Entrepreneurial Human Capital and the Early Survival Chances of New Start-ups: Opportunity-based *vs.* Necessity-based Entrepreneurship

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Abstract: We build an encompassing model of the determinants of short term survival of new firms based on three kinds of factors: industry-level; firm-level; entrepreneurial-level. It is found that: firm and industry characteristics have the expected effects on the probability of survival, based on the existing literature; entrepreneurial background variables such as education, professional experience and industry experience only display significant positive effects on survival probabilities when the business owner was in employment before starting the new firm. It is suggested that the explanation for these results lies in the origin of the entrepreneurial efforts. Entrepreneurial human capital significantly influences the chances of survival for new business owners that leave their current employment in order to take advantage of a recognized opportunity; but have no influence on the chances of success of business owners who started their new firms out of necessity, or as a "refuge" from unemployment.

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1. Introduction

Entry of new competitors is deemed to be an important phenomenon leading to the introduction of new products and processes, and to bring about competitive discipline into markets. It has been argued that start-ups bring about positive indirect supply-side effects (spillovers) through innovation and increased competitive pressure, leading to greater competitiveness and employment growth in the medium-long run (Fritsch and Mueller, 2004). Since not all entrants are equally efficient and/or innovative, the magnitude of the positive spillovers imparted on the economy by new firm entry should depend on the "quality" of new entrants (Baptista *et al.*, 2006). Although it is not strictly required that new firms survive in order to impart supply-side spillovers that would increase overall competitiveness, innovation and employment, it seems reasonable to expect that firms that survive the market selection process in the first years of existence are more likely to be sources of positive impacts on the economy.

In the present paper, we analyze the determinants of the short term survival (with regard to the first three years after start-up) of new firms, focusing in particular on the background of the founders. Unlike the more frequent survival analyses that can be found in the Economics, Business, and Industrial Ecology literatures (see Caves, 1998 for a review), we use the business owner and not the firm as the unit of analysis. This allows us to build an encompassing model of survival determinants. We follow an eclectic approach, the hypotheses to be developed further ahead being drawn from different strands of the literature, such as Industrial Organization, Organizational Ecology and the Resource-Based View of the Firm. In our model, survival is based on three kinds of factors.

- Firm-level determinants of survival, such as size, age and human capital, as proposed by, for instance, Evans (1987); Teece *et al.* (1997); and Mata and Portugal (2002);
- Industry-level determinants of survival, such as market growth and turbulence, concentration, and the extent of scale economies and barriers to entry, as proposed by, among others, Mata and Portugal (1994, 2002), Mata *et al.* (1995), and Agarwal and Gort (1996);

- Business owner, or entrepreneur-level determinants of survival: determinants of "entrepreneurial human capital" such as education, industry-specific and leadership experience (as owner and/or manager) have been found to influence new businesses' chances of success by authors such as Bates (1985, 1990), Brüderl *et al.* (1992), and Dahl and Reichstein (2005).

In order to test the hypotheses formulated in our model we explore a longitudinal matched employer-employee data set. By focusing our analysis on the owners of start-ups, we are able to track their backgrounds, thereby building substantial information on their past professional, business ownership and industry experience, allowing us to build several measures of entrepreneurial human capital. In particular, we are able to distinguish between entrepreneurs who give up their current employment in order to start a business from those who start businesses following an unemployment spell – it seems reasonable to expect that the former are considerably more likely to be starting a business to exploit a discovered opportunity than the latter, who should be more likely to be starting a firm out of necessity.

By estimating a model of the probability of survival it is possible to compare the relative significance of industry, firm and entrepreneurial characteristics in determining start-up's early chances of survival. This research has important implications both for practitioners and policy makers. First, to our knowledge no study attempting to ascertain the importance of entrepreneurial human capital *vis-à-vis* other factors in determining the chances of survival for newly-founded businesses covers such an encompassing set of factors while covering all sectors of an economy. Furthermore, by looking at the chances of survival in the crucial early years after start-up, it provides insights on the kind of support needed by struggling young firms in order to survive the market selection process and contribute more effectively to an overall increase in competitiveness and employment.

