**Start–ups survival analysis using the Kauffman Firm Survey: An analysis of founding and current conditions on survival.**

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**ABSTRACT**

This paper studies firms’ survival through an analysis of initial state at start-up and current state of the firms as they gain maturity. Probability of survival is determined using three probit models using both firm specific variables and an industry scale variable to control for the environment of operation. The firm’s specific variables include size, experience and leverage as a debt to value ratio. The results indicate that size and relevant experience are both positive predictors for the initial and current state. Debt appears to be a predictor of exit if not justified wisely by acquiring assets. As suggested previously in the literature, entering a smaller scale industry is a positive predictor of survival from birth. Finally, a smaller scale industry diminishes the negative effects of debt.

Key words: Survival of firms, founding conditions, current conditions, leverage, industry scale, Kauffman Firm survey

JEL classification: D 230, G3, L110, L200, L220, L250

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**I INTRODUCTION**

This paper reports the results of a study of the effects of current and founding conditions on firm survival using the Kauffman Firm Survey (KFS). We know from prior work that a firm’s founding conditions have persistent effects on its survival and growth (Mata and Portugal 1994, Mata et al. 1995, Audretsch and Mahmood 1995, Carroll et al. 1996, Geroski et al. 2002, Åstebro and Bernhardt 2003, Huynh et al. 2008, Geroski et al. 2007), but data limitations have left us with many unanswered questions.

Empirical research on survival or growth requires a dataset with three characteristics: a large sample containing a large range of sizes, firms that are followed from birth and short intervals between follow ups. Before the KFS, research on firm dynamics were conducted on databases each lacking one or more of the needed characteristics. For example, Åstebro and Bernhardt (2003) use a sample of firms taken from the “Characteristics of Business Owners” (CBO), a survey published by the US Census in 1982, 1987 and 1992. The study was conducted on a sample from the survey of new firms created in 1987 and the sample is checked again in 1992, a five year gap, to determine who survived. This is a large gap in time, enough to suggest that their results could be improved. Some of the firms found dead in 1992 could have died in 1988 or later.

The Kauffman Firm Survey is a new panel dataset on firms created in 2004, and firms are followed consistently every year. The KFS has all the needed characteristics and presents a bonus. It surveys a large range of industries. This paper contributes to the literature by filling some of the gaps brought about by the lack of data availability regarding the different firm and industry specific variables. I use the KFS to check on the reliability of past research conducted in the literature by studying the current state effects on survival together with the initial state.

Growth and survival analysis have been relatively well covered in the literature on firm dynamics. Both areas share common variables such as size[[1]](#footnote-1), experience and owners’ characteristics just to cite a few. Gibrat’s Law[[2]](#footnote-2) states that a firm’s growth rate is independent of its size. Past studies have provided empirical evidence suggesting that Gibrat’s Law could be wrong or at least wrong to some extent (Kumar 1985, Evans 1986a, Evans 1987, Hall 1987). Hall (1987) rejects Gibrat’s law for small firms although she accepts the law for larger firms. Evans (1987) shows that the growth rate and its variance are negatively correlated with a firm’s size and age. Evans also reported that survival was increasing with age, a result found in other studies (Dunne et al. 1989). Evans reinforced Hall, confirming that Gibrat’s Law was indeed holding for larger firms. Dunne et al. (1989) conducted their study on the growth and failure of manufacturing plants. Their results suggested that failure rates decline with plant size and age.

Few models have been developed to explain these age effects. Among them, Cooley and Quadrini (2001) is notable. Cooley and Quadrini (2001) added a theoretical model of size (equity) and age effects on firm’s dynamics, providing a significant contribution to the firm’s dynamics literature. They differentiate their contribution from previous research by taking both size and age dependency into consideration simultaneously, after introducing financial frictions into the model. Cooley and Quadrini claim that debt matters and is a cause of failure. The model depicted by Cooley and Quadrini predicts that younger firms tend to take on more debt which in turn increases the volatility of their profits, thus increasing their failure rate.

Although the age hypothesis cannot be tested directly using the KFS (all firms are part of the same cohort together with the KFS being a relatively new dataset), it is tested for indirectly through the debt hypothesis. Financial conditions (debt, equity and leverage) have also been a critical part of firms’ dynamics in the literature and the KFS offers a full range of data available at every life stage of the financial health of the company. Cooley and Quadrini also found that leverage (described as debt over equity) was decreasing with firm’s size because smaller firms take on more debt. Relating these findings to the size and survival literature (probability of exit decreases with size), I can assume that the probability of exit should be decreasing with leverage. Åstebro and Bernhardt (2003) studied the initial financing conditions of the firm effects on survival. They argue that probability of survival is increasing with initial external debt, although a negative correlation exists between initial bank loans and survival. On the other hand, Huynh et al. (2008) suggest that a firm’s exit probability is increasing with leverage[[3]](#footnote-3).

I test for the effects of quality using years of experience in the industry, as suggested by Thompson (2005). A literature promoting experience as an important contributor to survival has been developed. Research has tackled two main areas pertaining to firms’ experience. First, past studies[[4]](#footnote-4) find the effects on owners’ pre-entry experience to be a persistent determinant of performance in the years following entry. Second, the more related the experience is to the industry in which the firm operates the more valuable it is. Thompson studies both effects in the shipbuilding industry and his findings reinforce Klepper and Simons’s (2000) suggestion that firms with more experience in related fields of the industry perform better than *de novo* entrants with less experience.

Firm-specific characteristics are not the only major predictors of survival and growth. The environment in which the firm operates is also significant. Audretsch (1991), and Audretsch and Mahmood (1995) emphasize the need to consider the industry together with firm characteristics. I introduce a dummy representing the scale of the industry in which the firm operates. The minimum efficient scale (MES) specific to an industry could be an important determinant of survival. Growth constraints indicate that the higher the scale of the industry the more difficult it is for firms to reach the MES.

Probit regressions allow me to estimate the effects of current and initial conditions on the firm’s survival in the following period for every year the firm stays alive.

The current conditions’ effects on survival are estimated, allowing me to determine how the state of the company during a year affects its survival next year. The initial state effects are obtained the same way but only regressing on founding conditions variables. On one hand, the study finds that size is a more important positive predictor of survival in the current condition although I do find the founding conditions to be a significant positive predictor of survival as well. On the other hand, the relevance of owners experience is a more important positive predictor of survival in the founding stage. Current relevant owners’ experience is also found to be a positive contributor to survival. Both stages associate diminishing returns to relevance of owners’ experience.

 The probability of survival seems to be decreasing with leverage. The companies that have negative equity seem to be the most prone to exit. Evidently, a firm needs to use the debt it owes adequately or debt will drive the firm to exit. Entering a lower scale industry seems to increase the probability of survival and the results are significant in the first year and in the years following entrance. It is the choice of entrance into an industry that is significant as opposed to the yearly activity in a low scale industry. Moreover, entrance in a low scale industry decreases the negative effect of debt.

The first section of the paper describes the Kauffman Firm Survey and provides summary statistics on the full dataset. The second section introduces the variables used, in addition to providing a description of three different models. A brief literature review accompanies the model descriptions. The third section presents the results in two parts. The first part analyses the current year condition on survival and the second part adds the effects on survival of initial condition. Finally, I conclude the paper with a summary of the findings and a discussion for future research possibilities.

**II THE KAUFFMAN FIRM SURVEY**

I use the public release of the KFS, a panel data set covering a broad range of topics, allowing the study of a sample of firms created in 2004. The dataset contains information on a variety of topics including financing, organizational structure and legal status, business characteristics and strategy, owners demographics and work behavior.

The KFS is based on a random sample of businesses--from the Dun and Bradstreet (DB) database-- created in 2004. The questionnaires sent to the sample were designed by the Mathematica Policy Research. The baseline questionnaire was sent in 2004 and due to the quest for a longitudinal database, follow-up questionnaires were sent every following year. So far adding to the baseline are three following waves consisting of 2005, 2006 and 2007 data.

