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Abstract

This paper investigates whether employee characteristics matter for firm survival. The focus of the paper is on born global firms both within the manufacturing and KIBS industries. A Cox proportional hazard model is implemented to find hazard ratios of the included employee and control variables. The results show little significance of individual employee characteristics as determinant for survival rates when born global firms are investigated. Furthermore, neither spinouts nor firms categorized as future exporters show much significance on individual characteristics. However, when the sample is extended to include the total amount of new firms, we see that individual employee characteristics matter for survival. This is especially true for measurements of education levels, which affect survival rates positively.

Keywords: Born global firms, firm survival, employee characteristics, Cox proportional hazard model

JEL classification: L25, L26, M13, M21, F14

1. Introduction

Entry and exit of firms are two events with major influence on the dynamics of many industries. The larger the stock of new firms provided with the appropriate preconditions to grow and become competitive, the more likely it is for at least some of them to survive and become important players both domestically and internationally. Most economies are striving towards a business climate that facilitates the creation and survival of new firms. Some of these firms have a global mindset from the outset seeking "to derive significant competitive advantage from the use of resources and the sales of outputs in multiple countries'' Oviatt and McDougall, 1994: p.49). Such firms are labeled born global firms.

The theory on small firm internationalization has traditionally adopted an incremental step-by-step approach, where firms gradually increase their international involvements (see, for instance, Johanson and Vahlne, 1977, 1990, 2006 or Vernon 1966, 1971, 1979). The last couple of decades have, however, witnessed about many entrepreneurial firms that right from foundation start international activities in many countries simultaneously. In studies of these firms, a predominantly qualitative perspective has been adopted. Instead of looking at performance in terms of firm growth and survival rates, most studies have focused on the circumstances behind the foundation of born global firms (see Rialp-Criado et al. (2005) for a review on early internationalizing firms).

Since much of the research on born global firms has emphasized the entrepreneur and the people working within born global firms, the present paper will focus on individual employee characteristics as a determinant of survival. Thanks to a rich and detailed dataset, covariates such as gender, age, nationality, personal income and education will be used in a Cox proportional hazard model to investigate the effects of employee characteristics on survival rates of born global firms.

The remainder of the paper is organized as follows. Section 2 reviews the literature on firm internationalization with a special focus on born global firms. It also tries to describe the literature on firm survival and its determinants resulting in the hypotheses of the present paper. Section 3 and 4 describe the data and empirical methodology respectively. The section on data also contains descriptive statistics on survival rates of born global and other firms. Section 5 presents the results and finally the conclusions follow in the last section.

2. Literature review

Born global firms

Previous literature has made no attempt in describing the survival of born global firms. Partly, this has probably to do with the relatively short period of time since the concept of born global firms was first acknowledged. McKinsey & Co. (1993) were the first to use the term born global firm in a study of manufacturing exporters in Australia. In their study they distinguished between ordinary firms and so called born global firms. According to their definition, a born global firm is "one which views the world as its marketplace from the outset; it does not see foreign markets as useful adjuncts to the domestic market". Subsequent studies labeled the phenomenon of firms with early and sizable exports differently: born globals (e.g. Knight and Cavusgil, 1996), international new ventures (McDougall et al. 1994), instant exporters (McAuley, 1999) and global start-ups (Oviatt and McCougall, 1994). The Oviatt and McCougall (1994) study defines early internationalizing firms as those that ''from inception, seek to derive significant competitive advantage from the use of resources and the sales of outputs in multiple countries''.

The existence of these born global firms contradicted the prevailing idea of firms following an incremental stage approach in the internationalization process. Instead, these firms started their international activities right from birth entering multiple countries simultaneously. The gradual international commitment predicted by the stage theories of Vernon's (1966; 1971) and Johanson and Vahlne's (1977; 1990; 2006) basically implicated that firms had to learn about their own status and the situation of its surroundings before moving to a next step on the internationalization ladder. Hereby, firms start selling products to their home market and, thereafter, sequentially enter other markets.

