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Entrepreneurial backgrounds, human capital and start-up success

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by

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Abstract

We examine whether founders' backgrounds influence new firm survival in the early years after start-up. We develop hypotheses linking founders' backgrounds to pre-entry capabilities associated with entrepreneurial human capital, highlighting the cases of spin-offs and habitual entrepreneurs. The subject of unemployment-driven entrepreneurship is also explored. We find that specific human capital more frequently found in spin-off founders plays a key role in enhancing survival chances, while more general forms of human capital may help inexperienced entrepreneurs overcome the barrier posed by the critical early years after start-up.

JEL-classification: D21; L10; M13

Keywords: Founders' backgrounds; Human capital; Start-up Success;
Pre-entry capabilities; Spin-offs; Habitual entrepreneurs.

1. Introduction

Entry of new firms into an industry is a key determinant of the evolution of that industry and of economic development in general. Entry of new competitors leads to the introduction of new products and processes while bringing competitive discipline into markets (Schumpeter, 1934). Studies of new firm performance and of survival are abundant in economics, management and organizational ecology. Empirical studies of market selection indicate that entrants are heterogeneous and initial conditions influence subsequent success (see, for instance: Sharma and Kesner, 1996; Disney et al., 2003). However, with few exceptions, these studies develop and/or test theories linking new firm survival to firm-specific and environmental characteristics, and not to the characteristics of founders.¹ Moreover, research has focused mainly on the fit between firm characteristics and market conditions after those firms have entered markets.

Recent research has attempted to develop a structure for theory-building and applied work about the role played by pre-entry resources and capabilities in driving both entry decisions and post-entry performance (Helfat, 2000; Helfat and Lieberman, 2002; Helfat and Peteraf, 2003). Klepper (2002) argues that pre-entry assets affect both entry decisions and subsequent success. The role played by pre-entry resources and capabilities has been the subject of significant research on corporate diversification and industry evolution (see, for instance, Montgomery, 1994; Markides and Williamson, 1996; Klepper and Simons, 2000; Helfat and Lieberman, 2002). It can be claimed that, like diversifying entrants, entrepreneurial entrants (i.e. new businesses that are not

¹ Notable exceptions are the studies by Bates (1990); Brüderl et al., (1992); Cooper et al., (1994); and Dahl and Reichstein (2007).

wholly or partly owned by an existing company) also possess pre-entry resources and capabilities. Prior knowledge enables entrepreneurs to better recognize opportunities (Shane, 2000; Eckhardt and Shane, 2003), and gives them the ability to exploit them. This knowledge might be unique to entrepreneurs, making entrepreneurial entry a superior choice for opportunity exploitation (Alvarez and Busenitz, 2001).

A stream of research in organizational ecology focuses on the transfer of routines and experience from a founder's previous employer to his or her new firm (Phillips, 2002). The argument that the blueprints of a parent firm are passed on to new organizations through their founders is the cornerstone of a number of works by, among others, Carroll (1984), Hannan and Freeman (1986), and Romanelli (1989). Klepper (2001; 2002) has found traction for these ideas in the context of entrepreneurial spin-offs. A central argument of this research is that the success of new organizations is fundamentally shaped by the pre-entry experiences of their founders. Dahl and Reichstein's (2007) study of the survival of spin-offs² claims that industry experience as measured by the accumulated employment experience of owners affects new firm performance positively. This sort of relationship has been studied in the management literature, but only from the perspective of the relationship between the experiences of top managers and corporate performance (Hambrick and Mason, 1984; Murray, 1989; Michel and Hambrick, 1992; Hambrick et al., 1996).

New firms may also be founded by habitual entrepreneurs, i.e. individuals who have started at least one business prior to founding a new one (Westhead and Wright, 1998).

It can be argued that habitual entrepreneurs are also likely to acquire routines and

² For the purpose of the present study, spin-offs are defined as start-ups that enter the same industry in which their founders were previously employed. This type of entry is one of the most common among start-ups, particularly in high technology industries (Garvin, 1983).

experience in one business, carrying those to their next entrepreneurial effort. Knowledge accumulated by habitual entrepreneurs may also be translated into pre-entry capabilities.

The present paper examines the role played by the backgrounds and pre-entry experiences of founders in influencing new firm success. We regard prior experiences of founders as sources of pre-entry knowledge and capabilities, i.e. as components of entrepreneurial human capital,³ and develop theory and hypotheses concerning their contribution to new firm survival in the early years after start-up. Founders' backgrounds are used to create measures of entrepreneurial human capital, and used to test the hypotheses formulated by estimating a model of the determinants of short term survival. In order to facilitate the testing of these hypotheses, we use the founder and not the firm as the unit of analysis. By using a longitudinal database linking firms, founders and employees, our study is able to examine these issues for a substantial number of start-ups and founders in a wide variety of sectors.

We develop a model in which firm and industry-level determinants of survival are used as control variables when investigating the effects of different indicators of pre-entry entrepreneurial capabilities on survival. By focusing our analysis on the founders of new businesses, we are able to track their backgrounds over time, in order to build such indicators. We are also able to distinguish between individuals who gave up their previous employment position in order to start a business, from those who founded a business following an unemployment spell. It seems logical to expect that the former are significantly more likely to be starting a business in order to exploit an opportunity,

³ We use these two terms interchangeably throughout the paper, explicitly assuming a relationship between both education and career experiences, and the acquisition of capabilities embodied in entrepreneurs, i.e. human capital.

while the latter should be more likely to be starting a business out of necessity (i.e. due to the lack of satisfactory employment prospects).

The ultimate objective of the present study is to compare the relative importance of firm-level and environmental factors with that of pre-entry entrepreneurial capabilities, or human capital, in determining the early survival chances of start-ups. This research has important implications for both practitioners and policy makers. Founders play a fundamental role in determining the mission, strategy and organizational structure of new firms,⁴ so we believe that studies of new firm success – particularly in the first few years after start-up – are fundamentally incomplete when founders' characteristics are overlooked. By developing an encompassing set of hypotheses with regard to the effect of entrepreneurial human capital on start-up success and testing their effect on firm survival in a large variety of sectors, *vis-à-vis* a wide-ranging of firm-level and environmental factors that have been found to influence the survival chances of newly-founded businesses, we believe we provide a noteworthy contribution to the literature. Furthermore, by looking at the chances of survival in the crucial early years after start-up, this study provides insights on where to target government support to struggling young firms, in order to maximize their contribution to overall competitiveness and employment.

The rest of the paper is organized as follows. Section 2 discusses different streams of literature establishing theory about the influence of pre-entry capabilities on the early success of new businesses, and discusses a variety of ways in which entrepreneurs may accumulate such capabilities (or entrepreneurial human capital), leading to the

⁴ Busenitz et al. (2003, p. 298) point out that “opportunities do not come to fruition without unique insights, perspectives, and interpretations by the founders, and are not transformed into wealth generation without organizing actions.”

development of hypotheses with regard to their effect on new business survival. Section 3 establishes the firm and industry-level (i.e. environmental) factors to be used as control variables in the empirical testing of the hypotheses, identifying their expected effects on the probability of survival, based on a review of the extant theoretical and empirical literature on new business survival. Section 4 presents the data and empirical strategy, while section 5 displays and discusses the estimation results. Finally, section 6 offers some concluding remarks.

2. Entrepreneurs' Pre-entry Backgrounds, Human Capital, and Start-up Success

The early years after start-up are key for a firm's future. Virtually all studies in economics, management and organizational ecology find that younger firms confront higher probabilities of exit than older counterparts.⁵ The entrepreneurship literature often regards the first three years after start-up as critical for the survival and success of new firms (Littunen et al., 1998). The Global Entrepreneurship Monitor (GEM) surveys of entrepreneurial activity define young businesses as firms that have been active for three and a half years or less.⁶

Geroski (1995, p. 424), points out that the "mechanism of displacement, which seems to be the most palpable consequence of entry, affects young, new firms more severely." In

⁵ For instance, Bartelsman, Scarpetta and Schivardi (2005), who worked on data for ten OECD countries, find that about 20-40 per cent of entering firms fail within the first two years of life.

