the effect of initial size is still 73 percent of its initial effect, while the corresponding effect of GDP growth is about 83 percent and that of college 46 percent. The effect of entry rates is fully persistent and the effect of concentration totally disappears in the second year. Although, by construction, the estimated effects never reach zero, it is possible to compute the length of time it takes for each of them to reach one half of the initial effect. Simple calculations reveal that concentration reaches this level before the second year of life, while size, college, and GDP growth reach it before the twenty-first, ninth, and thirty-third years, respectively. These estimates are conservative in the sense that those in Column 4 would always lead to higher estimates of persistence.

In Table 6 we show the estimation results when the sample is split into subsamples of entrants of rather different initial sizes (smaller than the median, larger than or equal to the median, larger than or equal to the third quartile, and larger than or equal to the ninetieth percentile). It has been argued that a given industry may be more or less attractive, depending on the specific positioning of firms (Wernerfelt and Montgomery, 1986). This is also consistent with the argument that different strategic groups present different challenges to new competition, which may be more easily overcome by a group of firms than by others (Caves and Porter, 1977). These arguments have been given support by the findings of Sharma and Kesner (1996) in the context of a study on the survival of firms. The authors found an insignificant effect of concentration upon survival, but report that the

DOI: 10.1002/smj

Table 6. Hazard for samples of entrants of different sizes

Variable	Column 1		Column 2		Column 3		Column 4	
	Entrants smaller than median		Entrants larger than or equal to median		Entrants larger than or equal to 75 percentile		Entrants larger than or equal to 90 percentile	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Size								
Initial	−0.396	0.021	−0.222	0.015	−0.177	0.111	−0.090	0.045
Decay	1.069	0.018	0.976	0.026	0.997	0.032	1.042	0.139
Change	−0.553	0.018	−0.847	0.018	−0.347	0.277	−1.106	0.045
College								
Initial	−0.337	0.076	−0.871	0.128	−1.145	0.243	−1.642	0.438
Decay	1.060	0.075	0.844	0.090	0.669	0.147	0.668	0.229
Change	0.050	0.106	−0.016	0.134	0.387	0.232	0.407	0.412
Entry rate								
Initial	0.683	0.123	0.978	0.163	1.068	0.049	1.278	0.358
Decay	1.098	0.050	1.054	0.048	1.078	0.049	1.098	0.358
Change	0.613	0.179	−0.045	0.192	−0.997	0.032	−0.466	0.409
Concentration								
Initial	−0.830	0.173	−0.746	0.168	−0.531	0.256	−0.977	0.369
Decay	−0.159	0.208	0.230	0.321	0.908	0.176	0.966	0.059
Change	0.041	0.205	0.224	0.228	0.157	0.363	0.508	0.550
GDP growth								
Initial	−0.044	0.003	−0.067	0.004	−0.078	0.006	−0.081	0.010
Decay	1.048	0.023	0.957	0.034	0.969	0.029	0.992	0.059
Change	−0.032	0.003	−0.022	0.004	−0.024	0.006	−0.039	0.010
Exit rate	3.708	0.216	3.802	0.223	4.514	0.370	4.525	0.571
Gamma variance	0.119	0.073	0.978	0.102	1.726	0.189	1.903	0.328
LL	−80905.3		−76990.6		−36933.7		−14990.8	
N	58 975		59 095		29 061		11 745	

effect of concentration increases with the scale of entry. Our own results are quite robust but they are still consistent with those of Sharma and Kesner (1996). They are as follows: the signs of those that are significant never change, which is an indication of robustness. The magnitude of the effect of initial size decreases somewhat for larger firms, but This is the only such coefficient that experiences a considerable decrease. Larger firms display larger initial effects for college and, more moderately, for the entry rate and GDP growth. Finally, the persistence of the initial effects remains at nearly the same level for all variables, expect for concentration. The estimates of the persistence of all variables but concentration remain in the vicinity of one, being hard to establish that there were any changes given the precision of the estimates. The persistence of concentration, on the contrary, increases markedly. The effect of initial concentration, which was not persistent at all for the whole sample or for the smallest firms, becomes quite persistent (complete persistence cannot be rejected) in the two last regressions. The results indicate that the protecting effect of concentration that disappears instantaneously for the smallest entrants persists for the largest.

