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AND THE SURVIVAL OF NEW FIRMS**

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FOUNDING CONDITIONS AND THE SURVIVAL OF NEW FIRMS

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Abstract

This paper explores the effects that founding conditions have on the survival of new firms. A regression model which allows us to examine the role played by a number of different features of founding conditions on survival rates was estimated. The effect of founding conditions is estimated taking also into account that survival may be affected by current market conditions. Further, the model allows the effects of founding conditions to be transitory, and provides a way to assess how long such effects last. Using data on 118,114 Portuguese new firms observed over the period 1983 – 1993, we find that founding effects are important determinants of exit rates, and in some cases, they are more important that current conditions. In most cases, founding effects seem to persist without much of an attenuation in their effect on survival rates for at least several years after the founding of the firm.

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Abstract

This paper explores the effects that founding conditions have on the survival of new firms. A regression model which allows us to examine the role played by a number of different features of founding conditions on survival rates was estimated. The effect of founding conditions is estimated taking also into account that survival may be affected by current market conditions. Further, the model allows the effects of founding conditions to be transitory, and provides a way to assess how long such effects last. Using data on 118,114 Portuguese new firms observed over the period 1983 – 1993, we find that founding effects are important determinants of exit rates, and in some cases, they are more important that current conditions. In most cases, founding effects seem to persist without much of a attenuation in their effect on survival rates for at least several years after the founding of the firm.

I. INTRODUCTION

Firms fail all the time, more so in some time periods than in others. Of somewhat more concern is the fact that some types of firm fail much more often than others. New start up firms, for example, display amazingly high failure rates, and quite a lot of research effort has been devoted to working out why this is (Romanelli 1989, Dunne, Roberts and Samuelson 1989, Brüdel, Preisendörfer and Ziegler 1992, Mata and Portugal 1994, Sharma and Kesner 1996). One of the most interesting conjectures to emerge from this literature is the argument that the conditions in which a firm is born may have a substantial effect on its survival chances, and one that may last for many years (Romanelli 1989, Hannan 1998). Most of this literature concentrates upon the effect of environmental conditions and very few studies have focused on the impact that strategic choices at founding time may have upon the survival prospects of firms. Furthermore, in many cases, founding and subsequent conditions can be similar. Failing to account for the effect of one of these types of conditions may lead one to draw the misleading conclusion that the other type of conditions is responsible for the observed variation in survival rates. Finally, while the literature has developed the hypothesis that founding conditions matter, to our knowledge there is no study that has analysed how long the effect of these founding conditions upon survival persists.

This paper develops an empirical model which enables us to test the importance of founding

conditions against a plausible null hypothesis about firm failure rates. The study examines which of several possible founding conditions matter most and assesses how long their effects on survival last. We apply our model to a panel of data on 118,114 Portuguese new firms observed over the period 1983-1993, and obtain results which 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 size of founding effects on survival does not decay rapidly over the first 5 - 10 years of a new firm's life.

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 revert. 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 plan of the paper is as follows. In Section II below, we outline the basic issues that we will be concerned with, and try to weave together two different literatures which have addressed them in somewhat different ways. In this section we develop our basic hypotheses about which effects should matter for survival and discuss the determinants of survival. Section III discusses the data that will be the basis of our empirical analysis, while in Section IV the empirical model is presented. The results are discussed in Section V and, finally, Section VI concludes the paper.

II. THE ISSUES

Most studies of the survival of firms find that age matters (Freeman, Carroll and Hannan 1983, Dunne, Roberts and Samuelson 1989, Mata and Portugal, 1994, Mitchell 1994, Audretsch and Mahmood, 1994, Henderson 1999). Such results are not terribly hard to understand.

For economists the most commonly told story is about selection, a story that predicts that younger firms confront higher probabilities of exit than their older counterparts. New firms are taken to be unsure about exactly what their competencies are and how appropriate they will be prior to entry. Since there is no test like a market test, those firms whose talents are not up to the demands of the market exit soon afterwards. As it may take several years for firms to discover the

true worth of their competencies, selection is likely to lead to much higher exit rates for a particular cohort in the first few years of its life than for older cohorts also operating in the same market at the same time period (Jovanovic 1982, Ericson and Pakes 1992, Pakes and Ericson 1998). For organizational ecologists, the favourite explanation of age effects lies in what they call the "*liability of newness*". This refers to the time organizations need to take to get set up, make organization specific investments, build up trust within the organization and between it and other organizations, develop systems and routines that are reliable and accountable, and so on. Until all of this happens, an organization is less likely to be able to cope with extreme environmental challenges than better and longer established organizations. Since it takes some years to develop specific knowledge, trust and appropriate routines, it follows that survival rates are likely to be lower for young, newly established firms (see Carroll and Hannan, 2000, Chapter 13, for a review of this literature). Different patterns of exit over time have also been given explanations by organizational ecologists under the label of different "liabilities", namely those of adolescence and obsolescence (see Henderson 1999).

