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FIRM GROWTH AND SURVIVAL FROM A 14-YEAR PERSPECTIVE: A COHORT ANALYSIS*



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ABSTRACT

This study examines whether early growth is important for the short- and long-term survival and development of new firms. For this purpose, we use registry data for a specific cohort of Swedish firms that tracks their development until their exit, or up to 14 years, at which point only 8% of the firms remain. We find growth to be clearly associated with increased survival of the firms, that the number of employees (in the previous year) is positively correlated with survival in following years, and somewhat surprisingly, that subsidiaries face a significantly larger hazard of closure than independent firms.

INTRODUCTION

Given the necessary role of innovation and productive entrepreneurship in economic growth, successful start-up firms are considered indispensable for a country's economy (Baumol, 2002). Firms that exhibit high rates of growth and succeed in maintaining this growth over a longer period of time are seen as especially valuable. When this happens, a country enjoys numerous socioeconomic benefits from their efforts, such as jobs and marketable innovations (Haltiwanger et al., 2013). For this reason, newly started firms have attracted much attention to discern what factors underlie their emergence and survival (Davidsson & Klofsten, 2003; Wiklund & Shepherd, 2003). However, previous research has shown that most firms fail to survive over the long term and that only a fraction of the survivors can be considered high-growth firms (Storey, 1984; Autio, 2007). There is therefore a need for additional research that identifies and examines the factors benefitting growth and survival.

In general, research on firm growth can be divided into two perspectives. One perspective is the link between growth, profitability and survival, where findings diverge (Davidsson, 2005; Sapienza et al., 2006). For instance, while Délmar et al. (2013) find a positive relationship between growth and profitability, they claim that growth is not necessary for survival, only profitability. The second perspective is whether there are structural explanations in quantitative analysis or whether one has to kneel before randomness (Geroski et al., 2002). With somewhat different results, Daunfeldt & Elert (2013) and Coad et al. (2013) find support for the random walk hypothesis, observing that new firms which have survived their first five years may follow any one of numerous growth paths with nearly equal probability. However, chance is not the only determinant in survival; the growth path itself and the process of resource acquisition along this path will have substantial influence. Coad and colleagues (2013) also find that underlying performance factors may have roots that reach deep into a firm's history; more commonly discussed aspects like sources of counselling and founder characteristics such as age, gender, prior experience and education are of lesser importance - especially when performance is considered from the viewpoint of financial metrics.

Other studies have observed a dependent relationship of growth and survival with contextual factors such as market structures; local market concentrations - and the nature and intensity of the competition they engender - are particularly influential. Too rapid growth, suggest Aviad et al. (2016), can be costly, and

depending on market structure and firm age, it may well be detrimental to survival (Pierce & Aguinis, 2013; Probst & Raisch, 2005). Their model of growth rate versus failure for a new market participant is curvilinear and supports the idea that the structures of local economic activity and competition are determinants of the growth-survival relationship (Aviad et al., 2016). Continuing along contextual lines, Dosi et al. (2017) analyze early-stage growth by focusing on associations between market rewards to start-up firms and firm profitability and productivity. They identify variations in market selection according to sector; start-ups are more prevalent in low-technology, services, and under-concentrated sectors. They also find selection based on growth primarily to occur in terms of productivity, rather than profitability. Thus, contrary to the principle of “growth of the fitter,” changes in the relative productivity of a firm appear to drive selection (ibid.: 3).

Other researchers, however, are critical of these survival theories, which operate on the underlying assumption that business owners and managers hold survival as the primary aim, and see market exit as an ultimate outcome to be avoided (Josefy et al., 2015). Certain entrepreneurs may have as their goal to exit the market through an acquisition or a sale of their firm as soon as possible, while many statistics would likely list such an event as a failure. Thus, they propose a multi-faceted model with three dimensions: solvency, operations, and ownership. The lens that these dimensions provide helps clarify reviews of the literature and adds an understanding that improves research on new-firm failure and survival (ibid.).

AIM AND SCOPE

Previous studies, like Coad et al. (2013), have observed that survival is closely linked with growth paths and that when controlled for lagged size, results show that survival factors also include the length of the growth lag and start-up size. Efforts to explain the “when” and “why” of new-firm growth have yielded only modest progress in our understanding of new-firm survival. More mature firms undergo dynamics that are no less important to understand, but they are of a different nature (Davidsson & Klofsten, 2003; Haltiwanger et al., 2013). Our starting point is to employ established methods and models but to limit our analysis to a single cohort of start-ups - specifically a subset of this cohort - in order to address the issues of randomness and heterogeneity. A single cohort limits the set of new ventures with a more even distribution of market experience. Our data allows us to divide this set of start-ups into sub-sets, thus limiting heterogeneity further. For instance, we contrast manufacturing firms with professional services firms and the general population of new ventures. We are thereby able to perform an analysis on firms with similar initial conditions, thereby addressing the common problems of selection bias and accounting for numerous unobservable, yet confounding factors (Carpenter & Lynch, 1999; Hyytinen, Pajarinen & Rouvinen, 2015).