⁶ According to the GEM definition, an enterprise is classified as a young business if it has paid salaries and wages for more than three months but for less than 42 months, and as an established business if it has paid salaries and wages for more than 42 months (Acs et al., 2005).

economics, market selection theories argue that, upon entry, firms are unsure about the fit between their competences and market requirements prior to entry. Those firms whose talents are not up to the demands of the market exit soon afterwards. Hence, selection is likely to lead to much higher exit rates for recent start-ups firms than for older businesses operating in the same market at the same time period (Jovanovic, 1982). Organizational ecologists speak of 'liability of newness' (Stinchcombe, 1965; Freeman, Carroll and Hannan, 1983; Hannah, 1998) to describe the stylized fact that hazard rates decline monotonically with age as firms learn and adapt. In general, firms need time to get set up, make organization-specific investments, build up trust and develop systems and routines that are reliable and accountable. Since it takes some years to develop specific knowledge, trust and appropriate routines, it follows that newly formed firms are less likely to be able to cope with environmental challenges than established organizations.

The findings of economists and organizational ecologists suggest that the faster a firm learns about the fit between its resources and capabilities and market conditions, and the more able it is to adapt its competences to market conditions, the more likely it will survive the critical early years after start-up. The availability of pre-entry knowledge about market requirements and organizational development should therefore be a very important factor in determining the probability of survival in these critical early years, when firms have had little or no time to learn about the market. For start-ups that do not result from diversification or joint venturing operations by existing firms, pre-entry capabilities should be associated primarily with the founders, who usually play an important role in the management of the start-up.

All start-ups carry skills and routines embodied in their founders that are likely to influence the new firm's future development and success. Newly formed entrepreneurial teams begin with a set of endowments (Levinthal and Myatt, 1994). Helfat and Peteraf (2003) regard each member of the founding team as having human capital (knowledge, skills and experience), social capital (social ties within and outside the team) and cognition. While cognition enables corporate managers to build up dynamic capabilities as firms and organizations evolve (Adner and Helfat, 2003), human and social capital accrued by founders prior to start-up should play a more fundamental role in the early success of new firms. The educational and professional backgrounds of founders should be good indicators of their pre-entry capabilities.⁷

The concept of entrepreneurial human capital is implicit in a number of studies of new firm success. These studies examine the effects on the likelihood of survival of a variety of features such as the founders' education, career history, family and occupational background (Boswell, 1972; Bates, 1985, 1990; Preisendörfer and Voss, 1990; Brüderl et al., 1992; Cooper et al., 1994; Gimeno et al., 1997; Dahl and Reichstein, 2007).

Brüderl et al. (1992) propose a theoretical framework distinguishing general and specific forms of entrepreneurial human capital, where general human capital includes schooling levels while specific human capital includes work experience and industry-specific experience. General and specific entrepreneurial human capital, as indicated by schooling, work experience, leadership experience and industry-specific experience, enhance the productivity of the founder-manager. It can also be claimed that founders with greater human capital will be less uncertain about their efficiency and learn the

⁷ While educational and professional experiences should be more significant for the formation of human capital, it can be argued that individuals with more extensive backgrounds are also likely to have had more chances to build social capital.

market conditions faster than those with less human capital, hence their firms should be more likely to survive the early years of the market selection process. We build on this distinction between general and specific forms of entrepreneurial human capital, associating them with specific phenomena that have been highlighted by entrepreneurship research as being related with the extent of opportunity identification and exploitation: spin-offs, habitual entrepreneurship, and necessity-based vs. opportunity-based entrepreneurial activities.

Let us start with general human capital. It can be claimed that, through formal education (i.e. schooling), individuals acquire fundamental abilities to learn about markets and technology, and better recognize opportunities in the surrounding environment (Shane, 2000), regardless of whether this environment is more associated with science-based, research and development activities, or with the everyday practice of business. Formal education also allows individuals to develop learning aptitudes and organizational skills to better organize to exploit those opportunities (Grant, 1996). Furthermore, more educated people should command higher average earnings as paid employees, and should find it easier to fund their new business. In a comprehensive meta-analysis of studies of the returns to education for entrepreneurs, Sluis et al. (2005) conclude that entrepreneurship performance, regardless of the performance measure used, is significantly and positively affected by formal schooling. We can then formulate the following hypothesis:

H1: start-ups whose founder has more years of schooling (i.e. more degrees) have a greater probability of survival.

We consider that work experience and managerial experience (regardless of the specific industry) are forms of entrepreneurial human capital that straddle the distinction between general and specific. People with more work experience and who have performed managerial duties are more likely to be in a better position to detect opportunities and raise capital, thus setting up larger and better-equipped businesses (Colombo et al., 2004). People who have had at least some managerial experience are also more likely to have developed the necessary skills to organize new businesses (Shane, 2000; Eckhardt and Shane, 2003). We therefore put forward two more hypotheses to be tested:

H2: start-ups whose founder has more years of work experience have a greater probability of survival.

H3: start-ups whose founder has at least some managerial experience have a greater probability of survival.

We also theorize that work experience is likely to be more useful for entrepreneurs when it takes place in the same industry as the business is being started. People who have worked in the same industry for some time are likely to have accrued industry-specific human capital, i.e. specialized market and technological knowledge, plus a network of professional and social contacts that facilitate the acquisition and management of both technical and human resources. This sort of specific entrepreneurial human capital makes spin-off founders a particularly interesting case for the study of the effect of pre-entry capabilities on entrepreneurial performance. The role played by spin-offs in transmitting organizational heritage and routines across firms is explored by Klepper (2001, 2002). Spin-off founders are likely to bring to their new

firm specific knowledge about a wide range of issues, such as customer demand, products, technologies, suppliers and competitors (Helfat and Lieberman, 2002). They are also more likely to exploit prior scientific and technical training (Roberts, 1991), and to use new knowledge and technological developments to target unfulfilled customer needs (Shane, 2000). Based on this discussion, we formulate the following hypotheses:

H4: start-ups whose founder has more years of industry-specific experience have a greater probability of survival.

H5: start-ups whose founder was employed in the same industry before start-up (spin-offs)⁸ have a greater probability of survival.

We posit that specific human capital which is valuable for new business founders also manifests itself in habitual entrepreneurs, i.e. individuals who have started at least one business prior to founding a new one.⁹ Habitual entrepreneurs include all individuals who own several businesses simultaneously (portfolio entrepreneurs) as well as those who start a business subsequent to closing – or selling – another (serial entrepreneurs).¹⁰ Since, unlike novice entrepreneurs (i.e. those who start a firm for the first time), habitual entrepreneurs have accrued experience as business owners, they should possess higher levels of entrepreneurial human capital (Ucbasaran et al., 2003; Westhead et al., 2005).

⁸ While this spin-off definition may be deemed too inclusive (not all founders incorporated into this concept are necessarily exploiting opportunities discovered while working for their previous employer), any bias that may be introduced by such inclusiveness would counteract the effects supporting the hypothesis being tested.

⁹ The present study is restricted to business owners who have started their businesses, therefore excluding those who have acquired or inherited ownership. This includes habitual entrepreneurs. We believe that, in considering only starters and not acquirers and inheritors, we may better approach the concept of entrepreneurship as understood by the management literature (McGrath and Macmillan, 2000; Shane, 2000; Alvarez and Busenitz, 2001; Eckhardt and Shane, 2003; Busenitz et al., 2003).

¹⁰ Founding a new business may occur either immediately following exiting the previous one, or some time afterwards (Amaral and Baptista, 2007).