Time matters for survival not solely because of these age effects, but also because business conditions prevailing in different moments in time may have an impact upon the survival of firms. Economists view the exit process as a decision that is made depending on the firm's net present value of future streams of revenues and costs. Within this view, current conditions may matter for at least three reasons. First, the current market position of a firm may be a good indication of its long-run capabilities. For example, in Jovanovic's (1982) model, firms start with no knowledge about their efficiency. However, as time goes by and firms observe their performance in the marketplace, they gradually learn about their efficiency. The information they gather is then incorporated into their current size. Firms that are observed to be successful grow, while those which are less lucky contract. As in this model firms adjust instantaneously to their desired size, the information conveyed by current size is sufficient to predict the survival of firms. The second reason why current conditions may matter is because current conditions may change expectations about the future. If the state of affairs in a market today is taken as an indication of future adverse state of affairs, firms may decide to exit in response to a change in current conditions. Finally, current conditions may matter if firms suffer from cash constraints (Fazzari, Hubbard and Petersen 1988). Although firms may wish to remain active despite adverse conditions, they may lack the resources to do so, and may be forced to exit. Thus, our first - and

benchmark - hypothesis is:

Hypothesis 1) Current environmental and idiosyncratic conditions affect the firms' probability of survival.

However important current conditions may be, past conditions, in particular conditions at the moment of founding, may also affect the exit of firms. The effect of environmental founding conditions on the performance of firms has been the subject of much interesting work by organizational ecologists, who have explored this issue largely in the context of what they refer to as "*density delay*". This particular literature emerged from studies of population dynamics, and was developed to explain the often rather large shake-outs which occur in many relatively young markets (Carroll and Hannan, 1989, Ranger-Moore, 1997, Mitchell, 1994, Henderson, 1999; see also the survey discussion in Carroll and Hannan, 2000, Chapter 11). In essence, the density delay argument suggests that organizations founded in periods when markets are very crowded (e.g. with other entrants and incumbents) are likely to have persistently higher age specific rates of mortality than those founded in less demanding periods when the market is less densely populated. Thus, if a population becomes very large in a certain period, organizations founded in that period are likely to be much weaker, ceteris paribus, and the adverse founding conditions into which they are born is likely to create an enhanced stream of exit (and, as a consequence, a falling off in population size from the peak previously established).

There seem to be two rationalizations for this phenomenon. The first is a "*liability of scarcity*" story, which suggests that organizations created in unfavourable circumstances are unlikely to be anywhere near their optimal size or structural configuration and, in addition, may not be able to find the right kinds of resources, make the correct organization specific investments, or design the right kinds of routines. "*Tight niche packing*", on the other hand, is a story which suggests that new firms founded in crowded market conditions can get pushed into unpromising niches which may be transitory or may just lead them to develop knowledge and routines which are so specialized that they will never be able to reposition themselves into more favourable parts of the market later on. Another version of this same story says that the state of the environment at the time of birth largely determines the strategic choices of firms. As firms age and the environment changes, the initial choices of firms become less and less well suited to the new environment, but the routines developed by firms during their lives and that eased the

tasks of dealing with the firms' daily operations, may create rigidities that make the firms ill-suited to cope with changes in the firms' environments (Hannan 1998). The fact that a strategy has been successful in one moment in time can even exacerbate these rigidities. In fact, Audia, Locke and Smith (2000) found that managers are reluctant to abandon strategies that have been successful in the past, and that those strategies are likely to be maintained, even if the environment changes radically and those strategies are no longer appropriate.

For organisational ecologists, population density is the most important determinant of how favourable market conditions are for new entrants. However, the notion of "crowding" which lies at the core of their arguments suggests that it is population density relative to market size which matters most, and this introduces a broader range of factors which might be important determinants of how favourable founding conditions are for a particular cohort of firms. The state of the business cycle (and other macroeconomic conditions) is one class of important potential explanatory variables; elements of market structure (above and beyond a simple count of population numbers) are another. Indeed, there is much scope for exploring which of a potentially long list of specific features of the founding environment of young firms has the most systematic and profound effects on survival.

For economists, the important founding conditions are usually associated with the battle to enter the market and the nature of incumbent responses to entry. One reason why these strategic entry decisions may affect the survival of firms is because these decisions reflect the beliefs held by firms about their ability to compete. First, different entry sizes signal different expectations about success (Frank 1988). Firms that enter at larger scales have more optimistic expectations of success and, consequently, are apt to endure poor performance for a longer time. Second, the effect of initial decisions may also persist because strategic decisions frequently involve the deployment of resources that cannot be later reallocated, that is, which are sunk. When investment costs are sunk, there may be little point in reverting a decision, as costs cannot be recovered. Therefore, even if it comes out to be clear that one given decision was not a wise one, *ex post* the firm's best option may be to stick with it anyway (Dixit and Pindyck 1994). The third point, - adjustment costs - was emphasized by Penrose (1959). Writing in the context of the growth of firms she 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 very rapidly. Indeed, firms are observed to converge gradually to their desired size

(Bogner, Thomas and McGee 1996), which makes it relevant to know their departing point as well as their current position. The amount of resources available to the firm at founding may, therefore, exert an impact upon firm performance which lasts over time.