`The development and change aspects involved with innovations in high-tech industries motivated the Foundation to oversample firms in these fields. The screening/eligibility test allowed only 15 percent of the potential pool of firms to be part of the sample. The initial sample of firms passed “the eligibility test” defining a new business in 2004 and consisted of 4,928 firms out of an initial pool of 32,429 businesses. Respondents were paid $50 to answer using a self-administered web survey or a computer-assisted telephone interview.

Eligibility was determined with two tests. A firm had to be a new company and it had to be a company created individually by *de novo* entrepreneurs. The first test ensures that the company had started its activity in 2004. Therefore, if the firm had started activity in 2003 (or earlier) under any other form of structure and the 2004 initial year of activity for example only marked a restructuring (e.g., sold business, renamed business, or change in activity), the firm did not qualify to be part of the sample. The second test checked ownership and provenance of the firm. It could not be a subsidiary of any other business, could not have been a spin off, nor inherited by previous owners. Finally, it could not be a not-for-profit company. Firms that passed both tests were part of the sample in the baseline questionnaire and follow ups. The baseline questionnaire records data at the birth of the firm, and therefore is used as the initial conditions of operation in the study.

As previously stated, there are four waves available in the current KFS. Firms that participated in the first wave satisfied two conditions. They first needed to be part of the baseline sample, and needed to have survived the first year of activity. The first wave found that 7.4 percent (6 percent plus 1.4 percent) of the 4,928 (369) were out of business by the end of 2005 (see Table I). There were 4,523 businesses left in 2005. More businesses were found have closed by the time of the second and third follow ups. Some of the surviving firms chose not to answer and sample weights were adjusted accordingly.

The possible reasons for exit were determined at the beginning of the survey. Firms that ceased operation temporarily were a small minority in the sample. In the first year 3 percent of the sample temporarily ceased operation, 3.1 percent in the second and 1.7 percent in the third year. I exclude those firms from the study because the survey extends four years. A firm described as active in any year had to have been described as active in all previous years. A firm that ceased operation temporarily (for example one that exits in 2005 and is seen as reappearing in 2007) is dropped from the sample (36 observations were dropped).

Any reason that will bring the respondents to declare that the same original business is no longer in operation, with at least one of the original founders is defined as inactive in my study[[5]](#footnote-5). Hence, businesses that were sold or that merged with other businesses were also described as closed because of the change in ownership. The data show that there is an increasing trend of businesses sold as they get older. Only 1.45 percent of the businesses were sold or merged the first year , compared with 2.7 percent and 3.5 percent respectively in the second and third years.

**Table I: Firm outcomes (2004-2007)[[6]](#footnote-6) in percentages.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **2005** | **2006** | **2007** |
| **Survived**  | 89.6 | 80.2 | 73.4 |
| **Closed operations** | 6.0 | 14.0 | 21.4 |
| **Sold to or merged with another business** | 1.4 | 2.7 | 3.5 |
| **Temporarily ceased operations or other** | 3.0 | 3.1 | 1.7 |
|  **TOTAL** | 100.0 | 100.0 | 100.0 |

Source: Kauffman Firm Survey Microdata. Sample includes only surviving firms over the 2004-2007 period, and firms that have been verified as going out of business over the same period. The original sample size in 2004 was 4,928.

Some firms were reported to have no owner in 2004, 2005, 2006 and 2007, and were dropped from the sample (respectively, 41, 22, 23 and 16 observations were deleted). Some firms surveyed could also be firms created to reduce taxes on an individual. It has been shown in prior research, both theoretical and empirical (Gordon 1998, Åstebro and Bernhadt 2003), that paying fewer taxes could be an incentive for individuals to create companies as a tax shelter because corporate tax rules are often advantageous compared to income tax. Hence, I expect some of the firms surveyed were also created as tax shelters. The way I chose to correct for this issue was to drop the firms that reported no sales in all years of activity (58 observations were deleted).

The distribution of firms by industry shows by comparison to the U.S Census that the KFS has a higher proportions of businesses in many industries such as manufacturing, professional management, education, retail and wholesale, finance and insurance, just to cite a few. However, the KFS has a lower proportion of firms in construction, health care and social assistance, and accommodation and food services (see Table II).

**Table II: Firm distribution by industry[[7]](#footnote-7) in percentages.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Industry names and (code)** | **KFS New Employer Businesses** | **Census Employer Firm Births** | **PSED New Businesses** |
| **Professional (54), Management, and Educational Services (61)** | 15.5 | 14.1 | 16.1 |
| **Retail Trade (44)** | 15.6 | 12.0 | 18.6 |
| **Administrative and Support, and Waste Management and Remediation Services (56)** | 11.4 | 6.0 | 2.1 |
| **Construction (23)** | 9.8 | 15.7 | 10.0 |
| **Other Services (except Public Administration) (81)** | 8.0 | 8.5 | 0.3 |
| **Manufacturing (31)** | 7.2 | 3.2 | 3.5 |
| **Wholesale Trade (42)** | 6.0 | 4.5 | 1.5 |
| **Real Estate, Rental and Leasing (53)** | 3.7 | 5.1 | 5.3 |
| **Finance and Insurance (52)** | 4.7 | 2.2 | 3.1 |
| **Health Care and Social Assistance (62)** | 4.2 | 7.7 | 2.9 |
| **Information (51)** | 2.6 | 1.4 | 4.2 |
| **Transportation and Warehousing (48)** | 2.9 | 3.3 | 2.4 |
| **Arts, Entertainment, and Recreation (71)** | 3.1 | 2.1 | 3.2 |
| **Accommodation and Food Services (72)** | 3.9 | 9.1 | 10.9 |
| **Agriculture, Forestry, Fishing, and hunting (11)** | 1.4 | 0.4 | 2.0 |
| **Mining (21)** | 0.0 | 0.3 | 0.5 |
| **Utilities (22)** | 0.0 | 0.1 | 0.5 |
| **Management of Companies and Enterprises (55)** | 0.0 | 0.1 | 6.7 |
| **Unclassified (99)** | 0.0 | 2.2 | 5.6 |

Source: Kauffman Firm Survey, Baseline data: Tabulations by Mathematica Policy Research, Inc; and Office of Advocacy, U.S. Small Business Administration, from longitudinal data (established with some first-quarter payroll) provided by the U.S. Census Bureau; Reynolds, P. 2004. Entrepreneurship in the United States Assesment, Miami, Fla: Florida International University.

The sample surveyed shows that the majority of firms start as small with fewer than 5 employees (75.1 percent). Also, the distribution of firms by size shows similarities with the Census. For example, 10.35 percent of the KFS sample start with 10 or more employees, compared to 10.4 percent[[8]](#footnote-8) in the Census. Table III also shows that the KFS was not able to capture any firm in its sample with 500 employees or more. The Foundation suggests this could be because few firms have the capacity to begin at such a large scale. Note that the number of small firms with fewer than 5 employees and the ones with 20 or more employees are a bigger part of the distribution by 2007. On the other hand, firms with 5 to 19 employees are a smaller part of the distribution by 2007.

The KFS reports an 89.6 percent survival rate in the first year of activity. This rate is higher than those found in previous studies. For instance, the U.S. Small Business Administration found the survival rate of single establishment firms founded in 1997 was only 75 percent in the first year. The CBO has found rates similar to the U.S. Small Business Administration for different cohorts of single establishment firms (Shane, 2008). The KFS could be registering higher rates for a simple reason: firms created in the beginning of 2004 and closing shortly after may have been omitted from the sample due to the screening method. Therefore, a firm that would have closed before the baseline survey was issued in 2005 could not be part of the sample[[9]](#footnote-9).