Habitual entrepreneurs should have better managerial and technical skills, better networks of contacts, access to market-specific information and knowledge, and thus should be better equipped to discover and take advantage from new business opportunities (McGrath and MacMillan, 2000; Shane, 2000). Habitual entrepreneurs also learn from their entrepreneurial experiences, thereby augmenting their endowment of entrepreneurial skills over time (Stam et al., 2006). Also, habitual entrepreneurs are less likely to face financial constraints to start a new firm. This is likely to be particularly true for portfolio entrepreneurs, who can deploy assets from their current firm (or firms) in the new start-up. Hence, we propose the following hypotheses:

H6: start-ups whose founder owns one or more other businesses at the time of start-up (portfolio entrepreneurs) have a greater probability of survival.

H7: start-ups whose founder has more years of business ownership experience (habitual entrepreneurs) have a greater probability of survival.

We have argued that pre-entry capabilities of independent start-ups are strongly associated with entrepreneurial human capital. In general, entrepreneurs with high levels of human capital are more likely to be exploiting a business opportunity. In contrast, entrepreneurs with low levels of human capital have often been forced into business ownership. The distinction between opportunity-based and necessity-based entrepreneurial activity has been highlighted by the GEM surveys as a way to distinguish between new firm creation which occurs due to opportunity recognition and that which occurs due to the lack of a better occupational alternative (Acs et al., 2005).

People who give up their current employment to start a new business are likely to be doing it due to the discovery of a promising business opportunity; people who start their

business as an escape from unemployment do it in order to make ends meet. Unemployment is a powerful driver of new firm creation. Founding a new firm may be an alternative to uncertain future career prospects or even an “escape from unemployment” (Oxenfeldt, 1943; Evans and Leighton, 1990; Storey, 1991). The empirical evidence highlighting the role played by job losses in fostering new firm entry is quite robust (Storey and Jones, 1987; Audretsch and Vivarelli, 1995).

If unemployment is the main incentive for setting up a business, there may not be time to look for good opportunities, make detailed plans, get appropriate funding, and seek advice. Hence, the chances of survival may be affected by selection effects occurring prior to start-up. Indeed, empirical evidence on entrepreneurial careers has found that those who have entered self employment from unemployment exit to a higher extent than those who have entered from paid employment (Carrasco, 1999; Pfeiffer and Reize, 2000), and that new founders who were formerly unemployed have on average lower economic outcomes and a lower propensity to positively contribute to job creation (Andersson and Wadensjö, 2006). In view of this discussion, we propose that:

H8: start-ups whose founder was previously unemployed have a lower probability of survival.

The present study focuses on a concept of entrepreneurial pre-entry capabilities (or human capital) that is associated with individuals’ backgrounds and experiences, and not with their personality traits. Relating entrepreneurial personality traits to new firm success has fared less well than perhaps would be expected (Ciavarella et al., 2004). One possible explanation for this, as suggested by Santarelli and Vivarelli (2006), is that deeply rooted psychological traits and motivations, such as locus of control, the search

for autonomy, or the aspiration to a higher rank in social status, can obscure objective consideration of the actual economic chances of the new initiative and jeopardize the success of entrepreneurial endeavors.

3. Control Variables: Industry and Firm-level Determinants of Survival

Mortality rates vary consistently across firms and industries, regardless of age. An extensive literature examining firm-level and industry-level determinants of new firm survival and growth has built up over the last two decades.¹¹ In order to build our control variables accounting for such effects, we now discuss briefly the main results from this literature, using them to define and construct the control variables to be used in our study.

3.1. Industry-level determinants of survival

Studies conducted for a variety of countries and industries, such as the ones by Audretsch (1991, 1995); Mata and Portugal (1994, 2002); Audretsch and Mahmood (1994); Wagner (1994); Mata, et al. (1995); and Disney et al. (2003), suggest that there are four main industry-level variables influencing survival: i) economies of scale; ii) barriers to entry; iii) market concentration; and iv) industry growth.

¹¹ An recent and comprehensive review of such determinants is provided by Santarelli and Vivarelli (2006).

According to Audretsch (1995), one of the reasons why so many new firms fail is that their entry size is smaller than the minimum efficient scale (MES) in the industry, and they experience a cost disadvantage *vis-à-vis* the most efficient firms in the market. The larger the MES in an industry the higher is the cost of adjustment for new firms. Hence, firms entering industries where the MES is larger face a lower probability of survival.

Industries with high entry rates are those in which the highest exit rates are to be expected. For organizational ecologists, large entry flows signal a low level of legitimation in the market and therefore high exit rates are expected. Industrial economists emphasize that entry and exit barriers are positively correlated since the magnitude and irreversibility associated with costly industry-specific investments, which deter entry, also hinder exit (Caves and Porter, 1976, 1977; Eaton and Lipsey, 1980). Studies in industrial economics provide plenty of evidence of a positive correlation between entry and exit across markets.¹² Mata and Portugal (1994) observed that this positive correlation is due, in large part, to the early exit of entrants in industries characterized by high entry flows.¹³ Geroski (1995) suggested that, while it is expected that entry barriers should increase the survival chances of incumbents by deterring potential entrants, they may actually pose more of a barrier to survival than a barrier to entry. We therefore expect that firms entering industries with higher rates of entry will face a lower probability of survival.

Organizational ecologists (*e.g.* Hannan and Carroll, 1992) maintain that competition is a force which increases mortality. When the number of firms in a market is low, an increase in “density” (*i.e.* a decrease in market concentration) leads to increased

¹² See Siegfried and Evans (1994) and Caves (1998) for extensive reviews.

¹³ Audretsch (1995) used image of a ‘revolving door’ as a metaphor to describe this phenomenon.

legitimacy and may favor survival; however, after a certain point further increases in the number of firms lead to increased competition and increased mortality. Industrial economists argue that competitive (*i.e.* less concentrated) markets exert a strong disciplinary effect and drive inefficient firms out of the market, while high levels of concentration facilitate collusion, so in highly concentrated markets incumbents are more likely to retaliate against entrants (Bunch and Smiley, 1992). However, other authors have pointed out that, in some cases, the small size of entrants may not be perceived as enough of a threat to trigger retaliation by incumbents (Gelman and Salop 1983). The empirical evidence relating firm survival to market concentration is also 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. We decided to account for market concentration as a proxy for the effect of the intensity of competition on survival, despite the lack of consistent theoretical propositions and empirical evidence on its direction.

Industries registering higher growth rates, usually corresponding to early stages of their life-cycles, are likely to provide an environment in which the probability of exit is lower. Schmalensee (1989) establishes the stylized fact that profits are in general larger in growing than in otherwise identical industries. This makes survival easier, as new firms do not have to attract customers away from incumbents. It should be pointed out, however, that industries in the early stages of their life cycles also register higher rates of both entry and exit (Agarwal and Gort, 1996; Baptista and Karaöz 2007). Still, it is expected that firms entering markets that are growing are less likely to face competitive

pressures, so we expect that firms entering industries with higher growth rates will have a higher probability of survival.

3.2. Firm-level determinants of survival

The main firm-level determinant of survival is start-up size. New firms are, in general, small. The literature points out three different kinds of reasons for this to be so. First, new entrants may choose to be small for strategic reasons. Gelman and Salop (1983) argue that new firms may start small in order to avoid incumbents' retaliatory behavior. By choosing to enter at a small scale, entrants increase the incumbents' cost of retaliation relative to its expected benefit. Second, new firms may be small because of uncertainty with regard to their own capabilities. Jovanovic (1982) argues that new firms start small and gradually adjust capacity as the initial uncertainty about their own efficiency gradually disappears. Cabral (1995) claims that in industries with significant sunk costs, firms may choose to start small in order to avoid incurring big losses in case experience reveals that they are not efficient enough to survive. Third, new firms may be small not because they chose to be so, but because they lack the funds to be larger. Evans and Jovanovic (1989) found liquidity constraints to be binding for investment decisions with respect to firm creation.