Several empirical studies confirmed the impact of initial conditions on the performance of organisations. Eisenhardt and Schoonhoven (1990) showed that founding teams exert permanent effects upon the performance of firms, while Cooper, Gimeno-Gascon and Woo (1994) found that the initial stocks of financial human capital were good predictors of firm performance, including survival. Kimberly (1979) concluded that environmental conditions, the founder's personality, and the initial strategic choices exert an enduring effect on the behaviour of organisations. Therefore, we hypothesise

Hypothesis 2) Founding environmental and idiosyncratic conditions affect the firms' probability of survival

It is as conceivable that the conditions of birth affect the survival of firms in their first few years of existence, as it is inconceivable that these same conditions will still be affecting survival rates 100 years later. How long it might actually take for the effects of founding conditions to erode is, however, unclear. At base, many of the stories about the vulnerabilities of young firms turn on their need to learn certain things, or to make certain kinds of investments. Learning speeds and adjustment costs are notoriously hard to specify with great precision, but it is clear that empirical analysis ought to allow for the possibility that the effects of founding conditions may not be permanent. Most specifications of mortality equations that include founding conditions do not make any provision for the possibility that their effect on survival might change in the years after birth, fade, and eventually disappear altogether. Age effects, on the other hand, are often modelled in a way which allows their effects on survival to gradually disappear over time. It seems clear that this ought to apply to all founding conditions and not just to age effects alone.

The effects of the founding conditions were found to be increasingly larger over time by Eisenhardt and Schoonhoven (1990), but not so by Bamford, Dean and McDougall (1999). In both studies the proportion of total variance explained by the model was used as the main criteria to judge the the impact of founding conditions. Mata, Portugal and Guimarães (1995) estimated a model of survival in which they used simultaneously founding and current size. They

found that the both coefficients were significant, but that the one associated with current size was larger in magnitude. We thus hypothesise

Hypothesis 3) The effect founding conditions upon the survival of firms gradually vanishes over time

THE DETERMINANTS OF SURVIVAL

To test these hypotheses, one needs to set out a model of survival which identifies a systematic role for founding conditions to play in determining firm mortality rates. The model which must be general enough to include a range of different founding conditions, and to allow the effects of each founding condition to vary over time. Before going into the details of the specific formulation of such model, next we identify which factors should be included in our empirical model as determinants of exit.

The macroeconomic environment

The overall state of the economy has long been indicated 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. Recent research, however, indicated 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 firms 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 in comparison with those focusing on exit and survival (Boeri and Bellmann 1995, Ilmakunnas and Topi 1999).

The aforementioned studies focused on the effect of current business conditions upon entry and exit. Macroeconomic conditions prevalent at the time of entry may also affect survival. Highfield and Smiley (1987) showed that a period of high firm creation follow periods of relatively depressed conditions. Individuals that are unemployed are known to be more likely to create new firms than those that have a job (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.

The industry environment: Concentration

Apart from the overall economic conditions, the specific conditions in the industry where entry occurs are likely to affect businesses survival. Organizational ecologists typically use density (the count of the number of firms in the market) as the relevant variable to measure industry conditions. Density would not be adequate here, as we work with several industries with rather different sizes (carrying capacities in the organizational ecology terms). Instead, we will use industry concentration as a proxy for the degree of competition in the market. Two types of argument can be made about the effect of the degree of competition in the market upon survival prospects. On the one hand, Organizational Ecology scholars (e. g. Hannan and Carrol 1992), maintain that competition is a force that increases mortality. At low levels of density, an increase in the number of firms operating in a market translates into increased legitimacy and this will favour survival. After a certain threshold, however, further increases in the number of firms lead to increased competition and this leads to increased mortality.

While economists certainly agree that competitive markets (that is, those populated by a large number of firms) exert a strong disciplinary effect and drive inefficient firms out of the market, the Industrial Organization literature emphasizes a different point. It argues that market concentration facilitates collusion and that, in highly concentrated markets, incumbents may be more likely to retaliate against entrants (Bunch and Smiley 1992). The available evidence relating the survival of firms to market concentration is, however, inconclusive. Audretsch and Mahmood (1994) report a negative and statistically significant effect of market concentration on the survival of new firms, but Romanelli (1989) and Mata and Portugal (1994) found this effect to be insignificant. Sharma and Kesner (1996) also present an insignificant effect of concentration upon survival, but found that the (negative) effect of concentration increases with the scale of entry.

The industry environment: Entry Rates

Another element of the competitive structure of a market is the extent of entry in that market. Organizational ecologists and economists here agree 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 increases density in the market and one should therefore expect high exit rates as a consequence. Industrial Organization Economics arguments, on the other hand, 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 1984), the kind of knowledge needed to fuel innovation lies outside the industry and new firms need to be created in order to innovations to be possible. At the same time, no standard 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 (Suarez 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 industries 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, many studies (surveyed in Siegfried and Evans 1994) reported similar findings for the determinants of entry and exit, while 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.