**Table III: Distribution of firms by employment size category[[10]](#footnote-10) in percentages.**

|  |  |  |
| --- | --- | --- |
| **Number of Employees** | **All firms in 2004** | **All surviving Firms in 2007** |
| **1-4** | 75.1 | 76.7 |
| **5-9** | 14.6 | 13.0 |
| **10-19** | 6.6 | 6.0 |
| **20-99** | 3.4 | 3.8 |
| **100-499** | 0.3 | 0.4 |
| **500+** | 0.0 | 0.0[[11]](#footnote-11) |

Source: Kauffman Firm Survey, Baseline data; Office of Advocacy, U.S. Small Business Administration, Statistics of U.S. businesses, U.S. Census, 2004.

**III VARIABLE DESCRIPTION AND MODEL SPECIFICATION**

* *The variables:*

The KFS reports a wide range of information regarding the birth and evolution of establishments in the sample. I concentrate on a small part of the firms’ descriptive and financial variables. I also took into consideration the industry in which the firms operate because the environment of operation could affect survival rates (Huynh et al. 2008, Thompson 2005, Mata and Portugal 2007.)

The variable describing survival is the dependant variable and takes the form of a dummy equal to 1 if the firm is active (survived), and equal to 0 if inactive (out of business) respectively during 2004, 2005, 2006, 2007.

Only firms created in 2004 and that survived the first year are part of the sample. As previously stated, afirm is considered to be out of business if it was sold to another business, merged with another business, has temporarily stopped operation (those observations were dropped) or just closed*.* To correct for non-response, I added the condition that a firm needed to be active in the previous year as well. Thus, survival in a current period is equal to 1 only if survival in the previous period is also equal to 1 *and* the business has not been declared to be out of business in the current period.

I created three models. The first two models (M1 and M2) control for firm specific variables, with M2 adding leverage dummies to M1. M3 completes the series, adding an industry specific variable. I use the total number of employees on the firm’s payroll (part time and full time) to proxy for the size of the firm. Most reasonable measures of size are positive functions of number of employees. The total value of assets and revenues could be good proxies for size but I believe that the number of employees is a better proxy. The reason is straightforward. The value of assets recorded in the KFS is most likely the book value, and therefore, has depreciation accounted for. Thus, although the firm can remain the same size from one year to the next, its recorded asset value will decrease. Moreover, firm’s asset value described by the survey is classified in range variables. I could not use sales as a measure of size for the same reason. Thus the proxy for size is the first control variable on the right hand side (RHS) of M1. The total number of employees variable does not include the number of owner-operators. Regressions were run adding the number of owner-operators to the total number of employees and results were found to be similar[[12]](#footnote-12) (see Appendix A).

The survey reports the years of experience each owner has in the industry previous to the creation of the firm, giving me the second control variable on the RHS of M1- owners’ previous industry experience proxies for quality of the firm. The intuition is that the more the owners have experience in the related industry prior to starting the firm, the higher the probability for it to be of a higher quality. Thompson (2005) studies the effects of previous years of experience in the industry in which the firm competes and finds it to be highly significant and important. I adopt the same approach.

I constructed the experience of the firm by calculating the mean experience brought in by each owner. The survey has an upper bound for years of experience equal to 40 years. Whether the corresponding owner has 41 or more years of experience, he/she is registered as having 40+ years of experience bringing me to censor the years of experience variable from above, and lock it to a maximum of 40. Assuming decreasing returns to experience, censoring from above should have little or no consequence. This means that the marginal product of human capital is assumed to be decreasing. The argument could be made in which mean owners’ relevant experience is not the best measure of the firm’s experience. An average weighted according to the time put in the company by each owner would be a better measure. The more an owner works in the company, the higher the weight of his experience. Unfortunately, this method is impossible to apply given the data. The possibility of decreasing returns to experience is allowed for by including the square of the relevant experience.

Following the literature[[13]](#footnote-13), each firm in each period had their leverage calculated as a debt to value ratio[[14]](#footnote-14) defined as debt over assets and both values are reported by the survey. The KFS describes “total debts” to be the sum of the total debt owed by the owners’[[15]](#footnote-15)and in the business’ name[[16]](#footnote-16). “Total assets” is the sum of all assets held by the firm. The dataset reports range variables for “total debt” and “total assets”[[17]](#footnote-17). Operations not being possible on range variables, I use the ranges’ midpoints as point of reference (I did not have access to the ranges’ means and medians). This technique has been used in previous research[[18]](#footnote-18) including some working papers using the KFS[[19]](#footnote-19) and is accepted as an admissible replacement for the real values. Asset values are book values and therefore are subject to depreciation.

A firm’s calculated leverage is classified into dummy variables (five dummies were created). A leverage dummy equal to 0 at a given period means that the firm has not reported any debt and therefore the firm is financed entirely by equity (due to collinearity, this dummy was omitted from the regression). A leverage higher than 0 and lower than 1 in a given period means that the firm reported some existing debts of an amount smaller than its assets value and some positive equity was reported by the firm. A company that finances its assets completely with debt in a given time shows a leverage equal to 1. This means that the company has no equity or no equity left. An overleveraged firm has a leverage greater than 1 and has negative equity. The assets value is worth less than the debt owed by the firm. It could also be an indication that the firm has used some of the debt to pay for services or other aspects of business not describable as assets. I expect to see a negative value on this leverage. An infinite leverage[[20]](#footnote-20) is the worst situation for a firm. This case could be thought of as a firm that borrowed money but has no assets to justify the debt. The firm spent the entire amount of the debt on expenses without accumulating any form of assets (e.g., locals, stock, machinery etc). I expect the coefficient attributed to this variable to be the most negative in the regressions. A firm with infinite leverage only has negative equity.

The scale variable represents the percentage of firms in the observation’s two-digit industry that employs fewer than 20 employees (see Table IV). Åstebro and Bernhardt (2003), use two variables for 1 to 19 employees and 1 to 49 employees, the first variable being a subset of the second. Regressions were run using Åstebro and Bernhardt and adding their variables do not add explanatory power to the study (The results can be found in Appendix B).

**Table IV: Percentage in two-digits industries with fewer than 20 employees in 2004.**

|  |  |
| --- | --- |
| **Industry description** | **Firms with number of employees below 20** |
| **Forestry, fishing, hunting, and agriculture support** | 93% |
| **Mining** | 82% |
| **Utilities** | 71% |
| **Construction** | 91% |
| **Manufacturing** | 69% |
| **Wholesale trade** | 86% |
| **Retail trade** | 86% |
| **Transportation and warehousing** | 83% |
| **Information** | 80% |
| **Finance and insurance** | 90% |
| **Real estate and rental and leasing** | 95% |
| **Professional, scientific, and technical services** | 92% |
| **Management of companies and enterprises** | 66% |
| **Administrative and support and waste management and Rremediation services** | 83% |
| **Educational services** | 76% |
| **Health care and social assistance** | 85% |
| **Arts, entertainment, and recreation** | 84% |
| **Accommodation and food services** | 72% |
| **Other services (except public administration)** | 93% |

Note: The percentages represent how many firms employing

the number of employees described by the scale variable can

be found in the industry as of 2004.

* *Model specification:*

The dependent variable of interest (survival in a given period) is a dichotomous qualitative variable with outcomes survive=1 and exit=0. Therefore, a binary response regression model is needed in order to quantify the probability of survival. This study will use probit. As stated in the previous section, there are three model specifications. Each specification was run for survival in 2005, 2006 and 2007.

It is perhaps unusual to run separate regressions in order to capture the evolution of each variable over time and their influence on survival from one year to the next. Researchers usually use weighted regression models over many years (Geroski et al. 2007, Huynhh et al. 2008). Hazard models seem to be the most used tool of analysis although Mata and Portugal (1994) found similar results no matter the regressions (Weibull, ordered probit, ordered logit, Cox proportional hazard) using different model specifications, different assumptions of distribution and different sample definition. Hence probit should be just as effective and it has the advantage to be an easier model. The disadvantage of running separate probit regressions is that time effects cannot be controlled for. However, using the KFS, I only have access to one cohort of firms created in 2004. Thus, no age variable could be used in the regression and I could not test directly the age theory (this means that there is no age effect because firms are all the same age). Also, Thompson (2005) shows that the age effect on exit is eliminated when quality proxies are added to the regression. Thompson uses prior experience to proxy for quality and concludes that the age effect found on survival could be explained by selection bias. Hence, a separate probit should be a good tool of analysis.