Theoretical literature therefore does not point towards a clear prediction of the effect of firm size on survival. While the cash constraints and uncertainty explanations suggest that smaller firms will have a lower probability of survival, the strategic choice explanation suggests that smaller entrants would invite less retaliation from incumbents and therefore experience higher survival rates. However, empirical evidence supporting

a “liability of smallness”, *i.e.* a negative relationship between hazard rates and size (initial and/or current) is overwhelmingly unambiguous (Caves 1998). This result has been found in samples of firms of all ages (Evans, 1987; Hall, 1987) and in samples of new firms (Mata and Portugal, 1994; Haverman, 1995). Regardless of the reasons that might have led to the choice of entry scale, the fact remains that smaller entrants face lower sunk costs (*i.e.* lower barriers to exit) and should be more likely to exit than larger ones (Sharma and Kesner, 1996), so we expect that firms that enter at a large scale will have a higher probability of survival than firms that enter at a small scale.

Studies of survival have also addressed the effect of organizational characteristics on survival probabilities. The resource-based view of the firm posits that the ability of firms to survive and to compete successfully is strongly influenced by the extent to which firms develop distinct capabilities. Successful firms are those that develop and/or learn firm-specific assets, processes and routines which cannot be easily imitated by competitors and provide the basis for their competitive advantage (Wernerfelt, 1984; Barney, 1991; Peteraf, 1993; Eisenhardt and Martin, 2000). A number of authors have pointed out that a firms’ knowledge resides in its human resources (Grant, 1996; Conner and Prahalad, 1996) and it is the firm’s human capital that provides the basis for sustained competitive advantage arising from activities involving the use of complex technology (Youndt et al., 1996). Tacit knowledge, embodied in individual humans, is the foundation for firm-specific assets that are the sources of competitive advantage (Teece, 1998). Teece et al. (1997) argue that human capital forms the basis of the firms’ dynamic capabilities to learn and adapt to new circumstances. Grant (1996) sustains that an important way of acquiring knowledge and developing the ability to generate new knowledge is through formal education. Hence, education may be seen as an indicator

of the quality of human capital. Mata and Portugal (2002) argue that the quantity (and quality) of the education held by a firm's workforce can be regarded, albeit imperfect, as a measure of firm-specific resources and capabilities. We therefore expect that firms with higher levels of employee human capital should have a greater probability of survival.

4. Data and Methodology

4.1. The Data

In order to test the hypotheses developed in the present work, we explore the SISED database (*Quadros de Pessoal*), a longitudinal matched employer-employee data set built from mandatory information submitted annually by all firms with at least one employee to the Portuguese Ministry of Employment and Social Security covering the period from 1986 to 2002. There are a minimum of 145,000 firms, 170,000 establishments and 2,000,000 workers and business owners included in each annual survey. Firms, establishments and individuals are fully cross-referenced through the use of a unique identification number, thus allowing for the recognition of both new entrants and exiting firms, as well as the opening and closure of subsidiary establishments. Mobility of workers and business owners across firms and establishments over time can also be traced. For each firm, data is available for size (employment), age, location, sector and number of establishments (including location and employment). Data on

business owners and employees for each firm and establishment include gender, age, function (i.e. hierarchical level),¹⁴ tenure, and schooling.

While the Portuguese economy is characterized by a small average firm size (which is consistent with Portugal being a small open economy), we believe this does not significantly affect the validity of our results in comparison with other developed economies, as several features of the Portuguese data for both firms and human resources are consistent with other developed countries. In particular, Cabral and Mata (2003) provide compelling evidence that the Portuguese economy displays similar patterns to those of larger and more developed countries with regard to the firm size distribution across industries.

By focusing our analysis on the owners of start-ups in the years 1995-1996, we are able to track their background over the period 1986-1994, thereby building substantial information on their past professional, entrepreneurial and industry-specific experience. The sample includes start-ups in both service and industrial sectors, defined at the three digit level of aggregation.¹⁵ A control variable is included to identify partnerships, *i.e.* firms with more than one business owner.¹⁶

¹⁴ The data have information about each individual's occupational position and status within the firm coded using the International Standard Classification of Occupations (ISCO) and the International Classification by Status in Employment (ICSE).

¹⁵ While the data allow for lower levels of industry aggregation, a change in ISIC definitions in 1992-93 prevents us from making correspondences between sectors before and after that alteration. Such correspondences are indispensable to track founders' pre-entry experiences.

¹⁶ It is expected that firms started by entrepreneurial teams will have a greater chance of survival, since they likely benefit from more entrepreneurial human capital. However, aggregating human capital across new business founders is not a simple task. On one hand, it is not clear whether simply adding indicators of entrepreneurial human capital across the entrepreneurial team would produce an accurate measure of entrepreneurial human capital for the firm; on the other hand, considering only one of the founders as representative of the firm (even if it is the one with higher levels of entrepreneurial human capital), while ignoring the other partners is also likely to be inaccurate. Hence, we deliberately use the founder, and not the firm, as the unit of analysis, choosing not to aggregate measures of entrepreneurial human capital, and controlling for those founders who have partners.

In order to avoid asymmetries in initial conditions, we exclude founders who are 50 years old or more from our sample. While older people have had more time to build better networks, identify valuable opportunities (Calvo and Wellisz, 1980), and are more likely to have accumulated capital to finance the start-up (Blanchflower and Oswald, 1998),¹⁷ statistical evidence for other developed countries shows that positive effects of age on the probability of success fade as age increases, since older people may be less prone to embark upon the more demanding work schedules required by self-employment (Rees and Shah, 1986; Evans and Leighton, 1989; and Cowling, 2000).

We therefore have a sample of 9110 founders whose average age in the year of start-up was 37.3 years old. About 79% of the founders started firms in service sectors, and 21% in industry. Our data enable us to build the variables required to test the hypotheses developed in section 2, as well as the control variables discussed in section 3. Detailed variable definitions, including descriptive statistics, are presented in Table 1. We also control for the gender of the entrepreneur (about 28.7% of founders are female). Empirical findings on the success of ventures started by female entrepreneurs have been mixed. For instance, Cooper et al. (1994) found that firms with a male entrepreneur have a greater probability of high growth, but not of survival.

Table 1 about here

The Portuguese data are particularly useful to examine the influence on start-up performance of unemployment as a possible driver of new firm creation. Portugal displays relatively high levels of necessity-based entrepreneurship when compared with other developed countries (Acs *et al.*, 2005). As an additional way of examining the

¹⁷ Indeed, well-known successful entrepreneurial efforts such as McDonalds and KFC were started by people who were over 50 years old.

differences in outcomes between founders that were previously employed and those who were previously unemployed, we also include variables that check for interaction effects between the employment status of the founder in the year prior to start-up and the variables accounting for pre-entry capabilities.

It should be pointed out, however, that since data are collected on a yearly basis, some problems emerge. Firstly, a founder of a new business in year t who was registered as employed in year $t-1$ might have found employment in between the data collection time in year $t-1$ and the new business start. Someone in these circumstances is recorded by the data as if he/she were starting the firm following employment, when in fact he/she is starting the firm following unemployment. Likewise, a founder of a new business in year t who was registered as unemployed at time $t-1$ might have undergone a short spell of employment in between the data collection time in year $t-1$ and the new business start, and is therefore recorded by the data as if he/she were starting the firm following unemployment, when in fact he/she is starting the firm following employment.

In spite of such limitations, the longitudinal and often all-inclusive nature of large surveys, such as the one used in the present study, are particularly useful to answer research questions where interrelated heterogeneous factors concerning firms and individuals require large, unbiased samples with the possibility to simultaneously investigate a variety of factors (Wennberg, 2005). We therefore believe the approach followed here to be advantageous for the study of the research questions investigated in the present study.

4.2. Methodological approach

Estimation of a conditional Logit model (McFadden, 1974) of the probability of survival allows us to compare the relative significance of industry, firm and entrepreneurial characteristics in determining the chances of short term survival. The Logit model explains the probability of survival by estimating a linear equation of the logarithm of the odds ratio as a function of the explanatory variables. It is therefore possible to calculate estimates for the impact of each variable on the probability of survival using the regression coefficients for the explanatory variables.