Firm size

Larger firms have been found to experience higher survival probabilities than smaller firms (Dunne, Roberts and Samuelson 1989, Audretsch and Mahmood 1994, Mata and Portugal 1994, Mitchell 1994, Haverman 1995, Sharma and Kesner 1996), and several rationales have been developed to account for this observation. One is that larger entrants 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 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. A third reason is that firm size may be an observable consequence of something unobservable but fundamental for survival, like superior efficiency, the possession of valuable knowledge or skills, or the successful acquisition of trust, alliance partners or

general consumer goodwill. Large firms are successful firms, and, for this reason, they should have higher survival probabilities (Jovanovic 1982). Finally, large initial firm size may say something about the expectations about success held by both the firm's managers/owners (Frank 1988) and any financial backers it may have (Fazzari, Hubbard and Petersen 1988).

Although the earliest studies that have analyzed the effect of size on survival have used initial size as the relevant measure, some more recent studies have focused on the effect of current size (see Hannan et. al. 1998 and the references therein). If only one measure of size is to be included, there are good reasons to think that current size should be a more appropriate variable to include in studies of survival. For example, Levinthal (1997) emphasizes the ability of firms to adapt to changing environments as being crucial to shape the process of selection and survival. Mata, Portugal and Guimarães (1995) argue that current size should be a better predictor of exit than initial size even if the landscape does not change, as the current size of firms includes information on the reaction of firms to their market success over time.

There are, however, reasons to specifically include both initial and current size in models of firm survival. One reason is that, after having controlled for current size, measuring initial size amounts to measuring firm growth and growth is a measure of performance. Indeed, Mata, Portugal and Guimarães (1995) argue that, if there adjustment costs in the process of firm growth, the current size of growing firms will be an underestimate of the firm's desired size. The fact that a firm has grown in the past signals that it has been performing well and would wish to be larger than it currently is. Thus, it should have lower exit probabilities than its current size indicates. Although more direct measures of performance (e.g. profits) have been used in models of survival and a positive impact of profits upon survival has been reported in several studies (e.g. Hambrick and D'Aveni 1988, Silverman, Nickerson and Freeman 1997), it has also been argued that each firm has an idiosyncratic level of profits that triggers the decision of exiting, depending on the opportunity cost of its owners (Gimeno et al. 1997).

Resources: human capital

The Resource-Based View of the Firm has long stressed that the ability of firms to survive and to compete successfully is largely determined by the extent to which firms develop firm-specific assets, which cannot be imitated by competitors and 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, Thomas and McGee 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 robotics or complex information management systems, is by itself imitable'' (Barney 1991, p. 110). Indeed, assets which constitute the basis for superior performance cannot be imitable or tradeable, and knowledge assets are one of the few classes of assets that are not tradeable today (Teece 1998). Previous studies found human capital to be a good predictor of survival (Mata and Portugal 2002, Cooper, Gimeno-Gascon and Woo 1994) .

III. THE DATA

The data used in this paper was obtained from an annual survey which has been conducted by the Portuguese Ministry of Employment since 1982. The survey has two characteristics that make it particularly suitable for the analysis of firm entry and survival. First, it covers all firms employing paid labour in Portugal. Second, it has a longitudinal dimension, i.e., firms 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 have worked directly with raw files, we were able to compute entry and survival measures ourselves. This could be done easily because firms are identified in the survey 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 exceeds two years. This enabled us to track 118,114 new firm start-ups 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 latter date (but see below).

The time of exit is found by identifying the moment when firms cease to report to the survey. 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 survey form was 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 is used only to check the presence of the firm in 1994 and the last year for which we can identify an exit is 1993.

Our data ends in 1993 for all firms, irrespective of their starting time, and that means 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 eleven years of life, the ones from the 1991 cohort can reach, at most, two years. An obvious consequence of this is that, while the exit rates for the first and second cohorts are estimated using data from the seven years, the survival rates of subsequent cohorts are estimated using fewer years. In particular, our estimates for the exit rate after *ten* years is produced solely with data from the 1983 and 1984 cohorts.

Table 1 displays 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 important 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 was originally

designed to collect information on the labour market). Therefore, firm size is measured here by employment (number of workers). To proxy the firm's human capital, we computed the proportion of college graduates among the firm's labour force. For each firm, these variables were computed for every year they appear on 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 (5 digit) industry, as proxies for the competitive conditions of the markets in which the firms in our sample operated. Finally, we also use GDP growth to characterize the macreconomic 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.

IV. 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 are going to last. This is known in the statistical literature as right censoring, as 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 employ a semi-parametric 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 comes from an annual survey. This means that we only know whether or not a firm is active at the survey dates 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, of which a rigorous exposition can be found in Lancaster (1990).

Thus, the statistical model that we are going to work with is a semi-parametric discrete hazards model, which can be formally represented by

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

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 $t\text{-}1$). 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 model (1) can be written depending on the beliefs on what causes exit. One of the simplest versions of (1) that is possible to write is a model where x is a vector of variables which describe the current idiosyncratic and market conditions facing every firm which operates in the same market that we will denote by x_t.