Assuming that the total number of employees is a good proxy for size and considering that it has been used as such in many papers (Geroski et al. 2007, Mata and Portugal 1994), I introduce it as a control variable in the base regression model. M1 is a simple model controlling only for size and quality, using total number of employees and the owners’ mean industry experience as respective proxies. Decreasing returns to experience were also allowed for by using the square of the mean relevant experience variable.

Some studies have been conducted on the determinants of growth over time, while others have focused on the initial starting size (Dunne et al. 1989, Mata and Portugal 1994, Haverman 1995, Audretsh and Mahmoud 1994, Geroski et al. 2007, Sharma and Kesner 1996, Mitchell 1994). A simple reason for the higher failure rate of smaller firms is that larger firms have the option to downsize when needed (cut expenses). Moreover, in difficult times, larger firms can withdraw from dying markets and refocus on the ones still alive. This choice is more difficult for smaller firms because of the smaller scope of their operations. Others[[21]](#footnote-21) have suggested that larger firms are less susceptible to financial constraints and therefore have access to funds during unexpected difficult times or even to finance projects. An interesting alternative explanation deals with the costs of production. There are lower costs associated with producing at a larger scale (Lucas 1978). The bigger a firm is, the closer to the minimum efficient scale (MES) of production it is and the lower its costs of production. This could happen for two reasons. First, a larger size allows the firm to operate further down the cost curve. The second reason is that fewer financial constraints allow the firm to operate at higher scale**.**

Geroski et al. (2007) also report a non-instantaneous increase in survival prospects as a firm’s size increases. This is partly consistent with Jovanovic (1982), in which firms adjust their size (by learning about their efficiency as time goes by) according to past performance, and only current size matters in predicting survivability. This adjustment is made instantaneously. The KFS allows me to see if size is indeed an increasing factor of survivability[[22]](#footnote-22). Regarding the founding conditions, entering larger sends a positive signal and relaxes the liquidity constraints proposed by Evans and Jovanovic (1989). Thus, I expect positive and significant coefficients on the number of employees in both current and founding conditions regressions.

 Pre-entry relevant experience has also been shown to be an important predictor of survival. After showing pre-entry relevant experience to be a good proxy for quality, Thompson (2005) affirms that relevant experience does indeed have persistent effects on survival and moreover, the effects do not decay over a long period of time. Geroski et al. (2007) indirectly test the hypothesis (following previous research like Wernerfelt 1984, Barney 1991 and Youndt et al. 1996) that human capital is the factor that provides the hedge because it cannot be replicated by the competitors. Geroski et al. (2007) use education as a proxy for human capital, and find that education reduces the hazard of exit. Lucas (1978) shows that having better quality human capital allows a firm to lower its cost at any given level of production, thus seeking to produce at a larger scale.

The link between financial variables and firm dynamics has just recently started to attract the attention of researchers. Lack of financial data was the main reason empirical studies proved to be a challenge. Firms are reluctant to disclose information regarding their financial structure. Whenever the financial data is available, sampled firms are already too old and have already overcome the first stages of growth. We know that younger firms grow faster than older, and that survival is positively related to age (Evans 1987, Dunne Roberts and Samuelson 1989). Thus, if the sample is aged, we can assume that exit rates will be too low to conduct interesting research. This is commonly referred to as a sample bias problem[[23]](#footnote-23).

M2 adds five financial leverage dummies to the base model. Huynh et al. (2008) used quintiles dummies and found that the nonlinear model fitted the data better than the linear one. Thus, adding dummies to the regression (different slopes) helps me model the nonlinear property of leverage on survival.

Cases were found with reported assets value equal to 0. These observations are associated with an infinite ratio representing the worst case of financial state for the firm. No debt was reported in some cases and, as previously stated, the corresponding dummy was omitted from the regression (for collinearity purposes).

There is empirical evidence reporting that higher debt decreases the probability of survival. Huynh et al. (2009) found that once they control for size and productivity, firms with high level of leverage (debt to value ratio measured debt over assets) face an increasing failure risk with an increase in leverage. Alternatively, firms with low to moderate leverage have higher survival chances. Huynh et al. (2008) look at the introduction of the initial debt to value ratio into the firm dynamics and found it to be economically and statistically significant. They find that the higher the debt to asset ratio is at birth, the lower the life expectancy of the firm. However, it is to be noted that it is the increase in the debt to asset ratio that is dangerous and therefore it could either be an increase in debt or a decrease in asset value (book value depreciation maybe).Myers (1977) had already suggested that higher level of debt may limit a firm’s real value. Access to debt can influence survival trough both a positive and a negative relation. On the one hand, the more a firm has access to debt, the more it can finance its activities and therefore survive. On the other hand, the more debt a firm owes, the higher the temptation to walk away from the debt when found in harsh economic conditions. The debt to value ratio allows me to measure the financial obligations of a firm for each value unit of assets (book value) it has. Huynh and Petrunia (2009) control simultaneously for size, age and leverage and find that initial asset value had a positive effect on growth, providing evidence to the “deep pocket theory” suggested by Zingales (1998). The higher the asset stock at creation, the more positive the message sent to debt institutions and the more the firm has access to debt to finance its growth.

Huynh, Petronia and Voia research was conducted on the startup financial conditions and on a sample of manufacturing firms. Actually, most of the papers I have come across testing for leverage effects (financial conditions) onto survival or growth were done on a sample of manufacturing firms. Those results should be tested on other industries due to the fact that the manufacturing industry is highly capital-intensive. The KFS also provides me with a higher range of smaller industries. The interesting question would be whether or not increasing debt in the firm youth is a predictor of exit, while controlling for industry scale? This question will be addressed in M3.

The literature on firm dynamics emphasizes the importance of industry specific variables along firm specific variables. Audretsch (1991) looks at industrial variables effects on survival and found that survival rates do vary across industries; a finding that previous empirical research had not reported. Audretsch indicates that industry’s specific technical conditions as well as industry’s demand are important predictors of survival. Audretsch and Mahmood (1995), expends Audretsch (1991) by adding macro variables and firm level variables such as size and ownership. This methodology shows that size, when added to industry scale variables, can influence survival positively and thus reduce the negative effects of higher scale on survival. The literature[[24]](#footnote-24) indicates that the bigger a firm is, the closer it will be to the MES and therefore operate at a lower point on the cost curve, reducing cost and increasing profit, thus increasing chances of survival.

M3 adds a scale variable defined as the percentage of firms found in the two digits NAICS industry code in 2004 (represents date of entry for the sample) with fewer than 20 employees. Åstebro and Bernhadt (2003) find entering a small scale industry is a positive predictor of survival while entering a high scale industry is a negative predictor of survival. Åstebro and Bernhadt run probit regressions and found that initial entrance into a higher scale industry is a hazard for survival. The coefficient attributed to their variable representing a scale of fewer than 50 employees was negative and twice as big in magnitude as compared to the coefficient on the variable representing a scale of fewer than 20 employees (positive sign). The research and results provided by Åstebro and Bernhadt are only giving information on the founding conditions. I am not aware of a study that joins a leverage variable to an industry scale variable. I trust that M3 will help understand whether the impact of debt is increased or decreased when industry scale is controlled for.

Audretsch and Mahmood (1994) have studied the effect of concentration in an industry on survival and they have found it to be significantly negative. Geroski et al. (2007) suggest the more concentrated the industry at time of entry, the less the chances of exit, with the effects disappearing post entry. This finding supports the trial by fire hypothesis and suggests that the fittest survive in a highly concentrated market, hence in reality high concentration at entry increases probability of exit for the unfit firms. Once a firm enters a highly concentrated market and survives, it is more likely it will prosper in the future.