The rest of the paper is organized as follows. In the next section we start by reviewing the relevant literature, and by establishing the hypotheses to be tested. In the third section we present the data and statistical model used to estimate the effects of the different factors on the probability of survival. The fourth section presents and discusses the results. Finally, section five offers some concluding remarks.

2. The Determinants of Survival

The early years after start-up are key for a firm's future. Both economists and organizational ecologists predict that younger firms confront higher probabilities of exit than their older counterparts. In market selection theories firms are taken to be unsure about their competencies prior to entry. 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).

Organizational ecologists speak of "liability of newness" (Stinchcombe, 1965; Freeman *et al.*, 1983; Hannah, 1998) to describe the stylized fact that hazard rates decline monotonically with age as firms learn and adapt. In general, organizational ecologists argue that firms need time 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. Since it takes some years to develop specific knowledge, trust and appropriate routines, it follows that newly formed firms are likely to be less able to cope with environmental challenges than longer established organizations. Hence, survival rates are likely to be lower for young firms (Carroll and Hannan, 2000). Organizational ecologists have also proposed explanations for different patterns of exit over time under the label of different "liabilities", namely those of adolescence and obsolescence (Henderson 1999). In particular, Brüderl and Schüssler (1990) describe the "liability of adolescence" as follows: early on, firms live on a stock of initial resources while they monitor performance, postponing judgment about success or failure; in a later phase, firms are subject to the usual risks of failure, leading to an inverse U-shaped hazard curve. However, this phenomenon registers only in the first few months after start-up.

Mortality rates vary consistently across firms and industries/sectors, regardless of age. An extensive literature has been built up in the last decade and a half examining firm-level and industry-level determinants of survival. We now discuss briefly the main results from these studies, using them to generate hypotheses to be tested in our study.

2.1. Industry-level determinants of survival

Studies by Audretsch (1991, 1995), Mata and Portugal (1994; 2002), Wagner (1994), Mata *et al.* (1995), and Audretsch and Mahmood (1994), among others, suggest four main industry-level variables influencing survival:

- Economies of scale;
- Barriers to entry;
- Market concentration;
- Industry growth.

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 a new firm. Hence, the following hypothesis can be formulated:

H1: firms entering industries where the MES is larger face a lower probability of survival.

Studies in Organizational Ecology and Industrial Organization have found that 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 to be expected. Industrial economists emphasize that entry barriers are exit barriers (Caves and Porter 1977), and that the magnitude and irreversibility associated with investments, which deter entry, also hinder exit (Eaton and Lipsey, 1980). There is plenty of evidence of a positive correlation between entry and exit across markets, reflected in several studies of entry and exit rates, and of turbulence (as measured by the sum of entry and exit rates) – see, for instance: Beesley and Hamilton (1984); Dunne *et al.* (1988); Siegfried and Evans (1994); Baptista and Karaöz (2006).

Mata and Portugal (1994) observed that this positive correlation of entry and exit rates is due, in large part, to the early exit of entrants in industries characterized by high entry flows. Entry barriers exert different effects depending on the particular characteristics of the entrants (Caves and Porter, 1977). The small size of many

entrants may not be perceived as enough of a threat to trigger retaliation by incumbents. Geroski (1995) suggested that, while it would be expected that entry barriers should increase survival chances of incumbents by deterring potential entrants, they may actually pose more of a barrier to survival than a barrier to entry. Hence, this discussion leads to the following hypotheses:

H2: firms entering industries with higher rates of entry face a lower probability of survival.

The literature allows for different kinds of arguments to be made about the effect of concentration and the intensity of competition in the market on survival prospects. Organizational Ecology scholars (*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 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 emphasized that, while higher levels of concentration would increase the effectiveness of incumbent retaliation, thus decreasing the probability of survival (Audretsch 1991), the small size of entrants may not justify a reaction from incumbents (Gelman and Salop 1983).

Not surprisingly, given the mix of opposite effects suggested in the literature, the evidence relating the survival of firms to market concentration is 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. Mata an Portugal (2002) found a positive, but barely significant effect of concentration on survival. Given the lack of theoretical propositions and empirical evidence underpinning a conclusive direction for the effect of concentration on survival, no hypotheses are formulated with regard to this relationship.