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

There are, in however, two types of heterogeneities that may cause exit and that need to be considered: current heterogeneities between firms, that is heterogeneities based on differences that exist in period t, and heterogeneities that accrue from differences that existed in the moment when firms were created, that is to conditions prevalent in period $t = 0$. Heterogeneities due to differences in founding conditions include those conditions that are cohort specific, i.e. which take a common value for all firms in the same cohort, such as macroeconomic or industry-wide

factors and those which are specific to each firm. Using x_0 to denote founding conditions, irrespective of whether they are firm or cohort specific, inclusion of these variables generalizes (1) to

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

In this equation γ is the set of parameters to be estimated which 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 reparameterisation of equation (3) is

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

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 ($\Delta x_t \circ x_t - x_0$). 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* γ **¹** *0? or is* θ **¹** β*?*"), but it does not enable us to assess whether the effects of founding conditions are temporary or permanent. To do this, we must extend (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 et al, 2000). This yields

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

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

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

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 power function, $\theta = \sigma\phi^{(t-1)}$, which generalizes (4) to

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

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; i.e. after the founding period, initial conditions do not matter. In contrast, if $\sigma = 0$ initial conditions do not matter at all. Unlike in (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 specification (7) as our preferred specification for testing the persistence the effect of founding conditions, using (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.

V. RESULTS

Table 4 presents our benchmark regression results. The results in the table are based in model (2), relating the exit of firms to current conditions. The estimates (of the β's in 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 significant determinants of survival. Large firms, with more human capital, located in concentrated industries with low entry rates, operating during a period of macroeconomic grow, are more likely to survive. Of these relationships, the one associated with concentration is the only one that might cause some surprise. Our interpretation is that young, small firms that operate in highly concentrated industries are likely to benefit from a price umbrella established by dominant firms who may, in

any case, be reluctant to attract regulatory attention by squeezing out too many of their smaller rivals.

Further results are displayed in Table 5. The table shows five sets of regression estimates based on the models (4) to (7). Column (i) shows estimates of (4), which is a model in which both initial effects and current effects are included (if the estimates of $\theta = \gamma$ in (i), then (4) reduces to the null hypothesis, (2); column (ii) shows estimates of (7), which allows the effects of initial conditions to decay over time. All these equations include age dummies. Column (iii) shows estimates of a regression identical to (ii) except that the linear specification is used for the decay parameter (model (6)). Column (iv) shows estimates of a regression like (ii) except that the exit rate is included as an additional regressor; finally, column (v) shows a regression similar to (ii) but without age dummies.

Column (i) 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 (i) to the one displayed in Table 4; i.e. there is a clear indication that the null hypothesis that solely current conditions matter is inadequate. Column (ii) shows what happens when θ is allowed to decay over time, and it is clear that one should not simplify the regression shown as (ii) to (i); i.e. 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 58, well above the critical value for a test with 5 degrees of freedom, with a 5 percent significance level (11.1). The basis for this inference largely lies with the coefficient of concentration, which implies a rapid decay, and 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 4. The corresponding effect for GDP growth is just barely significantly different from one (the t-statistic is 1.96) and the hypotheses that the effect of entry and human capital are permanent cannot be rejected.

The story told in column (ii) is fairly straightforward. Firms that are larger in their initial year of founding will survive longer, and this effect is almost permanent (at least for the $2 - 8$ years of life recorded by the firms in our data). Furthermore, any subsequent increases in firm size

improve their survival prospects.

The impact on firm survival of initial human capital formation seems also to be both important and nearly permanent. In contrast, given the effects of founding human capital, it seems that subsequent human capital growth adds 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 does not lead to sizeable changes in the likelihood of exit.

The coefficients on entry are consistent with the arguments made by organizational ecologists that 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). The impact of initial and current entry rates are pretty much the same. This can be seen by noting that when the effect of initial conditions is persistent (ϕ=1 in model 7), as it is the case with concentration, the impact of initial conditional on current conditions (γ), can be retrieved from the estimated coefficients (θ and β) as $\gamma = \theta - \beta$. Based on the estimates in column (i) we would have 0.870 (1.566 - 0.696), while based in column (ii) we have 0.733 (1.595 - 0.862).

The effect of concentration at the time of entry has a strong effect upon the probability of survival. The effect, however, vanishes almost totally immediately after entry has occurred and subsequent changes in market concentration do not impact upon the survival prospects. One possible explanation for the indication that firms entering more competitive markets experience lower survival prospects but that this effect quickly disappears, has been put forward by Swaminathan (1996). He argues that unfavourable founding conditions may lead to a quick and immediate shake-out of "unfit" firms, leaving those who survive past a 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 (Swaminathan, 1996).

Finally, firms 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. Again, the effect of initial and current conditions are of a comparable magnitude. Indeed, they are -0.030 and -0.023 based in the estimates in column (i) and -0.026 and -0.029 based in those in column (ii).