The scale variable proxies for the scale of the industry in which the observation is operating. When the scale variable is not in the model, the number of employees accounts for its effects via the MES theory. A firm’s large size represents the will to reach a higher scale of operation bringing the coefficient on size down. Once the scale variable is added, correcting for its effect on size, the coefficient on size should increase.Assuming Geroski et al. (2007) are right; I should observe insignificant results on the years following entrance[[25]](#footnote-25). Moreover, assuming that low scale industries are associated with high competitive forces—and conversely that high scale industries are associated with strong negative forces at entrance due to incumbents’ market control—entry in a low scale industry should decrease[[26]](#footnote-26) probability of survival.

**IV EMPIRICAL RESULTS**

* *Effects of current year conditions on survival in the following period.*

Results for this section are presented in table V. M1 reports a positive, significant and persistent effect of size on survival. The literature has reported that the bigger a firm is, the more it can access external debt[[27]](#footnote-27) to finance growth and survive (Dunne Roberts and Samuelson 1989, Thompson 2005). The coefficients found for each year on size suggest that size contributes consistently to the probability of survival next year.

The coefficient on the total number of employees goes up once the industry scale is accounted for in 2005and 2006. This is expected because we know that total number of employees accounts for at least two effects in M1and M2. First, how successful the firm is (the more employees the firm has, the better it is doing). This is a positive effect. Second, how much employees are needed in the industry (the more employees a firm has the higher the probability it is in a higher scale industry and therefore the lower the probability of survival). This is a negative effect. By adding the industry scale variable to M2, I am controlling for the number of employees needed in the industry, which was previously bringing the coefficients on size down. Therefore the coefficient on the number of employees has to go up in the third model as compared to M1 and M2.

The mean experience in the industry, which is a proxy for quality, also proves to be an interesting predictor of survival. The coefficient is always really significant and positive. The coefficient on experience does not fluctuate much across models, suggesting that its effects on survival are somehow independent from other predictors. However, we do notice that the coefficients go up from one year to the next, suggesting that experience becomes increasingly important for survival. As previously assumed, the quadratic variable for experience reports a consistently small negative coefficient indicating that relevant experience have a slight marginal decreasing return on survival.

Adding leverage dummies to the regression consistently bring the coefficients on size down. Thus, size must be accounting for a portion of the contribution of leverage on survival. This confirms that financial structure does play an important role on survival. As previously stated, some studies[[28]](#footnote-28) found that the hazard of exit was augmented by debt and hence debt had a negative effect on survival. M2 reaffirms the results found in Huynh et al. (2008) and (2009) as well as Huynh and Petrunia (2009). The coefficients associated to leverage with more debt than asset are negative and the larger the difference, the more negative the coefficients become (the coefficients on infinite leverage are more negative than the coefficients on leverage greater than 1). This suggests that more debt increases the incentive to walk away and close the company as opposed to finance growth (the second hypothesis is stronger than the first one).

During the first year of activity, survival probability is increased when assets are financed with debt and equity. A debt amount below the assets value means that the owners have some positive equity in the company and therefore have an incentive to put more efforts into running the company, which in turn increases the probability of survival. In this scenario the positive effect dominates. The incentive to walk away from the debt is low because of the positive equity. This relation is only significant in the first year. The negative effects associated with the coefficients on infinite leverage are significant for 2005 and 2006 and increase from one year to the next. This suggests that if the firm has not financed some assets with the debt it owes by the second year, its exit probability is increased. This confirms the second hypothesis regarding the effects of debt (walking away from it). Leverage significance disappears as the firms enter their third year (I explain below that only initial effects are still significant by then). Current leverage becomes an insignificant predictor of survival as the firm becomes older. Checking the validity of both theories as the cohort ages will be possible as more data waves are released. Note that when running linear regressions with size as the dependant variable, I find that the more balanced the leverage is (leverage = 1), the larger the firm (see Appendix Table AC).

M3 reports that entering a smaller scale industry increases the probability of survival. Assuming that lower scale industries are less concentrated because of lower barriers of entry, this finding contradicts the common belief[[29]](#footnote-29) that competition increases exit rates. However, these negative effects are active as the density within the industry is increasing and the market becomes crowded with firms. Hence, it could be that the markets are not crowded yet as the firms enter their respective low scale industry. Not surprisingly, the industry scale variable is only significant the first year, confirming Geroski et al. (2007) that found that the effects of industry concentration at entrance disappear after the first year. Once a firm enters an industry, this decision cannot be reversed. The effects are therefore only visible on the first year and in the founding conditions. Thus it is the industry entrance choice that is significant and the current activity in a specific industry. According to the “trial by fire” hypothesis, a firm entering a highly concentrated market and surviving the first year has more chances to survive and prosper in the future. Only the firms with the financial capacities (deep pocket theory) should adventure themselves in a higher scale industry for the prospects of higher potential price-cost margins. However, the higher scale industry (percentage of firms in the two digit SIC code industry with more than 20 employees) is associated with a negative effect on survival, which raises the question: why would a firm with low financial capacities choose to enter a high scale industry? I suggest a possible intuitive explanation. A higher scale industry requires heavy investments and higher sunk costs as compared to a smaller scale industry. However, the border line is not perceivable (in my definition the marginal employee puts the firm into the higher scale) and firms enter a higher scale industry because of expectations of higher revenues (higher price-cost margin). Pre-entrance, the firm has expectations on costs and revenues. However, those expectations are prone to noise. Once a firm enters, the noise is reduced as time passes and the firm learns about the financial burden associated with higher cost forced by the scale and lower revenues due to the incumbents’ market power. When the noise is eliminated, and the firm realizes the true requirements associated with operating in a higher scale industry, it decides to continue its operation(s) or exit. Firms commit the mistake of entering a higher scale industry because they perceive a “mid-scale industry” between the smaller and higher scale. This “mid-scale” is believed easier to reach than the higher scale, and is expected to provide the firm with higher revenues. Hence the firm commits the mistake to enter and exits later.

* *Effects of founding conditions on survival in the following periods.*

As previously suggested by Mata et al. (1995) Table VI shows that initial size has persisting positive effects on survival later in the life of the firm. Initial size carries minimal decrease in coefficients in the years following birth. I find that the coefficients on initial size are below those found in table V, hinting to size in the current year being more important for survival than founding size. This last result was also found in Mata et al. (1995).

 Experience has similar coefficients for current and founding conditions. Geroski et al. (2007) suggested that the most valuable experience is the founding experience but my results report a slightly larger coefficient on experience for current conditions. That said, coefficients on relevant experience are not statistically different in the 95 percent confidence interval. Hence, despite the non-negligible contribution made by initial experience, current experience remains an important contributor to survival. I believe that this is a result of the correlation between current experience and founding experience. Thinking of experience as a stock of human capital, it is increasing (the human capital stock is building upon the initial stock) as the firm ages.

The coefficients associated with founding leverage dummies are significant in the cases with negative equity (debt is greater than assets). Firms with initial leverage greater than 1 or with an infinite leverage saw their probability of survival greatly diminished. A firm that starts operation with negative equity sees its likelihood of exit soar. This is true in 2006 and 2007. The coefficients on infinite leverage are decreasing in magnitude from 2006 and 2007 while the coefficients for leverage greater than 1 are increasing. This can be justified with the following intuition. An infinite leverage at foundation is most likely going to force an exit in the first years of activity and thus less firms in the cohort as subject to its effects. To summarize, having negative equity at start up diminishes greatly a firm’s probability of survival during the first years of activity. The industry scale variable points to an interesting clue on the effects of industry scale on debt. It seems that entering a smaller scale industry reduces the negative effects brought by debt on survival. The coefficients associated with negative equity and infinite leverage are decreasing in magnitude once small industry scale is controlled for. This could be explained with the following intuition. The individuals entering a low scale industry most likely have to put their own assets as collateral (such as home). Therefore walking away from the debt is harder and efforts and time will be invested by owners, hence increasing the survival probability.