Vernon's (1966; 1971) model based firm internationalization on the product life cycle. He believed it necessary for the firm to maintain flexibility in having production at home at early phases of the product life cycle. As the product gets more standardized, production locations further from the firm's home market can be considered in order to serve local markets or for cost saving reasons. In later work, Vernon (1979) began questioning whether his model of incremental internationalization had become obsolete since many differences between countries had narrowed down while the geographical reach of many companies had increased. The fact that some firms, launching new products in several markets simultaneously, could be

identified, especially within industries with high level of innovation, made his model lose some explanatory power. Vernon (1979) did not want to completely abandon his model. Instead he argued that it could be applied to small firms without large international networks.

Other studies favoring the stage models of firm internationalization are Johanson and Vahlne (1977, 1990; 2006) and Johanson and Wiedersheim-Paul (1975). These scholars constructed the Uppsala internationalization model in which the "enterprise gradually increases its international involvement" (Johanson and Vahlne, 1990, p.11). Key to their model is the distinguishing between psychic and physical distance. Psychic distance includes differences in languages, cultures, political system etc. whereas physical distance stands for geographical distance. First, the firm gains international experience in those markets that are perceived as psychically close. Gradually, experimental knowledge in foreign markets increases with a decreased psychic distance as a consequence. The lower this barrier gets, the more the firm expands its operations in foreign countries. Contrary to the Vernon model, it is, thus, the firm together with its international context that determines the degree of international activities of the firm.

Both Vernon's model and the Uppsala internationalization model have been criticized for an inadequate description of how firms internationalize in today's global markets, see e.g. Andersson & Wictor (2003) and Chetty & Campbell-Hunt (2004). The preconditions for starting an international venture have changed dramatically during the past decades. The criticism of the incremental stage theories of internationalization is very much based on this change in environmental conditions. The advancements in production, transportation and information technologies, for instance, have facilitated the creation of born global firms.[1] Despite these achievements, the vast majority of firms are not implementing a born global strategy. There are probably many reasons for founding a born global firm, but the perhaps most important one is the desire to lock-in new customers and swiftly exploit proprietary knowledge as the main source of competitive advantage (Bell et al., 2003). This is especially

[1] Knight and Cavusgil (1996) present several trends that have given rise to the emergence of born global firms: 1) The pressure to specialize in order to be competitive has created an increasing amount of niche markets. In order to be successful in niche markets firms have to increase their customer base by going global. 2) Advances in technology regarding production and transportation. 3) Advances in communication technology. 4) Advantages of small firms in terms of quicker response time, higher flexibility, adaptability etc. 5) Globalization itself in terms of knowledge, decreased trade barriers and facilitating institutions. Entrepreneurs nowadays have more international experience and foreign market knowledge. 6) Trends towards global networks which are facilitated by advances in information technology. Altogether, these trends and preconditions build an environment that facilitates the creation of born global firms.

true for firms with very niche oriented products of high technological content.[2] Hence, some firms are better suited for a born global approach than others.

Determinants of firm survival

Survival can be considered the critical performance factor of new firms since it is the precondition for other types of performance factors such as employment growth and profitability for instance. According to the theory by Jovanovic (1982), growth and survival are essentially two sides of the same coin. In his theory, heterogenous firms learn about their efficiency levels only after they enter the market. Firms experiencing bad outcomes realize that they are inefficient and are, hence, forced out of the market. On the contrary, high performers survive and grow larger as they update their beliefs about efficiency levels. In this sense, survival and growth are intimately associated.