Finally, all our models are estimated with age effects (the λ_ts) to account for the evolution of the hazard rates that accompanies the aging of firms. For the sake of economy, we do not report these parameters in Table 5. These effects are, however, graphically displayed in Figure 1 for our preferred specification. These estimates, which do not change much from regression to regression, clearly show that the older the firm, the less likely it is to fail. A log-likelihood ratio test on the constancy of the baseline hazard function produces a chi-square statistic of 590. This soundly rejects the null hypothesis, that is, we find evidence of a liability of newness (Stinchcombe, 1965; Freeman,

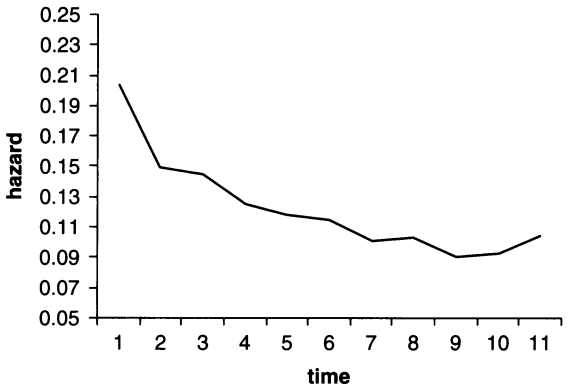

Figure 1. The impact of age upon survival

Carroll, and Hannan, 1983). We will come back to this issue below.

Quantifying the effect of initial and current conditions

To get an idea of what exactly our estimated effects mean for hazard rates, we plotted the hazard rates that would be confronted by a firm born in favorable (and unfavorable) conditions in Figure 2. The goal with this exercise is to obtain a weighted measure of the different coefficients in order to appraise the combined effect of the whole set of covariates.

To construct the 'favorable' scenario, we calculated the quartiles of each explanatory variable in our data. For each variable, we computed the hazard rates over time using the first or the third quartile, depending on whether the effect of the variable upon the hazards was positive or negative. That is, the favorable scenario is the estimated hazard for a firm that is larger than the median, employs a more educated labor force, was created in a period of relative prosperity, and operates in an industry that is more concentrated and less prone to entry than the median. To construct the 'unfavorable' scenario, we proceeded symmetrically, that is, we calculated the hazard rates for a firm that is relatively small, employs a less educated labor force, was created in a period of recession, and operates in an industry that is less concentrated and more prone to entry than the median.

Two different plots were produced and are reported in Figure 2. In the first plot we keep current conditions constant and appraise the effect of changes in initial conditions (solid line). This plot reveals that the impact of initial conditions can be

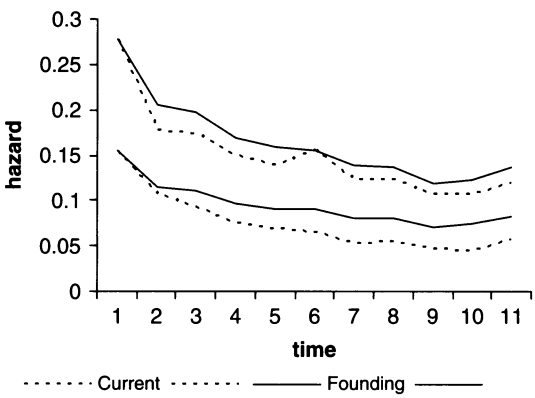

Figure 2. The impact of current and founding conditions upon hazard rates

quite substantial. In particular, in the less favorable scenario, firms exhibit sizably higher hazard rates than in the most favorable scenario. In the second plot we repeated the exercise, holding initial conditions constant and letting current conditions vary according to the observed variation in the sample (dotted line). Again, we constructed the favorable and unfavorable scenarios following the procedure described above. This new plot reveals that the impact of changing current conditions is also non-negligible.