Entering a small industry scale at foundation is an important and significant predictor of survival. The choice of operating industry is made at the firm’s entrance and thus the coefficients and foundation are positive and significant in both 2006 and 2007. Table VI also reports that the positive effect associated with entering a lower scale industry is decreasing as the firm ages (from 1.668 in 2006 to 1.003 in 2007).This could be the result of an entrance into a low density industry that becomes more crowded as the firm ages consequently the positive effects disappear to give place to—maybe—negative effects in the future. More data waves would help estimate how long the effects associated with an industry entrance remain a significant predictor of survival.

**Table V: Regressions on previous year conditions**

 **Table V A: Regressions of survival in 2005 using 2004 control variables.**

|  |  |  |  |
| --- | --- | --- | --- |
| *Models* | *M1* | *M2* | *M3* |
| **Control Variables in2004** | **Probability of survival in year 2005** | **Probability of survival in year 2005** | **Probability of survival in year 2005** |
| **Total number of employees** | 0.026 | 0.023 | 0.028 |
|  | (2.39)\*\* | (2.10)\*\* | (2.50)\*\* |
| **Relevance of experience** | 0.033 | 0.031 | 0.029 |
|  | (3.56)\*\*\* | (3.27)\*\*\* | (3.06)\*\*\* |
| **Quadratic of the relevance of experience** | -0.001 | -0.001 | -0.001 |
|  | (2.88)\*\*\* | (2.60)\*\*\* | (2.48)\*\* |
| **Leverage between 0 and 1** | \_ | 0.169 | 0.171 |
|  |  | (1.96)\* | (1.98)\*\* |
| **Leverage equal to 1** | \_ | 0.029 | 0.035 |
|  |  | (0.31) | (0.36) |
| **Leverage greater than 1** | \_ | -0.167 | -0.165 |
|  |  | (1.64) | (1.62) |
| **Leverage is infinite** | \_ | -0.203 | -0.200 |
|  |  | (2.14)\*\* | (2.10)\*\* |
| **Portion in the industry with fewer than 20 employees** | \_ | \_ | 1.847 |
|  |  |  | (2.85)\*\*\* |
| **Constant** | 1.379 | 1.399 | -0.210 |
|  | (22.97)\*\*\* | (18.67)\*\*\* | (0.37) |
| **Observations** | 4582 | 4582 | 4582 |

Absolute value of z statistics in parentheses.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

 **Table V B: Regressions of survival in 2006 using 2005 control variables.**

|  |  |  |  |
| --- | --- | --- | --- |
| *Models* | *M1* | *M2* | *M3* |
| **Control Variables in 2005** | **Probability of survival in year 2006** | **Probability of survival in year 2006** | **Probability of survival in year 2006** |
| **Total number of employees** | 0.029 | 0.027 | 0.028 |
|  | (3.20)\*\*\* | (2.94)\*\*\* | (3.02)\*\*\* |
| **Relevance of experience** | 0.034 | 0.034 | 0.033 |
|  | (3.43)\*\*\* | (3.35)\*\*\* | (3.27)\*\*\* |
| **Quadratic of the relevance of experience** | -0.001 | -0.001 | -0.001 |
|  | (2.65)\*\*\* | (2.58)\*\*\* | (2.52)\*\* |
| **Leverage between 0 and 1** | \_ | 0.097 | 0.099 |
|  |  | (1.19) | (1.22) |
| **Leverage equal to 1** | \_ | 0.066 | 0.069 |
|  |  | (0.61) | (0.64) |
| **Leverage greater than 1** | \_ | -0.071 | -0.069 |
|  |  | (0.59) | (0.57) |
| **Leverage is infinite** | \_ | -0.264 | -0.264 |
|  |  | (2.22)\*\* | (2.22)\*\* |
| **Portion in the industry with fewer than 20 employees** | \_ | \_ | 0.616 |
|  |  |  | (0.82) |
| **Constant** | 1.233 | 1.234 | 0.694 |
|  | (19.16)\*\*\* | (16.35)\*\*\* | (1.05) |
| **Observations** | 3664 | 3664 | 3664 |

Absolute value of z statistics in parentheses.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

 **Table V C: Regressions of survival in 2007 using 2006 control variables.**

|  |  |  |  |
| --- | --- | --- | --- |
| *Models* | *M1* | *M2* | *M3* |
| **Control Variables in 2006** | **Probability of survival in year 2007** | **Probability of survival in year 2007** | **Probability of survival in year 2007** |
| **Total number of employees** | 0.029 | 0.026 | 0.026 |
|  | (3.39)\*\*\* | (3.08)\*\*\* | (3.01)\*\*\* |
| **Relevance of experience** | 0.037 | 0.036 | 0.036 |
|  | (3.60)\*\*\* | (3.52)\*\*\* | (3.52)\*\*\* |
| **Quadratic of the relevance of experience** | -0.001 | -0.001 | -0.001 |
|  | (2.86)\*\*\* | (2.79)\*\*\* | (2.80)\*\*\* |
| **Leverage between 0 and 1** | \_ | 0.061 | 0.060 |
|  |  | (0.75) | (0.74) |
| **Leverage equal to 1** | \_ | 0.097 | 0.097 |
|  |  | (0.88) | (0.88) |
| **Leverage greater than 1** | \_ | -0.114 | -0.114 |
|  |  | (0.94) | (0.94) |
| **Leverage is infinite** | \_ | -0.165 | -0.165 |
|  |  | (1.30) | (1.30) |
| **Portion in the industry with fewer than 20 employees** | \_ | \_ | -0.181 |
|  |  |  | (0.24) |
| **Constant** | 1.093 | 1.095 | 1.254 |
|  | (16.24)\*\*\* | (14.06)\*\*\* | (1.92)\* |
| **Observations** | 3092 | 3092 | 3092 |

Absolute value of z statistics in parentheses.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table VI: Regressions on initial state**

 **Table VI A: Regressions of survival in 2006 using 2004 control variables.**

|  |  |  |  |
| --- | --- | --- | --- |
| *Models* | *M1* | *M2* | *M3* |
| **Control Variables in 2004** | **Probability of survival in year 2006** | **Probability of survival in year 2006** | **Probability of survival in year 2006** |
| **Total number of employees** | 0.020 | 0.017 | 0.020 |
|  | (2.72)\*\*\* | (2.21)\*\* | (2.65)\*\*\* |
| **Relevance of experience** | 0.033 | 0.032 | 0.031 |
|  | (4.48)\*\*\* | (4.29)\*\*\* | (4.04)\*\*\* |
| **Quadratic of the relevance of experience** | -0.001 | -0.001 | -0.001 |
|  | (3.43)\*\*\* | (3.26)\*\*\* | (3.09)\*\*\* |
| **Leverage between 0 and 1** | \_ | 0.036 | 0.039 |
|  |  | (0.55) | (0.60) |
| **Leverage equal to 1** | \_ | 0.094 | 0.101 |
|  |  | (1.22) | (1.31) |
| **Leverage greater than 1** | \_ | -0.179 | -0.175 |
|  |  | (2.16)\*\* | (2.11)\*\* |
| **Leverage is infinite** | \_ | -0.249 | -0.245 |
|  |  | (3.23)\*\*\* | (3.17)\*\*\* |
| **Portion in the industry with fewer than 20 employees** | \_ | \_ | 1.668 |
|  |  |  | (3.21)\*\*\* |
| **Constant** | 0.948 | 0.988 | -0.466 |
|  | (19.64)\*\*\* | (16.43)\*\*\* | (1.02) |
| **Observations** | 4582 | 4582 | 4582 |

Absolute value of z statistics in parentheses.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