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 are also more turbulent, registering high rates of both entry and exit (Agarwal and Gort, 1996). Audretsch and Mahmood (1994), and Mata and Portugal (1994, 2002) both found a positive and significant effect of industry growth on the survival of new firms. The following hypothesis can then be formulated:

H3: firms entering industries with higher growth rates have a higher probability of survival.

2.2. Firm-level determinants of survival

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 be small in order to avoid incumbents' aggressive behavior – by choosing to enter at a small scale, entrants increase the incumbents' cost of aggressive behavior relative to its expected benefit and thus reduce the likelihood of retaliation. Second, new firms may be small because of uncertainty with regard to their own abilities. 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 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 lacked 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 to 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 (Dunne *et al*.,1989; Mata and Portugal, 1994, 2002; Audretsch and Mahmood, 1994; Haverman, 1995; Sharma and Kesner, 1996).

Regardless of the reasons that might have led to the choice of the entry scale before actual entry, the fact remains that the sunk costs incurred by entrants that have chosen to enter at larger scale are normally greater than the corresponding costs incurred by smaller entrants. Therefore, smaller entrants face lower barriers to exit and should be more likely to exit than larger ones (Sharma and Kesner, 1996). We can therefore postulate that:

H4: 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 and/or strategies 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 which develop firm-specific assets which cannot be imitated by competitors and provide the basis for their competitive advantage (Wernerfelt, 1984; Barney, 1991).

The development of these firm-specific assets is often associated with the fact that those firms conduct R&D activities. These activities may have considerable spillovers to the whole firm and transform the firms' competences in other areas (Geroski *et al.*, 1993). A number of authors have pointed out that 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; Autor *et al.*, 1998). Empirical work by Audretsch (1995), Audretsch and Mahmood (1994) and, more recently, Cefis and Marsili (2005), has found evidence that firms who innovate are more likely to survive longer.

Tacit knowledge, embodied in human beings, is the foundation for firm-specific assets that are 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) states that knowledge exists only in individuals, and an important way of acquiring knowledge and developing the ability to generate new knowledge is through formal education. This suggests that schooling may be seen as an indicator of the quality of human capital. Mata and Portugal (2002) argue that the education of a firm's workforce can be regarded as a measure (albeit imperfect) of ownership advantages. Empirical studies of survival by Brüderl *et al.* (1991) and Mata and Portugal (2002) have found that the amount of human capital has a significant and positive effect on firm survival chances. The following hypothesis can then be formulated:

H5: firms with higher levels of employee human capital have a greater probability of survival.

Other evidence with regard to the effect of organizational characteristics and/or strategies on survival probabilities is somewhat limited. While some studies have linked organizational strategies to new firm survival (see, for instance, Brüderl *et al.*, 1991; Delmar and Shane, 2004), there is insufficient systematic evidence on the relationship between survival and specific strategies.

2.3. Entrepreneurial human capital and new firm survival

The concept of entrepreneurial human capital is implicit in several empirical studies of the survival chances of new businesses, both in the domain of Organizational Ecology and in Economics. These studies examine the effects of the founders' education, career history, family and occupational background (Boswell, 1972; Bates, 1985, 1990; Preisendörfer and Voss, 1990; Brüderl *et al.*, 1991; Cooper *et al.*, 1994; Gimeno *et al.*, 1997; Dahl and Reichstein, 2005).

Brüderl *et al.* (1991) argue that greater entrepreneurial human capital enhances the productivity of the founder, which results in higher profits and, therefore, lower probability of early exit. Higher productivity of the founder means the business owner is more efficient in organizing and managing operations or is able to attract more customers, negotiate better contracts with suppliers and raise more capital from investors. It can then be argued that entrepreneurial human capital increases efficiency and plays an important role in the market selection process (the environment selects on the basis of entrepreneurial human capital). Taking our cue from Jovanovic's

(1982) model of market selection, it is also possible to claim that entrepreneurs with greater human capital will be less uncertain about their efficiency and will be able to learn faster about market conditions, adjusting capacity therefore reducing the probability of exit.