With this in mind, this study is based on the notion that growth drives a self-perpetuating cycle where firms that retain resources can leverage these to continue growing. Hereby, those innovative firms which have succeeded in generating and using their profits to survive and grow can only be identified retrospectively. This study explores which common denominators are inherent in new-firm growth processes and how growth paths affect survival. Specifically, the present study asks how important growth is for (i) the short-term survival and development of new firms, and (ii) the long-term survival and development of new firms.

METHOD AND DATA

Prior research has emphasized the importance of the time dimension when studying firm growth (Box, 2008). A “major limitation” among previous empirical studies is the lack of longitudinal perspective (Daunfeldt & Halvarsson, 2011: 9), as panel data are preferable to cross-sectional samples when conducting causal analyses (Wooldridge, 2002). For this reason, we use data that follows start-up firms over an extended period of time, an approach that is “uniquely well-suited to study these issues” (Haltiwanger et al., 2013: 347). To mitigate concerns of selection bias, our sample comprises an entire cohort of firms, which we use to identify

determinants of new firm survival (Macdonald, 2012). We proceed to study the consequent development of the cohort with a focus on their age and the relationship between survival and growth (Agarwal & Audretsch, 2001; Hözl, 2014).

We retrieved the data used in this paper from databases maintained by Statistics Sweden, specifically FAD (data on founding, restructuring, closure, employees, and workplaces), FEK (accounting data from financial statements), and RAMS (employee data from labor market statistics) which provide annual, comprehensive, and reliable data for registered Swedish firms (Wennberg et al., 2016). It covers the full cohort of firms founded in Sweden in 1997 (83 842 firms), which helps alleviate survivor bias (Denrell, 2003). Furthermore, the time frame of 14 years is long enough to cover several business cycles, which should decrease the risk of isolated trends excessively affecting the data. As 1997 was not a year marked by extreme macroeconomic shocks or investment booms in Sweden, we see it as sufficiently representative with respect to the number and nature of firms that were established.

Hereby, we limit our analysis to firms founded as “genuinely” new firms, since the rich and detailed data allows us to distinguish between restructurings - like mergers, acquisitions, and spin-offs - on the one hand, and truly new entrants on the other (Davidsson et al., 1998). We only include limited companies (leaving 19 156 firms as the object of study), as we interpret incorporation (with the associated capital requirements) as a signal of intent to grow in the long run. Thus, we hope to exclude “part-time or hobby firms” from the analysis (Délmar et al., 2013: 282). Furthermore, Swedish incorporated firms need to be audited by law, which serves to further increase the reliability of the accounting data that is administered and verified by the Swedish tax authorities (*ibid.*). Finally, as in previous studies of firm growth, we limit our scope to organic growth (Coad, 2007), which excludes corporate measures like mergers and acquisitions. With this in mind, our empirical analysis is structured as follows. After an initial descriptive analysis of the firms, we conduct a logistic analysis to identify determinants of firm survival, both by pooling the firms and by treating it as panel data. Finally, as a robustness check, we conduct a duration analysis by employing a Cox proportional hazards model. All models include control variables based on prior literature (Coad, 2007; Manjón-Antolín & Arauzo-Carod, 2008).

Among the statistical approaches to analyzing firm survival, “discriminant and logit analyses have been the most popular approaches,” although survival analysis and hybrid models are also commonly used (Gepp & Kumar, 2008: 13). This study opts for two methods that show considerable promise. First, we use the widespread (Lin & Huang, 2008) logistic approach since it, along with probit models, has been shown to “identify failing firms more accurately than discriminant analysis” (Lennox, 1999: 347). In addition, we perform a duration analysis (also known as survival, or hazards, analysis), which is a widespread practice in the literature on firm survival (Cader & Leatherman, 2011; Suárez & Utterback, 1995). Compared to binary choice models like logit and probit analyses, duration analyses have the advantage that they account for right-censoring in the data and the duration of the firms’ survival (Esteve-Pérez, Sanchis-Llopis & Sanchis-Llopis, 2004; Geroski et al., 2010). This means that they also account for explanatory variables that are time dependent. Put differently, it estimates the conditional probability that a firm will survive a given period $t + \Delta t$. Specifically, this study employs a semi-parametric duration model, namely Cox’s (1972) proportional hazards model, since it is the one that is most prevalent in analyses of firm survival (Anavatan & Karaöz, 2013). It offers the advantage of not imposing distributional assumptions and addressing censoring and truncation in the data (Datta, Satten & Williamson, 2000; Shen, 2011).