 **Table VI B: Regressions of survival in 2007 using 2004 control variables.**

|  |  |  |  |
| --- | --- | --- | --- |
| *Models* | *M1* | *M2* | *M3* |
| **Control Variables in 2004** | **Probability of Survival in year 2007** | **Probability of Survival in year 2007** | **Probability of Survival in year 2007** |
| **Total number of employees** | 0.019 | 0.017 | 0.020 |
|  | (3.07)\*\*\* | (2.76)\*\*\* | (3.07)\*\*\* |
| **Relevance of experience** | 0.036 | 0.034 | 0.033 |
|  | (5.48)\*\*\* | (5.12)\*\*\* | (4.96)\*\*\* |
| **Quadratic of the relevance of experience** | -0.001 | -0.001 | -0.001 |
|  | (4.15)\*\*\* | (3.88)\*\*\* | (3.79)\*\*\* |
| **Leverage between 0 and 1** | \_ | 0.025 | 0.025 |
|  |  | (0.43) | (0.45) |
| **Leverage equal to 1** | \_ | 0.010 | 0.013 |
|  |  | (0.15) | (0.20) |
| **Leverage greater than 1** | \_ | -0.265 | -0.262 |
|  |  | (3.60)\*\*\* | (3.57)\*\*\* |
| **Leverage is infinite** | \_ | -0.200 | -0.197 |
|  |  | (2.85)\*\*\* | (2.80)\*\*\* |
| **Portion in the industry with fewer than 20 employees** | \_ | \_ | 1.003 |
|  |  |  | (2.16)\*\* |
| **Constant** | 0.604 | 0.665 | -0.210 |
|  | (13.99)\*\*\* | (12.46)\*\*\* | (0.52) |
| **Observations** | 4582 | 4582 | 4582 |

Absolute value of z statistics in parentheses.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**V CONCLUSION**

This paper is to be considered as an introductory study to firm dynamics using the KFS. My intention is to provide a starting point and a global perspective—using the KFS—on the effects of founding and current firm’s conditions on its survival. Scholars have already covered a broad range of subjects regarding the factors prone to increase the probability of survival. Many theories followed by empirical evidence assert that size and relevant experience are positive predictors of a firm’s survival in both current and founding conditions. However, other dimensions specific to a firm’s financial and environmental conditions are more obscure. The effects of leverage and industry’s concentration are less evident. The available data had always been lacking financial information on a broader range of industries which is why most financial research on firm dynamics was directed toward manufacturing and high-tech industries. Research has also claimed the non negligible and even important effects of founding conditions on survivability in the future periods. The release of the KFS allows me to conduct a more suitable study on the effects of leverage and industry scale in the current and founding conditions. I run three different probit models on survival using both current and founding conditions.

The results reaffirm the importance of size in both current and founding regressions with current size being more important than start-up size. First, a bigger size in the current state allows the firm to be operating closer to the MES and hence be more efficient. Second, the bigger a firm is the more room it has to downgrade when needed. This last theoretical advantage is also true for the founding size. Moreover, bigger size at start-up sends a positive signal to lenders.

I find that relevant experience is a significant positive predictor of survival and is prone to diminishing returns. Like Thompson (2005), the regressions report that the importance of relevant experience does not decay.

The probability of survival is decreasing with leverage and it seems that debt—when not justified by acquiring assets—is a negative contributor to survival. The more debt the company has at start-up the more likely the exit with effects decaying as the company matures. When the firm has negative equity, the probability of exit is found to be greater in both current and founding conditions regressions.

The effects of industry scale are significant only for industry entrance as opposed to yearly activity within the industry. The result that causes concern is the positive effects associated with entrance into a small scale industry. This goes against the generally accepted proposition that competition increases the probability of exit but can be justified by low density within the industry at time of entrance. Besides, Åstebro and Bernhardt (2003) find similar results. Moreover, the regressions results on M3 brings up a new proposition—entrance in a small scale industry reduces the negative effects of debt (more realistically of negative equity).

As more waves and data become available, more questions can be answered which opens the door to future research possibilities. For example, can we estimate the time frame before founding conditions’ effects on survival become insignificant or what is the link between industry concentration and firms’ survival?

**APPENDIX**

Appendix A: Regressions results with the firm’s total number of employees variable including the firm’s number of owner-operators. The first and second columns show the results of the first year survival probability using 2004 conditions. The third and fourth columns show the results of the probability of survival in the last year of the survey (2007) using founding conditions. The results are pretty straightforward. Including the firm’s owner-operators to the number of employees for a measure of size do not change anything in the regressions whether it be on current conditions or on founding conditions (See Table AA for results).

Appendix B: Regressions results using two measures of industry scale like Åstebro and Bernhardt (2003) show that the second measure of scale (percentage of firms in the two digit sic industry employing fewer than 50 employees) is not useful in my study. The second measure of scale is found to be insignificant in the current conditions regression and both measure of scale are found to be insignificant in the founding conditions regression (see Table AB for results).

**Table AA: Regressions adding the firm’s owner-operators to the number of employees.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Model* | *M3 in first year* | *M3 in first year* | *Founding conditions using M3* | *Founding conditions using M3* |
|  | **Model including owner-operators in total number of employees** | **Model excluding owner-operators in total number of employees** | **Model including owner-operators in total number of employees** | **Model excluding owner-operators in total number of employees** |
| **Control Variables in 2004** | **Probability of Survival in year 2005** | **Probability of Survival in year 2005** | **Probability of Survival in year 2007** | **Probability of Survival in year 2007** |
| **Total number of employees without owners operator** | \_ | 0.027 | \_ | 0.018 |
|  |  | (2.40)\*\* |  | (2.78)\*\*\* |
| **Total number of employees with owners operator** | 0.025 | \_ | 0.019 | \_ |
|  | (2.42)\*\* |  | (3.02)\*\*\* |  |
| **Relevance of experience** | 0.029 | 0.030 | 0.034 | 0.034 |
|  | (3.06)\*\*\* | (3.10)\*\*\* | (5.01)\*\*\* | (5.06)\*\*\* |
| **Quadratic of the relevance of experience** | -0.001 | -0.001 | -0.001 | -0.001 |
|  | (2.49)\*\* | (2.54)\*\* | (3.91)\*\*\* | (3.98)\*\*\* |
| **Leverage between 0 and 1** | 0.169 | 0.166 | 0.028 | 0.028 |
|  | (1.93)\* | (1.90)\* | (0.49) | (0.48) |
| **Leverage equal to 1** | 0.028 | 0.028 | 0.010 | 0.012 |
|  | (0.30) | (0.29) | (0.15) | (0.18) |
| **Leverage greater than 1** | -0.150 | -0.153 | -0.239 | -0.240 |
|  | (1.45) | (1.47) | (3.18)\*\*\* | (3.19)\*\*\* |
| **Leverage is infinite** | -0.200 | -0.203 | -0.203 | -0.205 |
|  | (2.08)\*\* | (2.11)\*\* | (2.84)\*\*\* | (2.87)\*\*\* |
| **Portion in the industry with fewer than 20 employees** | 1.958 | 1.949 | 1.096 | 1.069 |
|  | (2.99)\*\*\* | (2.98)\*\*\* | (2.32)\*\* | (2.26)\*\* |
| **Constant** | -0.360 | -0.318 | -0.331 | -0.281 |
|  | (0.62) | (0.55) | (0.79) | (0.67) |
| **Observations** | 4366 | 4366 | 4366 | 4366 |