Effects of entrepreneurial human capital on the probability of new firm success may occur prior to the founding of the business. Based on their higher earnings and more prestigious professional status as employees, people with higher human capital are in a position to raise more capital and set up larger and better-equipped businesses (Colombo *et al.*, 2004). They may also be better able to detect profitable market opportunities that are still unexplored, and to obtain relevant information about market conditions (thereby reducing uncertainty about their efficiency).

In contrast, people with few human capital resources are often forced into self-employment. While 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 started their business as a "refuge" from unemployment do it in order to achieve conditions for subsistence.

The distinction between "opportunity-based" and "necessity-based" entrepreneurial activity has been given highlighted by surveys conducted by the Global Entrepreneurship Monitor (GEM) as a way to distinguish between countries where new firm creation occurs mostly due to opportunity recognition from those where new firm creation occurs mostly to escape unemployment (see, for instance, Acs *et al.*, 2005). If unemployment is the main incentive for setting up a business, there may not be time to look for good opportunities, make detailed plans, and seek advice. Thus, independent from productivity and/or learning effects that occur after start-up, chances of survival may be affected by selection effects occurring prior to start-up. Hence, the first hypothesis to be formulated with regard to entrepreneurial human capital is as follows:

H6: firms whose founder was previously unemployed have a lower probability of survival.

Becker (1975) distinguishes between "general" and "specific" human capital. Although certain components of human capital important for employees do not necessarily apply for entrepreneurs, we expect measures of entrepreneurial human

capital to exhibit effects similar to those for human capital earnings functions. In order to examine entrepreneurial human capital we use the traditional measures of general human capital: years of schooling and years of work experience (see Brüderl *et al.*, 1991), formulating the following hypotheses:

H7: firms whose founder has more years of schooling have a greater probability of survival.

H8: firms whose founder has more years of work experience have a greater probability of survival.

Following Preisendörfer and Voss (1990), we account for specific human capital by measuring the number of years of experience in the same industry of the start-up (industry-specific experience) and the number of years of previous experience as a business owner (entrepreneur-specific human capital). The role played by both factors is a recurrent theme in past research on organizational success and survival (Brüderl *et al.*, 1991; Cooper *et al.*, 1994). The following hypotheses are then formulated:

H9: firms whose founder has more years of industry-specific experience have a greater probability of survival.

H10: firms whose founder has more years of business ownership experience have a greater probability of survival.

One of the findings of the literature that has examined the survival of entrants is that the effects of the determinants of survival are different depending on whether entry is attempted by a new or by an already established firm (Dunne *et al*., 1989; Audretsch and Mahmood, 1994; Mata *et al.*, 1995). Being owned by an already existing firm (or being started by an entrepreneur who already owns one or more firms) may give the new venture several types of advantage. In particular, portfolio entrepreneurs (Westhead and Wright, 1998; Westhead *et al.*, 2005) are less likely to suffer from lack of financial resources to start the firm. Hence, the following hypothesis can also be formulated:

H11: firms whose founder owns one or more other businesses have a greater probability of survival.

Finally, we control for the gender of the entrepreneur. 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.

Before proceeding to the next section, it should be pointed out that some studies have looked at the relationship between new firm performance and entrepreneurial traits, instead of entrepreneurial human capital. Relating entrepreneurial personality traits to new firm survival has fared less well than would be expected. For instance, Ciavarella *et al.* (2004) have found that, of the "big five" personality attributes of entrepreneurs (Digman 1990) – extraversion; emotional stability, agreeableness; conscientiousness; and openness to experience – only conscientiousness (efficiency, dependability) was found to influence survival positively, while openness (intelligence, innovativeness) was found to decrease survival chances. In a recent study, Stam *et al.* (2006) do not find significant correlations between measures of both risk tolerance and locus of control, and the probability of exit prior to and after starting a business.

3. Data and Methodology

In order to test the hypotheses in the model we explore the SISED database (*Quadros de Pessoal*), a longitudinal matched employer-employee data set built on the basis of mandatory information submitted by firms to the Portuguese Ministry of Employment and Social Security covering the period from 1986-2002. By focusing our analysis on the business owners of start-ups in the years 1995-1996, we are able to track their background over eight years, thereby building substantial information on their past professional, entrepreneurial and industry-specific experience. A control variable is included to identify partnerships, *i.e.* firms with more than one business owner. 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.