Figure 1 gives a deeper insight on the issue of persistence, by showing the estimated evolution of the magnitude of the effects of the different covariates over the first 25 years of life of firms. We are well aware that we are estimating the impact of the different covariates at ages which we do not observe at all. In doing this exercise, we are assuming that the patterns that we uncovered based on the first tem years of life will persist over time. Should the reader be uncomfortable with this assumption, he is advised to concentrate on the utmost left side of the plots. In the four plots (entry is not in the graph as its effect is estimated to be permanent), one sees that the effects disappear at quite different rates over time. The effect of concentration at founding disappear almost immediately after the founding period. A high proportion of the effect of initial size still persists after a quarter of century. Although, by construction, the estimated effects never reach the 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 22nd, 12th and 11th year, respectively.

ROBUSTNESS

The final three columns of Table 5 give some information about how robust these results are to alternative specifications. The first concern is about our specification of the decay parameter. In column (iii) 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 parameter is now zero. Inspection of column (iii) reveals that all the qualitative results remain unchanged. All those coefficients which were previously statistically significant remain significant and the point estimates are pretty much 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, previously rejected for college and entry, is still rejected for these two variables. In column (ii) 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 (iii) one estimates that the sign of the effect of initial concentration reverses before the 6th year of life. The corresponding estimates for the other variables are 34, 19, 45, and 7 years for Size, College, Entry and GDP Growth, respectively.

One might also wonder about the extent to which our results are driven by omitted variables at the industry level that do not vary much over time. One approach for handling this question would be to include a set of industry dummies to control for these effects. This approach would be unpractical in our context due to the nonlinearity of our models and to the high computational burden involved in their estimation. However, we employed a much easier alternative. As the dependent variable in our models is the probability of exit confronted by newly created firms, and we have observations on the past occurrence of exit in the industry, we included also the exit rate in the industry as a regressor. This variable, 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, will control for all other industry factors which are not included in the regression and that affect exit. In the context of the econometric literature, one would say that the exit rate is used as a valid instrument for omitted industry variables. The results of this exercise (column iv) show that the most significant change occurs with the effect of the current entry rates. Entry and exit rates are highly positively correlated (0.380), so it is not surprising that including it reduces the effects of entry. With respect to the other variables, however, no significant changes occur, so we conclude that omitted variables at the industry level is not a major concern in our study.

Finally, all our models in columns (i) to (iv) are estimated with age dummies, to account for the evolution of the hazard rates that accompanies the ageing of firms. In the sake of the economy, we do not report these parameters in Table 5. These effects are, however, graphically displayed in Figure 2 for our preferred specification. These estimates, which do not change much from regression to regression, clearly show that the older the firm is 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). We will come back to this issue below.

ESTIMATING 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 favourable (and unfavourable) conditions in Figure 3. The goal with this exercise is to obtain an weighted measure of the different coefficients, to appraise the combined effect of the whole set of covariates.

To construct the "favourable" scenario, we did the following exercise. We calculated the quartiles of each explanatory variable in our data. For each variable, we estimated 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 favourable scenario is the estimated hazard for a firm which is larger than the median, employs a more educated labour force, was created in a period of relative prosperity and operates in a industry which is more concentrated and less prone to entry than the median. To construct the "unfavourable" scenario, we proceeded symmetrically, i.e. we estimated the hazard for a firm which is relatively small, employs a labour force which is not much educated, was created in a period of recession and operates in a industry which is less concentrated and more prone to entry than the median..

Two different plots were produced and reported in Figure 3. 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 quite substantial. In particular, in the less favourable scenario, firms exhibit significantly higher hazard rates than in the most favourable 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 favourable and unfavourable 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 1. 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 two solid lines – is reduced. Figure 4 displays this information in a direct manner.

After the first year, the series for current conditions in Figure 4 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 ten years of life, founding conditions have a non-negligible impact upon the variability of hazard rates. Between the eighth and the tenth years, the difference between the hazard rate in the less and the most favourable scenarios are of 6 percent points for current conditions and 5 percent 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 ageing, as measured by the common baseline coefficients (which, however, does not affect the series in Figure 4). 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. In contrast, 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.

VII. CONCLUSIONS

In this paper, we explored a very simple set of questions, namely whether the conditions into which a firm is born have an effect on its survival chances, which founding conditions (if any) matter most, and how long do 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 null hypothesis that only current conditions matter; after taking current conditions into account, founding conditions contribute significantly to explain the variation in survival rates.

We were also able 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 effect of founding conditions upon survival being decreasing over time, founding conditions still contribute very significantly to explain the observed variation in firm survival rates a few years after birth. It is worth mentioning here that we observe our firms for ten years at most. Under these

circumstances, "permanent" means something rather less than "forever". At 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 larger 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 they are inherent limits to what policy makers can do for young struggling firms. It also suggests that policy makers ought to sharply distinguish between neo-natal and post-natal 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 beginning. 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.