5. Results

Estimation results are presented in Table 2. Three models were estimated. Model I assesses the effects on the probability of survival of all variables, including those accounting for the pre-entry capabilities of entrepreneurs and the ones controlling for industry (environmental) and firm-level factors. Model II focuses on the control variables only. Comparison of these two models finds that the inclusion of the variables accounting for pre-entry capabilities of entrepreneurs (entrepreneurial human capital) significantly improves explanatory power.¹⁸ Model III includes also variables that check for interaction effects between the employment status of the founder in the year prior to start-up and the variables accounting for pre-entry capabilities. By using a dummy variable assuming the value 1 when the entrepreneur was employed prior to starting the

¹⁸ A likelihood ratio test confirmed that the inclusion of the variables accounting for pre-entry capabilities of entrepreneurs significantly improves the explanatory power of the model at the 1% significance level.

firm and 0 otherwise, we intend to capture at least partially the effect of opportunity-based entrepreneurship *vis-à-vis* necessity-based entrepreneurship.

Table II about here

5.1. Control Variables

In general, variables controlling for industry and firm-level determinants of survival have the expected effects. Firms entering industries with higher MES have a significantly lower probability of survival, while firms entering industries where entry and exit are easier (i.e. those registering higher rates of entry and exit) also have lower probabilities of survival. Market concentration has a positive significant effect on survival probabilities, which is not too surprising, given the small average size of entrants,¹⁹ unlikely to warrant a reaction from large incumbents in the more concentrated industries (Gelman and Salop, 1983). The ambiguous effect of industry growth on survival probabilities is likely due to the juxtaposition of two different effects: while high market growth rates should favor profitability and, therefore, survival, industries experiencing higher growth rates are also more turbulent, registering high rates of entry and also of exit (the ‘revolving door’ at work), which could decrease the likelihood of survival. Start-ups in industrial sectors are more likely to survive, reflecting the higher levels of turbulence that occurred in the service sectors during the period under analysis, and also the fact that sunk costs associated with sector-specific investments are often higher in industrial sectors, thus making barriers to exit more effective.

¹⁹ The average start-up size (measured in terms of employment) is of about 5.76 employees, while only 19% of firms are started with more than 10 employees.

Survival probability increases significantly with initial size, as expected. Employee human capital has no significant effect on survival when all new firms are considered. However, when a dummy variable assuming the value 1 for firms with more than 10 employees is included in the model, we find that the interaction term between this variable and the human capital variable has a positive and significant effect on survival. This means that the quality of human capital only enhances the chances of survival significantly for relatively large firms (almost double the average initial size).

Firms whose founders are male are more likely to survive, as are firms created by teams of entrepreneurs. While the effect of the gender variables is more likely associated with cultural factors, the fact that teams of entrepreneurs are significantly more likely to survive the critical first years after start-up suggest that there are tangible and intangible features of entrepreneurial human capital that can be added across the members of the entrepreneurial team positive, positively influencing start-up survival and survival in entrepreneurship (as the entrepreneur is our unit of analysis, survival means that both the firm and the founder are still in business after three years).

5.2. Testing the hypotheses: the effects of entrepreneurial backgrounds and pre-entry capabilities on survival

We now discuss how the results contribute to support or reject the hypotheses formulated. Let us start by concentrating on the hypotheses concerning more specific forms of human capital, skipping for now hypotheses H1 and H2. Results from Model I show that start-ups are more likely to survive the critical first three years if founders have some managerial experience, regardless of the sector where this experience took

place, thus confirming hypothesis H3. Human capital associated with experience particular to the industry where the new firm was started is an important determinant of survival. As expected, entrepreneurial spin-offs have a greater chance of survival than other start-ups, and industry experience of founders also contributes to significantly improve survival probabilities, so hypotheses H4 and H5 are also supported by the study.

While firms started by portfolio entrepreneurs (i.e. those who owned at least one other firm at the time of start-up) are significantly more likely to survive (thus confirming hypothesis H6), not all habitual entrepreneurs seem to have better chances of creating successful start-ups. Indeed, entrepreneurial experience in itself does not have a significant effect on survival probability, so hypothesis H7 is not supported. This suggests that the positive effect associated with portfolio entrepreneurs might be more likely to be due to the ability to raise funding (or deploy resources of currently owned firms in the new firm) than with experience as an entrepreneur.

We now concentrate on the hypotheses concerning more general forms of human capital. The results from Model I suggest, at first glance, somewhat puzzling effects. Schooling and work experience have a weakly significant negative effect on survival probability. Another striking result from Model I is that it does not seem to matter for start-up survival whether the entrepreneur was employed prior to starting the firm. Results from Model I suggest that pre-entry capabilities contributing for the early success of new ventures come exclusively from the more specific forms of entrepreneurial human capital, such as industry and managerial experience, being

associated with the spin-off phenomenon and with portfolio, but not serial, entrepreneurship.

5.3. Interaction effects and the role played by necessity-based entrepreneurship

A closer examination of the effects on survival of general entrepreneurial human capital variables is provided by Model III. The variable indicating whether the founder was employed or unemployed before starting the business is used as a moderator (interaction) variable in order to determine whether the effects on new firm survival of pre-entry capabilities of entrepreneurs are different for previously employed than for previously unemployed entrepreneurs. While variables associated with more specific forms of entrepreneurial human capital continue to display a positively significant effect on survival, as in Model I,²⁰ we find that pre-entry experience variables accounting for more general forms of entrepreneurial human capital, such as schooling and work experience, show positively significant effects on survival only for those founders who had been employed before starting-up the new firm. This means that hypotheses H1 and H2 are supported only for founders who were employed before start-up.

These results suggest that in firms started by entrepreneurs who were employed prior to start-up, both general and specific forms of entrepreneurial human capital contribute to increase the probability of surviving the critical first three years after start-up. However, in firms started by entrepreneurs who were unemployed prior to start-up, only more

²⁰ The exception being the spin-off variable, whose positive effect on survival becomes only weakly significant.

specific forms of entrepreneurial human capital matter for survival during the early years.

6. Concluding Remarks

This study sought to examine the role played by pre-entry capabilities associated with the experiences of founders, which are taken as indicators of entrepreneurial human capital, in contributing for the early survival of new businesses. Concepts of general and specific human capital associated with education and experience were used to develop theoretical arguments underpinning hypotheses with regard to the role played by different indicators of entrepreneurial human capital of founders on the early survival chances of new businesses. The dimension of unemployment-driven entrepreneurship was added to the analysis in order to examine the role played by necessity-based entrepreneurship vs. opportunity-based entrepreneurship in determining success.

Using a comprehensive data set linking firms, business owners and employees over time, variables were constructed in order to account for the different kinds of specific and human capital examined, as well as for a series of industry and firm-level control variables. An encompassing model of the determinants of survival probability was therefore built in order to test the hypotheses developed.

Two specific phenomena deserve particular attention in the study, their specific characteristics being associated with the concepts of pre-entry capabilities and entrepreneurial human capital. Firstly, spin-offs (i.e. start-ups founded by entrepreneurs

who were previously employed in the same industry) were deemed likely to personify industry-specific human capital of the entrepreneur; secondly, habitual entrepreneurship (i.e. firms started by entrepreneurs who own, or have owned, other firms) was deemed to represent entrepreneurial human capital resulting from ownership experience.

While, in general, control variables associated with environmental/industry and firm-level conditions were found to have the expected effects on survival probabilities, the role played by entrepreneurial pre-entry capabilities and human capital in influencing early survival probabilities was also significant. Entrepreneurial human capital influencing survival is, first and foremost, of the specific kind, and mostly associated with spin-offs and industry experience, as well as with managerial experience. It seems therefore reasonable to claim that people who have worked (and indeed were employed before start-up) in the industry where they are founding the new firm, and who have had at least some managerial experience, embody the entrepreneurial human capital features which are more likely to contribute to the early success of new businesses.