The nature of the database also enables us to construct variables that account for the firm-level and industry-level factors affecting survival, as described in the previous section. Variable definitions, including descriptive statistics, are presented in Table 1.

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 [P(S)] by estimating a linear equation of the logarithm of the odds ratio (O) as a function of the explanatory variables. It is therefore possible to calculate estimates for the impact of each variable on the odds of survival using the regression coefficients:

$$\text{Log}(O) = \text{Log}\{P(S)/[1-P(S)]\} = \alpha + \beta.X \quad (1)$$

$$O = \exp(\alpha + \beta.X) \quad (2)$$

Where X is a vector of explanatory variables.

The Portuguese data is particularly useful to examine the role played by necessity-based entrepreneurship, as opposed to opportunity-based entrepreneurship, on survival patterns. Portugal, similarly to other Southern European regions, displays relatively high levels of business ownership but relatively low levels of opportunity-based entrepreneurship as measured by the Global Entrepreneurship Monitor (Acs *et al.*, 2005). This is usually connected with a strong tradition of business ownership and also with a "refugee" effect by which people start small firms as a way to escape unemployment (Baptista *et al.*, 2005).

4. Results

Estimation results are presented in Table 2. Three models were estimated. Model I estimates the effects on the probability of survival of all industry-level, firm-level, and entrepreneurial human capital factors. Model II excludes entrepreneurial human capital factors in order to check their significance as a whole. Comparison of the two models using a likelihood ratio test finds that the inclusion of entrepreneurial human capital variables significantly improve the explanatory power of the model.

Model III includes variables that check the interaction effects between the employment situation of the entrepreneur in the year prior to the start-up and other entrepreneurial human capital variables. By using a dummy variable that assumes the value 1 when the entrepreneur was employed prior to starting the firm, and 0 otherwise, we intend to capture at least partially the effect of opportunity-based entrepreneurship *vis-à-vis* necessity-based entrepreneurship. Although we cannot know for sure, it is reasonable to assume that the likelihood that an entrepreneur who

was employed prior to start-up – and therefore has to give up his job in order to start the new business – is doing so to explore an opportunity is much higher than for an entrepreneur who was previously unemployed[1].

We find that, in general, industry-level (environmental) characteristics have the expected effects on the probability of survival, based on the hypotheses formulated. Firms entering industries with higher MES have a significantly lower probability of survival, thus confirming hypothesis H1. Firms entering industries registering higher rates of entry (and, therefore, of turbulence) also have lower probabilities of survival, so hypothesis H2 is also verified.

Market concentration has a positive significant effect on survival probabilities, contradicting the prediction that in highly concentrated markets incumbents are more likely to retaliate against entrants (Bunch and Smiley, 1992). This is not too surprising, given the small average size of entrants, which might not justify a reaction from incumbents, as suggested by Gelman and Salop (1983).

Higher rates of industry growth only have significantly positive effect on survival when entrepreneurial human capital factors are excluded form the model. The ambiguity of results with regard to the effect of industry growth on survival probabilities, giving only partial support to hypothesis H3, 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, which could decrease the likelihood of survival.

The dummy variable controlling for industrial versus service firms is significantly positive, meaning that firms started in industrial sectors are more likely to survive. This likely reflects the higher levels of turbulence (entry and exit) that occurred in the service sectors during the period under analysis, and also the smaller average size of new service firms.

Turning to firm-level variables, survival probability significantly increases with initial size, thus corroborating hypothesis H4. Human capital, as measured by the percentage

[1] Likewise, the likelihood that entrepreneurs starting new firms following an unemployment spell are starting them out of necessity, is much higher than for entrepreneurs who were previously employed. It should pointed out, however, that since the data is collected anually, an individual may change his or her employment status more than once in the interval between the two data collection stages.

of employees with tertiary education, has no significant effect. However, 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 dummy variable and the human capital variable has a positive and significant effect on survival. This means that the quality of human capital only significantly enhances the chances of survival for relatively large firms (starting with more than 10 employees, almost double the average initial size of 5,76). Hence, hypothesis H5 is only partially substantiated.