This exercise allows one to compare the magnitude of the impact of current and initial conditions upon survival. At birth, current and initial conditions are the same. Accordingly, the two plots are identical for age one. As firms age, the variability in the hazard rates that can be attributed to founding conditions—measured by the difference between the two dotted lines—as well as the one that can be attributed to current conditions—measured by the difference between the

DOI: 10.1002/smj

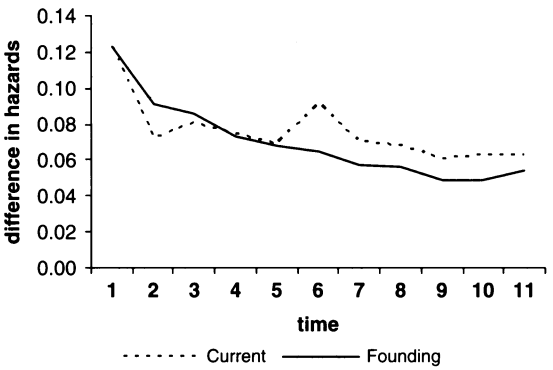

Figure 3. The impact of current and founding conditions upon the variability of survival

two solid lines—is reduced. Figure 3 displays this information in a direct manner. After the first year, the series for current conditions in Figure 3 is essentially horizontal, while the series for founding conditions is decreasing. This means that the relative weight of founding conditions is at a maximum during the first years of life. However, even after 10 years of life, founding conditions have a non-negligible impact upon the variability of hazard rates. Between the eighth and tenth years, the difference between the hazard rate in the least and most favorable scenarios are of six percentage points for current conditions and five percentage points for founding conditions.

It is useful to note that the drivers of the changes in the hazard rates over time are different in the two plots. There is, of course, a common element in both plots, the effect of aging, as measured by the common baseline hazard function parameters (which, however, does not affect the series in Figure 3). Apart from this, in the first plot the estimated changes in the hazard rates are driven by the estimated decays in the effects of the initial conditions. As these decays are, in general, small, their compounded effect is also relatively small. On the other hand, in the second plot the estimated changes in the hazard rates are driven by the observed changes in the covariates; in this plot firms face different hazard rates because at different points in time they face different conditions.

CONTRASTING THE DIFFERENT THEORETICAL PERSPECTIVES ON SURVIVAL

Ecological and economic arguments offer two rather different views on the impact of firm strategies upon survival. Ecological arguments stress inertia, emphasizing that selection tends to favor those firms that remain highly immutable (Hannan and Freeman, 1984). According to this view, the greater the magnitude of change, the greater the probability of exit. Economic arguments, in contrast, emphasize the adaptive role of change. Confronted with suboptimal positions, firms change—and try to change for the better. Those that are successful survive and prosper, while those that are less successful wither and eventually exit. In this view, it is not only the magnitude of change that matters, but rather the direction of change that matters the most (Jovanovic, 1982).

Our results for size are consistent with the economic, not the ecological view. Firms that are larger in their initial year of founding will survive longer and this effect is almost permanent (at least for the time span recorded in our data). Furthermore, any subsequent increases in firm size improve their survival prospects. Adjustments in size are, however, far from being instantaneous, as indicated by the fact that the effect of initial size is almost permanent, thus suggesting that the mechanisms indicated by Hannan and Freeman (1984) as reasons for firm inertia may indeed apply.

The impact on firm survival of initial human capital also seems to be both important and nearly permanent. In contrast, given the effects of founding human capital, it seems that subsequent changes in human capital add almost nothing to survival prospects. The larger the initial stock of human capital in the firm, the lesser the (permanent) likelihood that the firm will exit, but attempts to increase this stock do not lead to sizeable changes in the likelihood of exit. This is, perhaps, particularly surprising, as firms adjust

DOI: 10.1002/smj

the qualifications of their human capital quite a lot (correlation of human capital over time is the lowest among all the explanatory variables). Although we do not know the details of how these changes are brought about, they are likely to be the consequence of labor turnover rather than that of training of a constant set of workers. Our results indicate that new hires do not immediately translate their potential into improved odds of survival. Resources are important for the survival of firms, but their impact is not instantaneous.

The effect of concentration at the time of entry has a strong negative effect upon the probability of exit. However, except perhaps for the largest entrants, the effect vanishes almost totally immediately after entry has occurred. The impact of subsequent changes in market concentration is positive, and these results fit well the 'trial by fire' hypothesis. In contrast, the largest entrants remain sheltered by the protective umbrella of concentration for long periods of time. These results are interesting as they suggest that the two conflicting hypotheses advanced by organizational ecology and industrial organization economics may both hold, but in relation to different types of entrants.