ANALYSIS AND RESULTS

The study finds that among the cohort of 19 156 “genuine” start-ups only 1 515 firms (i.e., 8%) survive until the end of the 14-year period. An overview of the firms’ establishment and attrition rates shows that less

than 8% of the firms in the initial 1997 cohort remain intact until 2011. Almost 75% were liquidated, while approximately 12% (mergers) and 6% (splits) were restructured. The large number of exits in the first few years shows how a firm is subject to the strongest forces of market selection and adversity in the first three or four years of its life in terms of survival chances. We also find that the surviving firms still exhibit growth 10 years after their establishment.

Analogously to previous studies (Audretsch et al., 2000; Bates, 1990), our multivariate logit regression model uses a binary coding for the dependent variable. It is set to equal one if a firm is still operative in the present year and otherwise takes the value zero. As is commonly done, we calculate a given firm's growth rate at time t as the log-differences of firm turnover between times $t-1$ and t (Bernard, Massari, Reyes & Taglioni, 2014; Colombelli, Haned & Le Bas, 2013). Furthermore, building on Geroski's (1995) stylized facts, we control for firm and industry characteristics when analyzing potential determinants of survival.

Besides 1- and 2-year lagged growth rates (Coad & Hölzl, 2010; Davidsson & Wiklund, 2013), which are the variables of interest, we control for additional dimensions by including them as covariates in the models. First, we include firm size measured as number of employees (Koch, Späth & Strotmann, 2013; Lööf & Nabavi, 2014), firm age (Délmar et al., 2013; Hölzl, 2014), and firm profitability measured as return on assets (Délmar et al., 2013; Wennberg et al., 2016). Furthermore, we include geographic expansion (Barringer & Greening, 1998) proxied by the number of firm offices, a dummy variable indicating if the firm is a subsidiary (Harhoff, Stahl & Woywode, 1998), export orientation measured as the export share of sales (Giovannetti et al., 2011), and the firm's indebtedness measured as the equity share of total assets (Halldin, 2010). In addition, we control for physical capital, measured as investment expenditures (Coad, 2009; Spiezia & Vivarelli, 2000), human capital, measured as the share of employees with tertiary education (Halldin, 2010; Délmar et al., 2013), and the share of female employees (Halldin, 2010). We lag all control variables by one year in order to account for reverse causality (Coad, 2016; Hamilton and Nickerson, 2003). Finally, we control for the respective average industry growth (Hölzl, 2014; Wennberg et al., 2016) and include dummies for industry classification and region (in the duration analysis) as well as current year (in the logistic analysis). Following the results from a Hausman test, the pooled logistic regression employs fixed effects, while we find support for employing a random effects approach in the panel model, owing to low variation in the independent variables between years. We conduct this analysis for the entire cohort, as well as the individual industries, to account for potential heterogeneity (Halldin, 2010; Saridakis et al., 2007).

We find that the three models yield generally comparable results, namely that growth appears to be positive and highly significant with respect to firm survival. In other words, the results suggest that growth in the year $t-1$ for a given firm is clearly associated with a higher likelihood of survival in year t . Similarly, the results from the duration analysis indicate that an increased growth rate in the preceding year suggests a decreased risk (or hazard) of closure in the following year. Testing for joint significance of the growth variables also shows that growth in two consecutive years significantly increases the chances of survival in all three models. Turning to the results for the control variables, we find that firm size (i.e., number of employees) and being a subsidiary are the only significant variables with a magnitude that is comparable to the growth covariates. Hereby, size appears to promote survival, while, somewhat surprisingly, subsidiaries appear to be less prone to survive. While the positive effect of profitability and the adverse effect of a higher share of female employees are both statistically significant, the estimates are of negligible magnitude. Analyzing the industry groups separately yields largely comparable results for the three models, even though, in line with prior research (Hölzl, 2013), several industries exhibit higher mortality rates with increasing age.