Absolute value of z statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table AB: Regressions for comparison using Åstebro and Bernhardt (2003) two measures of scale.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Model* | *M3 on first year* | *Åstebro and Bernhardt (2003): on first year* | *M3 on founding conditions* | *Åstebro and Bernhardt (2003) on founding conditions* |
| **Control Variables in 2004** | **Probability of Survival in year 2005 using one measure of industry scale (M3)** | **Probability of Survival in year 2005 using two measures of industry scale in M3** | **Probability of Survival in year 2007 using one measure of industry scale (M3)** | **Probability of Survival in year 2007 using two measures of industry scale in M3** |
| **Total number of employees** | 0.027 | 0.028 | 0.018 | 0.019 |
|  | (2.40)\*\* | (2.48)\*\* | (2.78)\*\*\* | (2.77)\*\*\* |
| **Relevance of experience** | 0.030 | 0.029 | 0.034 | 0.034 |
|  | (3.10)\*\*\* | (3.06)\*\*\* | (5.06)\*\*\* | (5.05)\*\*\* |
| **Quadratic of the relevance of experience** | -0.001 | -0.001 | -0.001 | -0.001 |
|  | (2.54)\*\* | (2.50)\*\* | (3.98)\*\*\* | (3.96)\*\*\* |
| **Leverage between 0 and 1** | 0.166 | 0.168 | 0.028 | 0.028 |
|  | (1.90)\* | (1.92)\* | (0.48) | (0.48) |
| **Leverage equal to 1** | 0.028 | 0.032 | 0.012 | 0.013 |
|  | (0.29) | (0.33) | (0.18) | (0.19) |
| **Leverage greater than 1** | -0.153 | -0.149 | -0.240 | -0.239 |
|  | (1.47) | (1.43) | (3.19)\*\*\* | (3.18)\*\*\* |
| **Leverage is infinite** | -0.203 | -0.203 | -0.205 | -0.205 |
|  | (2.11)\*\* | (2.12)\*\* | (2.87)\*\*\* | (2.87)\*\*\* |
| **Portion in the industry with fewer than 20 employees** | 1.949 | 3.028 | 1.069 | 1.201 |
|  | (2.98)\*\*\* | (1.97)\*\* | (2.26)\*\* | (1.04) |
| **Portion in the industry with fewer than 50 employees** | \_ | -2.484 | \_ | -0.299 |
|  |  | (0.77) |  | (0.12) |
| **Constant** | -0.318 | 1.101 | -0.281 | -0.112 |
|  | (0.55) | (0.57) | (0.67) | (0.08) |
| **Observations** | 4366 | 4366 | 4366 | 4366 |

Absolute value of z statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table AC: Linear regressions of size**

|  |  |  |  |
| --- | --- | --- | --- |
| **Total number of employees**  | **2005** | **2006** | **2007** |
| **Relevance of experience** | 0.041 | 0.115 | 0.114 |
|  | (2.36)\*\* | (4.56)\*\*\* | (3.92)\*\*\* |
| **Quadratic of the relevance of experience** | -0.001 | -0.002 | -0.003 |
|  | (1.54) | (3.20)\*\*\* | (3.13)\*\*\* |
| **Leverage between 0 and 1** | 0.790 | 1.174 | 1.291 |
|  | (5.50)\*\*\* | (6.19)\*\*\* | (5.94)\*\*\* |
| **Leverage equal to 1** | 2.122 | 1.733 | 2.145 |
|  | (12.85)\*\*\* | (6.86)\*\*\* | (7.50)\*\*\* |
| **Leverage greater than 1** | 0.584 | 0.280 | -0.295 |
|  | (2.91)\*\*\* | (0.90) | (0.81) |
| **Leverage is infinite** | -0.081 | 0.119 | -0.164 |
|  | (0.43) | (0.36) | (0.43) |
| **Constant** | 0.791 | 1.280 | 1.551 |
|  | (5.60)\*\*\* | (6.52)\*\*\* | (6.79)\*\*\* |
| **Observations** | 4582 | 3664 | 3092 |
| **R-squared** | 0.04 | 0.03 | 0.03 |

 Absolute value of z statistics in parentheses.

 \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

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1. The empirical literature has been more developed on the subject with papers such as Dunne et al. (1989); Mitchell (1994), Audretsch and Mahmood (1994), Haverman (1995), Geroski et al. (2007) Huynh et al. (2008). Theoretically, on the other hand, size effects on growth and survival is harder to find. Jonavovic (1982), a reference, assumes that initial size does not matter and current size includes all the information on the firm history allowing survival or exit. This is contrary to some of the empirical findings cited above reporting the importance of initial size for survival. [↑](#footnote-ref-1)
2. See Sutton (1997). [↑](#footnote-ref-2)
3. Huynh et al. (2008) describe leverage as debt over assets. Exit is increasing with the leverage variable and therefore with debt value relative to asset value (leverage= debt /assets). This is the definition I use in the paper. This confirms the results found by Cooley and Quadrini (2001). [↑](#footnote-ref-3)
4. Carroll et al. (1996), Geroski et al. (2002), Jovanovic and Rousseau (2001). [↑](#footnote-ref-4)
5. Hall (1987) considers mergers as the exit of two firms and the creation of a new firm. The creation of a new firm is irrelevant in my study. [↑](#footnote-ref-5)
6. From A. Robb et al. *“An overview of the Kauffman Firm Survey”, Results from the 2004-2007 Data”*, 2009. [↑](#footnote-ref-6)
7. From A. Robb et al. *“An overview of the Kauffman Firm Survey”, Results from the 2004-2007 Data”*, 2009 [↑](#footnote-ref-7)
8. A. Robb et al. *“An overview of the Kauffman Firm Survey”, results from the 2004-2007 data”*, 2009 [↑](#footnote-ref-8)
9. Hall (1987) suggests that the sample bias created by the earlier death probability of younger firms is not a problem in her study of growth. [↑](#footnote-ref-9)
10. From A. Robb et al. *“An overview of the Kauffman Firm Survey”, results from the 2004-2007 data”*, 2009. [↑](#footnote-ref-10)
11. This number rounds to 0.0. Actual number is 0.04. [↑](#footnote-ref-11)
12. See appendix for results of first year regression on current conditions and last year regression on initial conditions using M3. [↑](#footnote-ref-12)
13. See Cooley and Quadrini (2001), Cassar (2004), and Huynh et al. (2008). [↑](#footnote-ref-13)
14. Debt to value =debt / (debt+equity) = debt / assets and debt = assets – equity. [↑](#footnote-ref-14)
15. Debt taken by owner = personal credit cards balance, personal loans taken from bank or family members or any other creditor, business credit cards for which the owner is responsible. [↑](#footnote-ref-15)
16. Debt taken under business name= credit cards balance established for the business, bank loans for the business, credit line of business, any other kind of loans taken under the business name (such as family, government, employees, other businesses). [↑](#footnote-ref-16)
17. The survey classifies financial information under range variables. [↑](#footnote-ref-17)
18. Kennickell (1998) suggests that range variables reported in the Survey of Consumer Finances is a limitation to research and thus suggests in Kennickell (1999) to use the midpoints of the respective ranges. [↑](#footnote-ref-18)
19. The working paper by Braymen and Neymotin entitled “Immigrant enclaves and the success of entrepreneurial ventures” (december 2, 2009) assigned midpoints to the range variables whenever the respondent was asked to choose a range in the KFS. Robb and Coleman’s working paper entitled “The impact of financial capital on business performance: a comparison of women- and men-owned firms” (may 7, 2009) uses a similar approach. [↑](#footnote-ref-19)
20. Although a division by 0 is algebraically undefined, the reader must consider that the assets’ value is never really 0. The value of assets is more likely to tend to 0 so the limit on the ratio goes to infinity. [↑](#footnote-ref-20)
21. Fazzari et al. (1988) was a pioneer paper that asked the cash flow effect on investment question. Zingales 1998, like Fazzari et al. (1998), study the effect of capital market imperfections on survival. They find that highly leveraged firms are less likely to survive. [↑](#footnote-ref-21)
22. I do find an increase in the coefficient on size for the second year. I also find that the coefficient on size is greater on current state than the coefficient on initial state. [↑](#footnote-ref-22)
23. See Hall (1987). [↑](#footnote-ref-23)
24. Geroski et al. (2007), Mata and Portugal (2004). [↑](#footnote-ref-24)
25. Concentration was found insignificant in previous studies like Mata and Portugal (1994) and Huyghebaert and Van de Gucht (2004). [↑](#footnote-ref-25)
26. Hannan and Carrol (1992) asserts that competition increases mortality. [↑](#footnote-ref-26)
27. See Pointevin (1989), Zingales (1998). [↑](#footnote-ref-27)
28. Cooley and Quadrini (2001), Huynh et al. (2008) and (2009), Huynh and Petrunia (2009). [↑](#footnote-ref-28)
29. See hannan and Carrol (1992). [↑](#footnote-ref-29)