The coefficients on entry are consistent with the argument that competition and excessive crowding in markets reduce survival prospects. Firms that are born in years when many other firms are also entering their industry are much less likely to survive, and their survival prospects are even lower if subsequent entry rates are high. The effect of the founding entry rate is persistent, the estimate being even greater than one (although not significantly so).

Finally, firms that are born in a boom seem to have almost permanently high survival rates *ceteris paribus*, and survival rates are higher during times in which the economy is growing rapidly than in those in which the economy is declining. The results for entry rates and macroeconomic conditions are very similar; both current and initial conditions are relevant, and initial conditions exert a permanent effect upon survival. While these results support the ecological view that initial conditions matter for survival, they seem to indicate that the conditions that affect survival go clearly beyond those that are specifically related to the individual markets in which firms operate.

CONCLUSIONS

In this paper we explored the issue of whether the conditions into which a firm is born have an effect on its survival chances, which founding conditions matter most, and how long their effects last. We applied a structured set of statistical models to data on more than 118,000 Portuguese firms over the period 1983–1993, and uncovered very strong evidence that initial conditions matter. Indeed, it was very easy to reject the hypothesis that only current conditions matter; after taking current conditions into account, founding conditions contribute significantly to explain the variation in survival rates.

Our analysis combined elements from economics, organization ecology, and the resource-based view of the firm. The results indicate that all the theories have elements that significantly affect the survival of firms and that an eclectic approach may be necessary for fully explaining survival and the impact of initial conditions upon it. For example, whereas our results for firm size support economic but not ecological perspectives, the results for concentration indicate that economic explanations may be more important for the largest entrants while ecological ones may explain better the observed pattern of survival of the smallest. Our results also support the resource-based view that human capital resources are important. They clearly indicate that the view that summary measures of the firm, such as firm size, which are often used in the most parsimonious economic modeling, are insufficient to capture all the heterogeneity of firms. However, they also show that the effect of increasing these resources has an imperceptible immediate impact upon survival and that, in contrast, changes in firm size have a strong and robust impact upon survival.

Our results allow us to reject the hypothesis that founding effects are permanent, finding that the effect of initial conditions decreases as time goes by. However, although their effect is not permanent *strictu sensu*, many factors (firm size, human capital, entry rates, and GDP growth) seem to have relatively long-lived effects on survival. Indeed, despite the fact that the effect of founding conditions upon survival decreases over time, founding conditions still contribute very significantly to explaining the observed variation in firm survival rates a few years after birth. It is worth mentioning here that we observe our firms for 10 years at most. Under these circumstances, 'permanent' means something rather less than 'forever.' At

DOI: 10.1002/smj

most, what we have observed is that founding effects persist relatively unaltered (except for the concentration effect) through the first 10 years of a new firm's life. How much longer they last is an open question. All of these results point to the conclusion that firms bear scars from the conditions of their birth, possibly for at least 10 years after they are born. Further, our simulations show that these effects are far from negligible and, at least in the first years after founding, the effects associated with founding values of the independent variables are greater than the effects associated with current values.

For policy makers, this is sobering news. It is often possible to affect the current market conditions that a firm operates in, but it is never possible to go back in history and alter the conditions under which it was born. That is, the importance of founding effects means that there are inherent limits to what policy makers can do for young, struggling firms. It also suggests that policy makers ought to sharply distinguish between neonatal and postnatal policies, and perhaps focus rather more of their energy on the former than the latter. For managers, a similar caveat applies. When one is going to set up a new firm, it is important to establish it properly from the outset. Founding conditions have long-lasting effects upon survival, and subsequent reversal of the initial decisions later on may be insufficient to produce the desired improvement in the probabilities of survival.

ACKNOWLEDGEMENTS

We are grateful to Thomas Astebro, Robert Edwards, two *SMJ* referees, and seminar and conference audiences in Bologna, Catania, Cardiff, Copenhagen, Covilhã, Essex, Ghent, Lisbon, London, Michigan, Paris, Tokyo, and Warwick for helpful comments, and to Lucena Vieira and Bernardo Pimentel for research assistance. Support from the ESRC, Fundação para a Ciência e Tecnologia and NOVA Fórum is gratefully acknowledged. The usual disclaimer applies.

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