Adding entrepreneurial background factors to the model provides important insights with regard to the market selection process in the first few years after start-up. One striking result from the estimation of model I is that the coefficients for some of variables accounting for general and specific human capital are either not significant or do not display the expected signs. Considering both single and quadratic effects, the effect of the number of years of education of the entrepreneur on the probability of survival only becomes positive when the entrepreneur has more than 10 years of education.

The amount of employment experience of the entrepreneur has no significant effect on survival probabilities. While industry-specific experience has a positive impact on survival probabilities, ownership experience has no significant impact. The employment status of the entrepreneur prior to start-up also has no significant impact on survival probabilities.

The use of this last variable as a moderator (interaction) variable in order to determine whether entrepreneurial background effects on survival are different for previously employed and previously unemployed entrepreneurs produces more striking results, as displayed in model III. While other variables do not change their effects on survival probabilities, it is found that the interaction terms between the employment status of the entrepreneur prior to start-up and entrepreneurial human capital variables all have positive and significant effects on survival probabilities. This means that, for firms started by entrepreneurs who were employed in the year prior to start-up, both general and specific entrepreneurial human capital variables (education, employment experience, industry-specific experience and entrepreneurial, or ownership, experience) have positive significant effects on survival probabilities. For firms started by entrepreneurs who where unemployed in the year prior to start-up, only industry-specific experience matters for survival. Hence, while hypothesis H9 is

verified for all firms, hypotheses H7, H8 and H10 are only valid for firms whose entrepreneurs were employed in the year prior to start-up.

The results confirm that firms started by entrepreneurs owning other firms in the year of start-up (portfolio entrepreneurs) have significantly higher chances of early survival, thus validating hypothesis H11. It is also found that firms started by men have a greater probability of survival, but this effect is only significant at the 10% confidence level.

5. Concluding Remarks

This study has sought to examine the determinants of the short term survival (with regard to the first three years after start-up) of new firms, focusing in particular on entrepreneurial human capital determinants of survival. An encompassing model of survival determinants was bolt, the hypotheses being drawn from different strands of the literature, such as Industrial Organization, Organizational Ecology and the Resource-Based View of the Firm. Three different kinds of factors were deemed to influence survival chances of new firms in the short term:

- Firm-level determinants of survival;
- Industry-level (or environmental) determinants of survival;
- Entrepreneur-level determinants of survival, more specifically entrepreneurial human capital.

The use of a longitudinal matched employer-employee database covering all firms in the Portuguese economy allowed us to build measures of general and specific human capital for entrepreneurs, as well as to construct variables accounting for the main business-level and market-level influences on new firm survival. The variables used to assess entrepreneurial human capital measured the business owners' education level; ownership experience in other firms; professional experience as employees of other firms; experience in the industry was started; whether they owned other businesses at the time of start-up; and whether the business owner was unemployed previous to starting-up the firm.

While, in general, environmental/industry and firm-level conditions have the expected effects on survival probabilities, two striking results arise from the examination of entrepreneurial human capital effects on survival:

- entrepreneurial background factors contribute significantly to explain the survival chances of new businesses in the short run, and do not seem to be significantly less influential on survival probabilities than firm-level and industry-level factors;
- entrepreneurial human capital variables such as education, employment experience and ownership experience display the expected significant positive effects on survival probabilities only when the business owner was employed prior to starting the new firm.

It is suggested that the explanation for these results lies in the origin of the entrepreneurial efforts: for business owners that start firms out of opportunity – leaving their current employment in order to take advantage of a recognized opportunity – background factors significantly influence the chances of survival in the short term; for business owners who started the firms out of necessity, or as a "refuge" from unemployment, only industry-specific experience contributes significantly to enhance survival probabilities, while other entrepreneurial human capital variables are either not significant or display inconclusive signs.

Other effects associated with entrepreneurial backgrounds should also be highlighted. In particular, firms that are started by portfolio entrepreneurs are a significantly higher chance of survival. It is suggested that this effect is associated with liquidity constraints, as current business owners are more likely to have both available funds and access to investors.