Much research has been made to disentangle the determinants of firm survival.[3] These determinants can be grouped into three types.[4] The first group deals with personal characteristics such as competency, entrepreneurial background, education levels etc. Previous literature has mainly been concerned with the traits of the entrepreneur and not so much the employees of the newly started firm, see for instance Saridakis et al. (2008). The second group of determinants concerns firm-specific factors. These include firm age, size and industry affiliation. Evans (1987) finds that the probability of surviving for a firm increases with the time it has lived. This liability of newness has been confirmed in, for instance, Dunne et al. (1988) and Audretsch (1991). In these studies, firm size is also found to positively influence firm survival. Hence, as described by Box (2008), a liability of smallness is present. This effect is, furthermore, an outcome of the model by Jovanovic (1982), which predicts that firm survival increases with size. The third group of determinants acknowledges that environmental factors impact the survival rates of firms. These could be regional attributes or other macroeconomic variables like unemployment rates or per capita income growth as in Acs et al. (2007). For Swedish municipality data, Berglund and Brännäs (2001) find evidence that survival probabilities vary much more between municipalities than within.

[2] Freeman et al. (2006) list a number of key variables that can be positively associated with rapid internationalization. 1) A too small domestic market. 2) Commitment and belief by senior management to the idea of internationalization. 3) Personal networks. 4) Unique technology as source of competitive advantage. 5) Growth through partnership and alliances.
[3] See for instance, Saridakis et al. (2008) or Audretsch et al. (2000) for studies on the determinants of firm survival.
[4] Similar three groups are found in the description of survival determinants in Box (2008).

When addressing survival of new firms, some studies focus on differences in industry characteristics or time period effects. Attempts to characterize differences in survival rates across industries can be found in Audretsch (1995). He differentiates industries depending on their innovative activity and finds that the likelihood for surviving more than a decade subsequent to birth is lower in industries where innovation matters more than in industries of lower innovation activity.[5] Box (2008) is an example where time period effects are emphasized. Based on a long time series, he finds that the time cohort affiliation of a firm has an impact on survival with higher survival rates during periods of macroeconomic expansion. Others have stressed differences in survival between groups of firms, see for instance Klepper and Sleeper (2005) or Agarwal et al. (2004) for studies on spinoff firms. They find that firms founded in this way survive longer than other new firms. Another group of firms differing in survival probabilities is small and medium-sized exporters. These firms have been shown to experience a significantly lower probability of failure than non-exporters (Silviano & Máñez, 2008).

However, despite the large amounts of studies on firm survival and the increasing literature on born global firms, no study has tried to link employee characteristics in newly founded firms to survival rates among born global firms. In studies on these firms, the importance of the entrepreneur and his or her networks has been emphasized without focusing on the total amount of people employed by these firms. The present paper will investigate survival of new born global firms. In order to contrast the results on born global firms to other groups of firms, it uses three reference groups of firms, namely the total amount of new firms, new firms that export during the studied time period and spinoff firms. The investigation of a possible impact of employee characteristics on firm survival will use the following three hypotheses as starting point:

H1. Firms with higher shares of immigrants or women survive longer.

This hypothesis is based on the Becker (1957) model of employer discrimination. In this model employers are believed to discriminate, for instance, women and immigrants. These groups, which are subject to discrimination, are only hired if it is possible to pay them lower wages to compensate for the utility loss resulting from their employment in the firm.

[5] In addition to the mentioned finding, Audretsch (1995) also finds that the conditional likelihood of surviving an additional two years for entrants that have already survived the first few years is actually greater, and not lower, in highly innovative industries.

However, if these groups are paid lower wages, it becomes profitable to hire them. Non-discriminatory employers would, thus, hire these discriminated groups resulting in more profitable firms which are more likely to grow and survive in a competitive market.[6]

H2. Having educated employees is beneficial for survival.

Human capital is considered to be a critical intangible asset for new firm survival (Peña (2002)). This effect should be particularly present among rapidly internationalizing born global firms, which, according to Freeman et al. (2006), exist in high-technology niche markets. The higher the technology content of a sector, the more likely it is that a high education level among the firm's employees influences firm survival positively.

H3. Firms with employees of higher age are less likely to survive.