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Table 1 - Survival rates

Cohort	Firms	Survival rates after x 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	52	48	44			
1987	10880	81	71	63	57	52	48				
1988	13356	82	71	63	57	52					
1989	15633	80	70	63	57						
1990											
1991	16161	81	71								
1992	15909	80									

Table 2 - Independent variables: Descriptive statistics

	Mean	Standard Deviation	Correlations					
			Size	College	Entry rate	Concentration	GDP growth	Exit rate
Size	4,461	9,424	1					
College	0,018	0,098	0,032	1				
Entry rate	0,182	0,064	0,002	0,018	1			
Concentration	0,017	0,060	0,058	0,061	0,233	1		
GDP growth	2,954	2,913	0,043	-0,012	0,22	0,001	1	
Exit rate	0,106	0,034	-0,047	-0,066	0,384	-0,034	-0,07	1

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	0,26
9 years	0.483	0.364	0.562	0.553	0,272
10 years	0.513	0.322	0.451	0.536	0,254

Table 4 - Regression results

Variable	Coef	SE
Size	-0,399	0,005
College	-0,473	0,049
Entry rate	1,38	0,069
Concentration	-0,179	0,079
GDP growth	-0,044	0,002
AGE dummies	YES	
N	118114	
LL	-159660	

Table 5 - Regression results

Variable	(i) Coef	(i) SE	(ii) Coef	(ii) SE	(iii) Coef	(iii) SE	(iv) Coef	(iv) SE	(v) Coef	(v) SE
Size										
Initial	-0,338	0,005	-0,356	0,008	-0,355	0,007	-0,352	0,007	-0,311	0,006
Decay			0,966	0,008	0,011	0,002	0,965	0,008	1,059	0,005
Change	-0,648	0,009	-0,642	0,009	-0,643	0,009	-0,630	0,009	-0,675	0,009
College										
Initial	-0,572	0,053	-0,611	0,065	-0,617	0,090	-0,589	0,066	-0,577	0,062
Decay			0,942	0,051	0,034	0,024	0,938	0,061	1,012	0,039
Change	-0,039	0,078	-0,005	0,081	0,013	0,077	0,041	0,061	-0,058	0,080
Entry rate										
Initial	1,566	0,070	1,595	0,078	0,805	0,127	0,688	0,095	2,533	0,057
Decay			1,021	0,020	0,018	0,035	1,014	0,050	0,430	0,023
Change	0,696	0,106	0,862	0,117	0,789	0,117	0,212	0,121	0,076	0,100
Concentration										
Initial	-0,358	0,081	-0,737	0,113	-0,718	0,167	-0,970	0,096	-1,016	0,039
Decay			0,193	0,221	0,134	0,033	0,012	0,168	0,287	0,156
Change	-0,091	0,144	0,172	0,129	0,179	0,152	0,097	0,129	0,066	0,135
GDP growth										
Initial	-0,053	0,002	-0,055	0,002	-0,034	0,003	-0,048	0,002	-0,052	0,002
Decay			0,949	0,026	0,005	0,001	0,950	0,030	1,023	0,014
Change	-0,030	0,002	-0,026	0,003	-0,022	0,003	-0,023	0,003	-0,033	0,002
Exit rate							3,389	0,115		
AGE dummies	YES		YES		YES		YES		NO	
N	118114		118114		118114		118100		118114	
LL	-159070		-		-159041		-158690		-159336	

The estimate of the decay in column (iii) follows a linear specification (equation (6) in the main text)