Entrepreneurial experience in itself does not seem to play a significant role in enhancing survival probability, but firms started by portfolio entrepreneurs (i.e. individuals who owned other firms at time of start-up) do have a significantly higher probability of survival. This last result suggests that any connection between habitual entrepreneurship and the early success of new firms is mostly associated with the ability to deploy resources in the new business, which is likely to be stronger for portfolio entrepreneurs than for serial entrepreneurs (i.e. those who have entrepreneurship experience but did not own another firm at the time of start-up), but not with specific knowledge or human capital.

More general entrepreneurial human capital indicators, such as education and work experience, only display significantly positive effects on survival probabilities when founders were employed prior to starting the new business. We propose that the explanation for these results lies in the origin of the entrepreneurial efforts. For those entrepreneurs more likely to have started their firms as a result of opportunity discovery – having left their current employment in order to take advantage of a recognized opportunity – general human capital significantly influence the chances of survival in the early years. This may be particularly important if the founder lacks more specific entrepreneurial human capital, such as industry-specific or managerial experience. In the cases where a profitable opportunity is being exploited, higher levels of education and a long employment experience may help the entrepreneur in obtaining the required resources and capabilities to sustain the firm during its early years, and also provide him with the abilities required to learn about the market and acquire industry-specific and/or managerial experience more rapidly, while “on the job.”

For those founders who are more likely to have started their firms as an escape from unemployment, only industry-specific experience contributes significantly to enhance survival probabilities. This implies that opportunity recognition and pre-entry capabilities (at least those associated with general human capital) need to be linked: both are necessary conditions for the success of new ventures, at least in the early years after start-up.

We believe these results hold sizeable implications for theory building and policy-making. Pre-entry knowledge of entrepreneurs is a significant determinant of early survival, helping to offset the disadvantages of new entrants – who need to survive

through their early years in order to learn about the market – with respect to established incumbents. Specific human capital acquired through employment in the same industry where the new firm is started, preferably in managerial positions, seems to be more easily translated into useful pre-entry capabilities, making entrepreneurial spin-offs by managers of existing firms the type of start-up with the strongest chances of survival (industry and firm-specific conditions being equal). Moreover, the association between general forms of human capital – such as formal education and work experience – and opportunity exploitation (as opposed to unemployment or necessity-driven entrepreneurship) are likely to help inexperienced entrepreneurs overcome the barrier posed by the critical early years after. These results are important for those in charge of private and public institutions dedicated to assist the development of entrepreneurial start-ups.

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References

- Acs ZJ, Arenius P, Hay M, Minniti M. (Eds.) 2005. *Global Entrepreneurship Monitor–2004 Summary Report*. Babson College & London Business School.
- Adner R, Helfat CE. 2003. Corporate Effects and Dynamic Managerial Capabilities. *Strategic Management Journal* **24**: 1011-1025.
- Agarwal R, Gort M. 1996. The Evolution of Markets and Entry, Exit and Survival of Firms. *Review of Economics and Statistics* **78**: 489-498.
- Alvarez SA, Busenitz LW. 2001. The Entrepreneurship of Resource-based Theory. *Journal of Management* **27**: 755-775.
- Amaral AM, Baptista R. 2007. *Serial Entrepreneurship: Differentiating Direct from Latent Re-entrants*. Mimeo, Center for Innovation, Technology and Policy Research, IN+, Instituto superior Técnico, Technical University of Lisbon.
- Andersson P, Wadensjö E. 2006. *Do the Unemployed Become Successful Entrepreneurs? A Comparison between the Unemployed, Inactive and Wage-Earners*. Discussion paper no. 2402, IZA, Bonn.
- Audretsch DB. 1991. New-Firm Survival and the Technological Regime. *Review of Economics and Statistics* **73**: 441-450.
- Audretsch DB. 1995. Innovation, Growth and Survival. *International Journal of Industrial Organization* **13**: 441-457.
- Audretsch DB, Mahmood T. 1994. The rate of hazard confronting new firms and plants in U.S. manufacturing. *Review of Industrial Organization* **9**: 41-56.
- Audretsch DB, Vivarelli M. 1995. New Firm Formation in Italy. *Economics Letters* **48**: 77-81.
- Bartelsman E, Scarpetta S, Schivardi F. 2005. Comparative Analysis of Firm Demographics and Survival: Evidence from Micro-level Sources in OECD Countries. *Industrial and Corporate Change* **14**: 365-91.
- Barney J. 1991. Firm resources and sustained competitive advantage. *Journal of Management* **17**: 34–56.
- Baptista R, Karaöz M. 2007. *Turbulence in High Growth and Declining Industries*. Mimeo, Center for Innovation, Technology and Policy Research, IN+, Instituto superior Técnico, Technical University of Lisbon.
- Bates T. 1985. Entrepreneur Human Capital Endowments and Minority Business Viability. *Journal of Human Resources* **20**: 540-554.
- Bates T. 1990. Entrepreneur Human Capital Inputs and Small Business Longevity. *Review of Economics and Statistics* **72**: 551-59.
- Blanchflower D, Oswald A. 1998. What Makes an Entrepreneur? *Journal of Labor Economics* **16**: 26-60.
- Boswell J. 1972. *The Rise and Decline of Small Firms*. Allen and Unwin: London.
- Brüderl J, Preisendörfer P, Ziegler R. 1992. Survival Chances of Newly Founded Organizations. *American Sociological Review* **57**: 227–242.

- Bunch D, Smiley R. 1992. Who deters entry? Evidence on the use of strategic entry deterrents. *Review of Economics and Statistics* **74**: 509–521.
- Busenitz LG, Page West III G, Shepherd D, Nelson T, Chandler GN, Zacharakis A. 2003. Entrepreneurship Research in Emergence: Past Trends and Future Directions. *Journal of Management* **29**(3): 285-308.
- Cabral LMB. 1995. Sunk costs, firm size and firm growth. *Journal of Industrial Economics* **43**: 161–172.
- Cabral LMB, Mata J. 2003. On the Evolution of the Firm Size Distribution: Facts and Theory. *American Economic Review* **93**(4): 1075-1090.
- Calvo GA, Wellisz S. 1980. Technology, Entrepreneurs, and Firm Size. *The Quarterly Journal of Economics* **6**: 663-677.
- Carrasco R. 1999. Transitions to and from Self-employment in Spain. *Oxford Bulletin of Economics and Statistics* **61**: 315-41.
- Carroll GR. 1984. Organizational Ecology. *Annual Review of Sociology* **10**: 71-93.
- Caves RE. 1998. Industrial Organization and New Findings on the Turnover and Mobility of Firms. *Journal of Economic Literature* **36**: 1947-1982.
- Caves R, Porter M. 1976. Barriers to Exit. In *Essays in Industrial Organization in Honor of Joe Bain*, Eds. R. Masson and P. Qualss. Ballinger: Cambridge MA.
- Caves R, Porter M. 1977. From entry barriers to mobility barriers: conjectural decisions and contrived deterrence to new competition. *Quarterly Journal of Economics* **41**: 241–261.
- Ciavarella MA, Buchholtz AK, Riordan CM, Gatewood RD, Stokes GS. 2004. The Big Five and venture survival: Is there a linkage? *Journal of Business Venturing* **19**: 465-483.
- Colombo M, Delmastro M, Girilli L. 2004. Entrepreneurs' human capital and the start-up size of new technology-based firms. *International Journal of Industrial Organization* **22**: 1183-1211.
- Conner KR, Prahalad, CK. 1996. A Resource Based Theory of the Firm: Knowledge versus Opportunism. *Organization Science* **7**(5): 477-501.
- Cooper AC, Gimeno-Gascon FJ, Woo CY. 1994. Initial Human and Financial Capital as Predictors of New Venture Performance. *Journal of Business Venturing* **9**: 371-395.
- Cowling M. 2000. Are Entrepreneurs Different Across Countries? *Applied Economic Letters* **7**: 785-789.
- Dahl M, Reichstein T. 2007. Are You Experienced? Prior Experience and the Survival of New Organizations. *Industry and Innovation* **14**(5), Forthcoming.
- Delmar F, Shane S. 2004. Legitimizing First: Organizing Activities and the Survival of new ventures. *Journal of Business Venturing* **19**: 385–410.
- Disney R, Haskel J, Helden Y. 2003. Entry, Exit and Establishment Survival in UK Manufacturing. *Journal of Industrial Economics* **51**: 91-112.