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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
Education	Number of years of education of the entrepreneur	3.552	1.685
Education squared	Number of years of education of the entrepreneur squared	15.458	15.604
Employment experience	Number of years of employment experience of the entrepreneur	1.944	2.347
Ownership experience	Number of years of experience of the entrepreneur as a business owner	0.581	1.443
Same sector experience	Number of years of experience of the entrepreneur in the industry of the start-up	1.303	2.098
Business owner in previous year	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	0.245	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 business owner, 0 for firms started by one business owner	0.532	0.498
Human capital	Employee human capital, measured as the percentage of employees with terciary education	0.047	0.153
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
MES	Minimum efficient scale for the industry, measured following Lyons (1980)[2]	1.023	1.573
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 ownership 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 same sector 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

[2] Logarithm of one half of the size of the firms that, on average, operate 1,5 plants or more (see also Mata and Portugal, 1994).

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

	I		II		III	
Gender	-0.097*	(-1.76)			-0.1072*	(-1.71)
Education	-0.340***	(-4.94)			-0.3255***	(-4.08)
Education squared	0.0390**	(5.11)			0.0382***	(-4,29)
Employment experience	-0.0209*	(-1.85)			-0.0399***	(-2.58)
Ownership experience	-0.237	(-1.24)			-0.0117	(-0.47)
Same sector experience	0.0859***	(5.84)			0.0393*	(1.74)
Business owner in previous year	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)
Human Capital	-0.0592	(-0.34)	0.172	(1.06)	-0.2812	(-1.36)
Industry Growth	0.0021	(0.94)	0.0024	(1.13)	0.0038	(1.46)
Herfindhal concentration index	0.000796**	(2.17)	0.00077**	(2.17)	0.0021***	(4.19)
MES	-0.0778**	(-2.30)	-0.075**	(-2.28)	-0.1918***	(-4.33)
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 human capital on survival in firms with more than 10 employees					2.0548**	(2.16)
Effect of employment experience on survival when business owner was employed prior to start-up					0.0399**	(2.04)
Effect of ownership experience on survival when business owner was employed prior to start-up					-0.0341	(-0.64)
Effect of same sector 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)
Nº of observations		8957		9110		6371
Log likelihood		-4884.8		-5033.4		-3670.2
$\chi 2$		345.03		251.86		256.40

Values in parentheses are Z-values (T-ratios).
*** - significant at 99% confidence level; ** - significant at 95% confidence level; * - significant at 10% confidence level.

Table 3: Sensitivity analysis – changes in the probability of survival due to individual changes in the variables (all the others at their mean value)

Variable**	Probabilities (in percentage points) *					Changes in Probabilities for each Standard Deviation***				
	-2sd	***-sd***	***m***	***+sd***	***+2sd***	***Δ1***	***Δ2***	***Δ3***	***Δ4***	Total Change
Firm size	59.4	66.8	73.5	79.2	84	7.40	6.60	5.70	4.80	24.5
Same sector experience	65.9	69.8	73.5	76.8	79.9	3.90	3.70	3.40	3.10	14.1
Herfindhal index	68.1	70.9	73.5	75.9	78.2	2.80	2.60	2.50	2.30	10.2
Business owner in previous year	72.6		73.5		78.9	0.80		5.50		6.3
Existence of partner in ownership	71.2		73.5		75.4	2.30		1.90		4.2
Industry dummy	72.8		73.5		76	0.70		2.50		3.2
Education	72.0	72.8	73.5	74.2	74.9	0.70	0.70	0.70	0.70	2.8
Employment experience	75.3	74.4	73.5	72.5	71.5	-0.90	-0.90	-1.00	-1.00	-3.8
Gender	75.8		73.5		74	-2.40		-1.40		-3.8
Entry rate	76.4	75.0	73.5	71.9	70.3	-1.50	-1.50	-1.60	-1.60	-6.2
MES	78.0	75.8	73.5	71.0	68.4	-2.20	-2.30	-2.50	-2.60	-9.6

* - Probabilities based on calculations from Model 1, for variables significant at a 10% confidence level or better. For dummy variables, the probabilities correspond to the values 0 and 1 (1 and 2 in the case of gender).

** - variables are ranked with reference to the sum of the changes in probabilities – variables ranked higher have greater impact on survival probabilities.

*** - Δ1, Δ2, Δ3 and Δ4 are consecutive differences between probabilities; for dummy variables, Δ1corresponds to the total change for 0-1 variables.