Figure 1: The impact of initial conditions over time
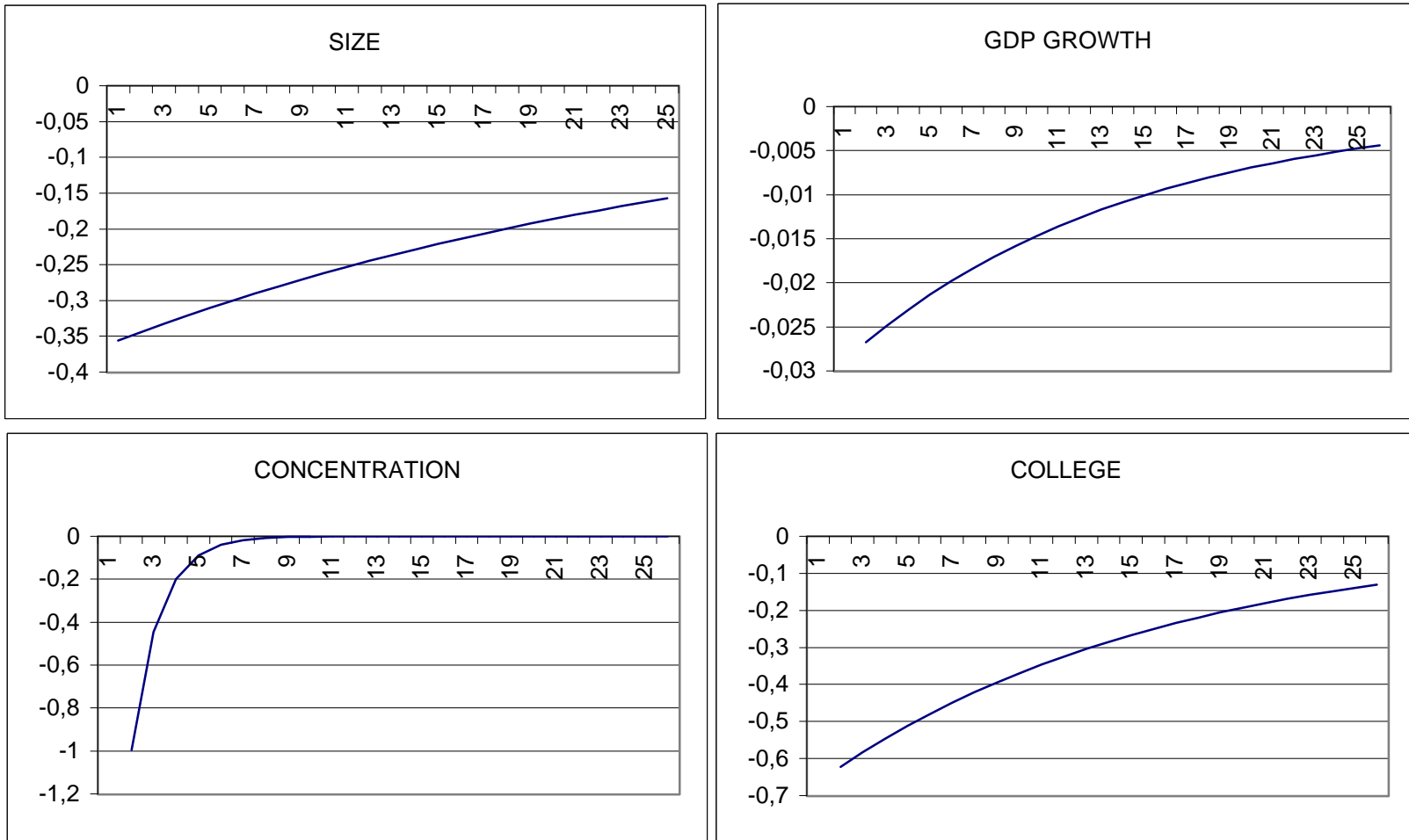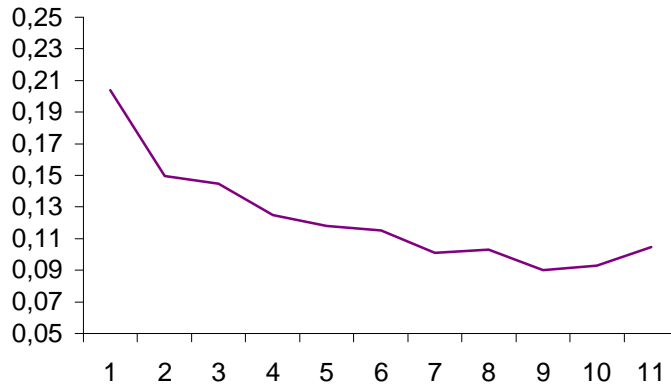
Figure 2: The impact of age upon survival

Figure 3: The impact of founding and current conditions upon hazard rates
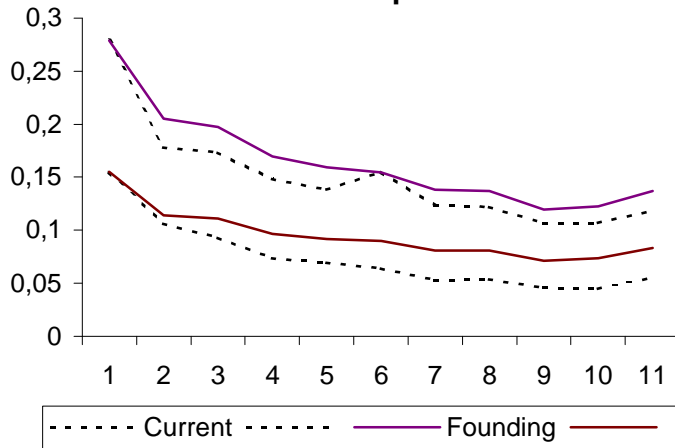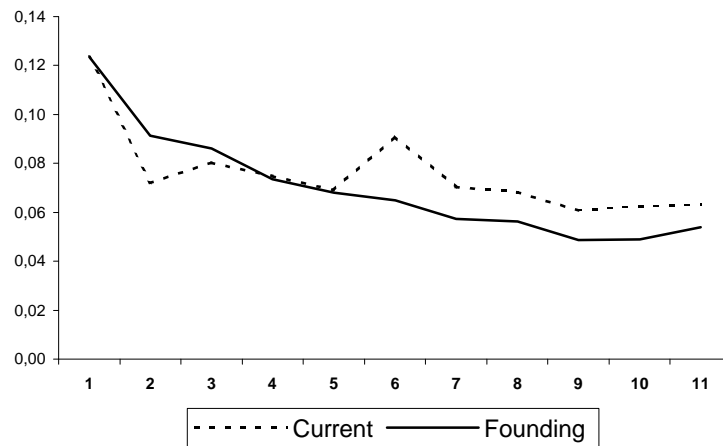

Figure 4: The impact of founding and current conditons upon the variability of survival

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