- Eaton B, Lipsey R. 1980. Entry barriers are exit barriers: the durability of capital as a barrier to entry. *Bell Journal of Economics* **11**: 721–729.
- Eckhardt JT, Shane SA. 2003. Opportunities and Entrepreneurship. *Journal of Management* **29**: 333-349.
- Eisenhardt KM, Martin JA. 2000. Dynamic Capabilities: What Are They? *Strategic Management Journal* **21**: 1105-1121.
- Evans DS. 1987. The Relationship Between Firm Growth, Size and Age: Estimates for 100 Manufacturing Industries. *Journal of Industrial Economics* **35**: 567-581.
- Evans DS, Jovanovic B. 1989. An Estimated Model of Entrepreneurial Choice under Liquidity Constraints. *Journal of Political Economy* **97**(4): 808-827.
- Evans LB, Leighton LS. 1990. Small Business Formation by Unemployed and Employed Workers. *Small Business Economics* **2**: 319-30.
- Freeman J, Carroll G, Hannan M. 1983. The Liability Of Newness - Age Dependence in Organizational Death Rates. *American Sociological Review* **48**: 692-710.
- Garvin DA. 1983. Spin-offs and the New Firm Formation Process. *California Management Review* 3-20.
- Gelman J, Salop S. 1983. Judo economics: capacity limitation and coupon competition. *Bell Journal of Economics* **14**: 315–325.
- Geroski PA. 1995. What Do We Know About Entry? *International Journal of Industrial Organization* **13**: 421- 440.
- Gimeno J, Folta TB, Cooper AC, Woo CY. 1997. Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly* **42**: 750-783.
- Grant R. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal* **17**: 109–122.
- Hall B. 1987. The relationship between firm size and firm growth in the United States manufacturing sector. *Journal of Industrial Economics* **35**: 583–606.
- Hambrick DC, Mason PA. 1984. Upper Echelons: The Organization as a Reflection of Its Top Managers. *The Academy of Management Review* **9**: 193-206.
- Hambrick DC, Seung Cho T, Chen MJ. 1996. The Influence of Top Management Team Heterogeneity on Firms' Competitive Moves. *Administrative Science Quarterly* **41**: 659-84.
- Hannan M. 1998. Rethinking Age Dependence in Organizational Mortality: Logical Formalizations. *American Journal of Sociology* **104**: 126 – 164.
- Hannan MT, Carroll G. 1992. *Dynamics of Organizational Populations*. Oxford University Press: Oxford.
- Hannan MT, Freeman J. 1986. Where do Organizational Forms come from? *Sociological Forum* **1**: 50-57.

- Haverman H. 1995. The Demographic Metabolism of Organizations: Industry Dynamics, Turnover, and Tenure Distributions. *Administrative Science Quarterly* **40**: 586–618.
- Helfat CE. 2000. Guest Editor's Introduction to the Special Issue: the Evolution of Firm Capabilities. *Strategic Management Journal* **21**: 955-959.
- Helfat CE, Lieberman MB. 2002. The Birth of Capabilities: Market Entry and the Importance of Pre-history. *Industrial and Corporate Change* **11**: 725–760.
- Helfat CE, Peteraf MA. 2003. The Dynamic Resource-based View: Capability Lifecycles. *Strategic Management Journal* **24**: 997-1010.
- Jovanovic B. 1982. Selection and Evolution of Industry. *Econometrica* **50**: 649-670.
- Klepper S. 2001. Employee Start-ups in High-Tech Industries. *Industrial and Corporate Change* **10**: 639-674.
- Klepper S. 2002. The Capabilities of New Firms and the Evolution of the US Automobile Industry. *Industrial and Corporate Change* **11**: 645-666.
- Klepper S, Simons KL. 2000. Dominance by Birth Right: Entry of Prior Radio Producers and Competitive Ramifications in the U.S. Television Receiver Industry. *Strategic Management Journal* **21**: 997-1016.
- Levinthal D, Myatt J. 1994. Co-evolution of Capabilities and Industry: the Evolution of Mutual Fund Processing. *Strategic Management Journal* **15**: 45-62.
- Littunen H, Streamer E, Nenonen T. 1998. Survival of Firms Over the Critical First Three Years and The Local Environment. *Entrepreneurship & Regional Development* **10**: 189-202.
- Markides CC, Williamson PJ. 1996. Corporate Diversification and Organizational Structure: A Resource-Based View. *Academy of Management Journal* **39**: 340-367.
- Mata J, Portugal P. 1994. Life Duration of New Firms. *Journal of Industrial Economics* **42**: 227–246.
- Mata J, Portugal P. 2002. The Survival of New Domestic and Foreign-Owned Firms. *Strategic Management Journal* **23**: 323-343.
- Mata J, Portugal P, Guimarães P. 1995. The Survival of New plants: Entry Conditions and Post-entry Evolution. *International Journal of Industrial Organization* **13**: 459–482.
- McFadden D. 1974. Conditional Logit Analysis of Qualitative Choice Behavior. In *Frontiers in Econometrics*, Zarembka P (Ed.). Academic Press: New York: 105–142
- McGrath RG, Macmillan I. 2000. *The Entrepreneurial Mindset*. Harvard Business School Press: Boston, MA.
- Michel JG, Hambrick DC. 1992. Diversification Posture and Top Management Team Characteristics. *Academy of Management Journal* **35**: 9-37.
- Montgomery CA. 1994. Corporate Diversification. *Journal of Economic Perspectives* **8**: 163-178.

- Murray AI. 1989. Top Management Group Heterogeneity and Firm Performance. *Strategic Management Journal* **10**: 125-41.
- Oxenfeldt AR. 1943. *New Firms and Free Enterprise: Pre-War and Post-War Aspects*. American Council on Public Affairs: Washington.
- Peteraf MA. 1993. The Cornerstones of Competitive Advantage: a Resource-based View. *Strategic Management Journal* **14**: 179-191.
- Pfeiffer F, Reize F. 2000. Business Start-ups by the Unemployed – An Econometric Analysis Based on Firm Data. *Labour Economics* **7**: 629-63.
- Phillips DJ. 2002. A Genealogical Approach to Organizational Life Changes: The Parent-Progeny Transfer among Silicon Valley Law Firms, 1946-1996. *Administrative Science Quarterly* **47**: 474-506.
- Preisendörfer P, Voss T. 1990. Organizational Mortality of Small Firms: The Effects of Entrepreneurial Age and Human Capital. *Organizational Studies* **11**: 107-129.
- Rees H, Shah A. 1986. An Empirical Analysis of Self-employment in the U.K. *Journal of Applied Econometrics* **1**: 101-108.
- Roberts EB. 1991. *Entrepreneurs in High Technology*. Oxford University Press: New York.
- Romanelli E. 1989. Environments and Strategies at Startup: Effects on Early Survival. *Administrative Science Quarterly* **34**: 369–387.
- Santarelli E, Vivarelli M. 2006. *Entrepreneurship and the Process of Firms' Entry, Survival and Growth*. Discussion paper no. 2475, IZA, Bonn.
- Shane S. 2000. Prior Knowledge and the Discovery of Entrepreneurial Opportunities. *Organization Science* **11**: 448-469.
- Sharma A, Kesner I. 1996. Diversifying Entry: Some Ex Ante Explanations for Post-Entry Survival and Growth. *Academy of Management Journal* **39**: 635–677.
- Schmalensee R. 1989. Inter-Industry Studies of Structure and Performance. In *Handbook of Industrial Organization*, Schmalensee R, Willig R (Eds). North-Holland: Amsterdam: 951–1010.
- Schumpeter JA. 1934. *The Theory of Economic Development*, Harvard University Press: Cambridge, MA (translation from the German 2nd Edition, 1912).
- Siegfried J, Evans L. 1994. Empirical Studies of Entry and Exit: a Survey of the Evidence. *Review of Industrial Organization* **9**: 121–156.
- Sluis JV, Praag, MV, Vijverberg W. 2005. Entrepreneurship, Selection and Performance: A Meta-analysis of the Impact of Education in Less Developed Countries. *World Bank Economic Review* **19**: 225-261
- Stam E, Audretsch DB, Meijaard 2006. *Renasant Entrepreneurship*. Discussion Paper on Entrepreneurship, Growth and Public Policy #06/06. Max Planck Institute of Economics, Jena, Germany.
- Stinchcombe A. 1965. Social Structures and Organizations. In *Handbook of Organizations*, March J (Ed.). Rand McNally: Chicago, IL: 142–193.