Table 1 - Results from regressions to predict firm survival

Variable coefficient (robust standard errors in parentheses)	Model 1 Pooled Logistic, FE (log-odds, survival)	Model 2 Panel Logistic, RE (log-odds, survival)	Model 3 Cox Prop. Hazards (hazard ratio, exit)
growth (1-year lag)	0.313*** (0.0554)	0.419*** (0.102)	0.750*** (0.0242)
growth (2-year lag)	0.126** (0.0434)	0.173* (0.0748)	0.882*** (0.0297)
firm size (employees)	0.159*** (0.0221)	0.314*** (0.0459)	0.8674*** (0.0171)
firm age (years)	-0.320 (0.192)	-0.865* (0.414)	(omitted)
return on assets (net profit/total assets)	0.00470** (0.00148)	0.00560* (0.00282)	0.999955*** (0.0000168)
expansion (number of offices)	-0.137 (0.0723)	-0.222 (0.200)	1.1530* (0.0810)
subsidiary (dummy variable)	-0.222* (0.110)	-0.356 (0.184)	1.2155* (0.1155)
export orientation (export share of sales)	-0.0174 (0.0125)	-0.0572 (0.0316)	1.0114** (0.0043)
firm indebtedness (equity share of total assets)	-0.000644 (0.000949)	-0.000728 (0.00127)	0.999984* (0.00000738)
physical capital (net investments)	0.0000226 (0.0000157)	0.0000447 (0.0000427)	0.999981 (0.0000129)
human capital (share of employees with tertiary education, %)	0.000713 (0.000682)	0.00172 (0.00147)	0.999340 (0.000593)
female employees (share of female employees, %)	-0.00230** (0.000710)	-0.00559*** (0.00157)	1.00195** (0.000610)
average industry growth	-0.00278 (0.0192)	0.00747 (0.0351)	1.001228 (0.016486)
constant	2.709*** (0.439)	6.610*** (1.161)	
Number of observations	17 744	17 744	17 744
Number of groups (companies)		6 901	6 901
Unless otherwise noted, all independent variables are lagged by one year with respect to the dependent variable. Dummy variables for year (models 1 and 2), industry and region are included in the estimations, but results are suppressed for brevity.			
* p < 0.05, ** p < 0.01, *** p < 0.001			

Finally, we estimate the three models using 3- and 4-year lags for the growth rates and limiting the sample to the first five years of the time period, i.e., 1997-2002, thereby evaluating the importance of growth in the firms' first two years following inception. While the results are once again largely comparable to the main models, growth in the first year (i.e., lagged by four years) is not significant (although it is jointly significant with the 3-year lagged variable) and geographic expansion has a significant negative effect on survival. The remaining estimates are either not statistically significant, or negligible in terms of the magnitude of the effect.

CONCLUSIONS AND IMPLICATIONS

This study corroborates previous findings that growth is a good predictor of new-firm survival. Earlier studies using similar methods have also observed this pattern (Ha, 2013; Hao & Naiman, 2007). Our findings lend support to the stylized fact that growth improves the chances of survival for young firms. First, early growth appears to be important with respect to both short- and long-term survival, and growth in later developmental stages is associated with greater chances of survival (Coad et al., 2013; Mata et al., 1995). Similarly, limiting our analysis to the first five years of life of the study cohort also yields an association between growth and higher survival rates. Although this relationship is not as robust when industries are estimated individually, there is still a clear tendency for growth to be followed by survival. Second, the number of employees in the preceding year correlates positively with survival in the following year. This mirrors results from earlier studies, implying that firms with a higher number of employees stand a higher chance of surviving (Bates, 1995; Brüderl et al., 1992). Third, and somewhat surprisingly, we find that subsidiaries seem to face a significantly larger risk of closure than independent firms. While unexpected, this finding has also emerged in previous literature. Audretsch and Mahmood (1995: 101) find that “the hazard rate is significantly higher for establishments which are a branch or subsidiary of an existing enterprise than for new independent enterprise.” Similarly, Bradley et al. (2011: 506) suggest that “subsidiaries are likely to take on the characteristics, routines ... and orientation of their parent organizations, thus undercutting the adaptive potential of the organization.” Though subsidiaries are initially somewhat protected from competition, the fiercer pressures from selection may in fact strengthen the “resourceful capability development” of independent firms which have no such shield (ibid.).

A notable caveat in this study is that, as in prior literature (Coad, 2009; Hoogstra & van Dijk, 2004), our models exhibit low explanatory power, as shown by low R² values (below 5%). This illustrates the elusiveness of measuring early firm dynamics, and why firm growth is often considered predominantly random and mainly driven by stochastic shocks. As Davidsson and Klofsten (2003) note, the additive models used in quantitative research today only partially explain outcome variance in assessments of new, small-firm development. Notably, early-stage firms generally find themselves in a volatile environment, where short-term decision-making leaves little time for considering fundamental weaknesses in their situation (Davidsson & Klofsten, 2003). More comprehensive methods that are quantifiable and generalizable are still lacking, as current holistic approaches tend to be qualitative and have unknown generalizability. While our analysis seeks to account for the most important determinants of firm survival, prior literature identifies additional factors that we were unable to assess (cf., Klofsten, 2005; Saridakis et al., 2007; Wennberg et al., 2016). Nevertheless, our findings suggest that interventions aimed at new firms may not have their desired effect if they ignore the crucial role of firm age (Haltiwanger et al., 2013). Thus, focusing on firm size while ignoring age may render small-business policies ineffectual in pinpointing real needs in new-firm support (Klofsten & Jones-Evans, 1996).

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