- Storey DJ. 1991. The Birth of New Firms – Does Unemployment Matter? A Review of the Evidence. *Small Business Economics* **3**: 167-78.
- Storey DJ, Jones AM. 1987. New Firm Formation – A Labor Market Approach to Industrial Entry. *Scottish Journal of Political Economy* **34**: 37-51.
- Teece D. 1998. Capturing Value from Knowledge Assets: the New Economy, Markets for Know-how and Intangible Assets. *California Management Review* **40**: 55–79.
- Teece DJ, Pisano G, Shuen A. 1997. Dynamic Capabilities and Strategic Management. *Strategic Management Journal* **18**: 509-533.
- Ucbasaran D, Wright M, Westhead P. 2003. A Longitudinal Study of Habitual Entrepreneurs: Starters and Acquirers. *Entrepreneurship & Regional Development* **15**: 207-228.
- Wagner J. 1994. The Post-entry Performance of New Small Firms in German Manufacturing industries. *Journal of Industrial Economics* **42**: 141– 154.
- Wennberg K. 2005. Entrepreneurship Research through Databases: Measurement and Design Issues. *New England Journal of Entrepreneurship* **8**: 9-21.
- Wernerfelt B. 1984. A Resource-based View of the Firm. *Strategic Management Journal* **5**: 171-180.
- Westhead P, Wright M. 1998. Novice, Portfolio, and Serial Founders: Are They Different? *Journal of Business Venturing* **13**: 173–204.
- Westhead P, Ucbasaran D, Wright M, Binks M. 2005. Novice, Serial and Portfolio Entrepreneur Behavior and Contributions. *Small Business Economics* **25**: 109–132.
- Youndt M, Snell S, Dean J, Lepak D. 1996. Human Resource Management, Manufacturing Strategy and Firm Performance. *Academy of Management Journal* **39**: 836-866.

Table 1: Variable definitions and descriptive statistics

Variable	Description	Mean	Std. Dev.
Survival	Dependent variable, equals 1 if the firm survives, 0 if the firm exits after 3 years	0.735	0.435
Gender	Dummy variable: 1 for male entrepreneurs, 2 for female entrepreneurs	1.287	0.452
Schooling	Number of years of education of the entrepreneur	3.552	1.685
Work experience	Number of years of experience of the entrepreneur as a paid employee	1.944	2.347
Spin-off	Dummy variable: 1 if the entrepreneur was employed in the same sector in the year prior to start-up	0.452	0.23
Industry experience	Number of years of experience of the entrepreneur in the industry (three-digit level) of the start-up	1.303	2.098
Managerial Experience	Dummy variable: 1 if the entrepreneur had a managerial employment qualification for at least one year	0.458	0.204
Entrepreneurship experience (Habitual)	Number of years of experience of the entrepreneur as a business owner	0.581	1.443
Multi-business owner (Portfolio)	Dummy variable: 1 if the entrepreneur owned one or more other businesses in the year of start-up	0.121	0.327
Employed in previous year	Dummy variable: 1 if the entrepreneur was employed in the year prior to start-up	0.645	0.43
Firm size	Logarithm of the number of employees of the start-up	1.481	0.750
Firm size dummy	Dummy variable: 1 for firms started with more than 10 employees, 0 for smaller firms	0.190	0.392
Existence of partner in ownership	Dummy variable: 1 for firms started by more than one individual, 0 for firms started by one individual only	0.532	0.498
Employee human capital	Employee human capital, measured as the percentage of employees with tertiary education	0.047	0.153
MES	Minimum efficient scale for the industry, measured following Lyons (1980) ^a	1.023	1.573
Industry growth	Average industry growth rate (in employment) over three years after start-up (x100)	17.033	13.891
Industry concentration	Herfindhal concentration index for the industry (x100)	40.546	163.039
Entry rate	Industry entry rate in the year of start-up divided by the average entry rate for all industries (x100)	189.654	441.615
Industry dummy	Dummy variable: 1 for industrial firms, 0 for services	0.21	0.40
Effect of human capital in firms with more than 10 employees	Product interaction between employee human capital and dummy variable for firm size	0.0059	0.0501
Effect of employment experience when business owner was employed	Product interaction between employment experience and dummy for employment prior to start-up	0.7778	1.881
Effect of entrepreneurship experience when business owner was employed	Product interaction between ownership experience and dummy for employment prior to start-up	0.0871	0.5897
Effect of industry experience when business owner was employed	Product interaction between industry-specific experience and dummy for employment prior to start-up	0.5796	1.5985
Effect of business owner education when business owner was employed	Product interaction between education and dummy for employment prior to start-up	0.9398	1.8392

^a - Logarithm of one half of the size of the firms that, on average, operate 1.5 plants or more.

Table 2: Results – Logit models of the probability of survival^b

	I		II		III	
Gender	-0.097*	(-1.76)			-0.1072*	(-1.71)
Schooling	-0.340*	(-1.94)			-0.3255	(-1.08)
Work experience	-0.0209*	(-1.85)			-0.0399***	(-2.58)
Spin-off	0.0859***	(5.84)			0.0393*	(1.74)
Industry experience	0.0859***	(5.84)			0.0393**	(2.21)
Managerial Experience	0.0390***	(5.11)			0.0382***	(4.29)
Entrepreneurship experience (Habitual)	-0.237	(-1.24)			-0.0117	(-0.47)
Multi-business owner (Portfolio)	0.3444***	(3.63)			0.4159***	(3.61)
Employed in previous year	-0.067	(-1.04)			-0.5296***	(-2.76)
Firm size	0.4244***	(10.29)	0.477***	(11.85)	0.3047***	(3.79)
Firm size dummy					0.0313	(0.848)
Existence of partner in ownership	0.217***	(4.12)	0.203***	(3.92)	0.1688***	(2.73)
Employee human capital	-0.0592	(-0.34)	0.172	(1.06)	-0.2812	(-1.36)
MES	-0.0778**	(-2.30)	-0.075**	(-2.28)	-0.1918***	(-4.33)
Industry growth	0.0021	(0.94)	0.0024	(1.13)	0.0038	(1.46)
Industry concentration	0.000796**	(2.17)	0.00077**	(2.17)	0.0021***	(4.19)
Entry rate	-0.0018***	(-2.91)	-0.0001**	(-2.31)	-0.0002***	(-2.56)
Industry dummy	0.1670**	(2.03)	0.181**	(2.24)	0.4403***	(4.31)
Effect of employee human capital on survival in firms with more than 10 employees					2.0548**	(2.16)
Effect of work experience on survival when business owner was employed prior to start-up					0.0399**	(2.04)
Effect of entrepreneurship experience on survival when business owner was employed prior to start-up					0.0341**	(2.64)
Effect of industry experience on survival when business owner was employed prior to start-up					0.0699**	(2.05)
Effect of education on survival when business owner was employed prior to start-up					0.0787*	(1.87)
Constant	0.530*	(1.78)	-0.1627	(-0.65)	0.7735**	(2.20)
N° of observations		8957		9110		6371
Log likelihood		-4884.8		-5033.4		-3670.2
χ^2		345.03		251.86		256.40

^b - Values in parentheses are Z-values (t-ratios).

*** - significant at 99% confidence level;

** - significant at 95% confidence level;

* - significant at 90% confidence level.