Many studies have found a negative effect of age on employee productivity. Skirbekk (2008) reviews these findings and groups them according to the methodology of choice, e.g. supervisors' assessments of employees, self-assessed work ability, task-quality/speed tests and analyses of employer-employee datasets. More elderly employees are found to be especially low-productive when it comes to tasks that require a reorientation towards solving new kinds of problems. Such age-induced productivity reductions may increase with the complexity of new work tasks (Myerson et al., 1990).[7] The smallness of newly founded firms often requires a wider variety of work tasks, some of which inevitably are new and unfamiliar to the individual worker, resulting in lower productivity among individuals of higher age. The likelihood of firm survival would, all else equal, be lower for firms with inefficient and low-productive employees.[8]

[6] When it comes to immigrants and international activities, it is very likely that immigrants add knowledge on destination countries, especially if exports are directed towards the country in which the immigrant is born. This knowledge is probably increasing survival probabilities on export markets.

[7] The typical example is the introduction of computers and IT-related ingredients in many work tasks, which, if used appropriately, often can enhance productivity (see Czaja and Sharit (1993) for an investigation of the link between age and low productivity in computer-based work performance). However, in fields they know well and where long experience is especially beneficial, employees of a higher age can remain very productive.

[8] Senior employees are also often paid higher salaries and employee obligations in terms of pension benefits, which tend to increase as a firm's employees are ageing. Hereby, a more elderly employee has to produce more than its younger counterpart in order to be as productive.

3. Data and descriptive statistics

The data on entry and exit of new firms is provided by Statistics Sweden. A firm is characterized as new in a certain year if it is absent in the business statistics the previous year. Since the data is available from 1997-2008, we can identify new firms from 1998 onwards. The compiled dataset includes information from business statistics, international trade data on exports in manufacturing goods and information on the circumstances surrounding the foundation of firms. This last information is crucial in determining if a new firm truly can be regarded as a new firm or if it is the result of a spinoff or a merger. The duration of a firm's life can be considered to vary depending on how it was founded. The experience of the firm as such and its employees is expected to be very different if one is to compare, for instance, a merged firm to a completely new firm.

Three definitions are used to characterize firms as born global. In line with Halldin (2011a) and Halldin (2011b), this paper adopts a *stringent*, a *modest* and an *alternative* definition of born global firms. The common characteristics of the three definitions are the timing of export market entry and the magnitude of export activities. Born global firms according to the *stringent* definition are those firms with at least 25 percent of sales in exports within two years of foundation. The *modest* definition encompasses those firms reaching an export share of at least 10 percent within five years of firm birth. The third definition, the *alternative* one, introduces an element of persistence in export behavior. Firms classified according to this definition have an export share greater than 25 percent on average during three consecutive years no later than year two, three and four of the firm's life. The use of multiple definitions to characterize born global firms is motivated by the many varying definitions in previous literature. If interpreted jointly, the chosen empirical definitions are believed to better capture born global firms according to the definitions of McKinsey & Co.'s (1993) or Oviatt and McDougall's (1994).

The access to export data on manufacturing goods makes the manufacturing industries a natural object of study in this paper. However, as in Halldin (2011b), one can argue that firms from the KIBS industries also could be incorporated into the study of born global firms since they have non-negligible amounts of exports in manufacturing goods. Therefore, this paper investigates both born global manufacturing and born global KIBS firms.

Except for the above mentioned data considerations, there are a few more worth mentioning. First, born global firms that leave export markets during the time period of study are removed from the sample since they cannot be perceived as born global in the sense of Oviatt and McCougall (1994) or McKinsey & Co. (1993). Furthermore, firms that become subject to a merger or spinoff during the studied time period are also excluded since such restructuring within the firm in many cases would imply a somewhat new firm. Hereby, only organic growth is allowed. Firms leaving the dataset due to a merger or acquisition are also excluded since they exit the market for other reasons than being low-performers. Lastly, the dataset is, due to data availability, restricted to include new firms where at least one person has its main employment.

The focus of attention in this paper is on how employee characteristics influence the survival of born global firms. However, in order to contrast born global firms to other firms, three reference groups are used to investigate if and how survival of born global firms differ vis-à-vis other firms. These three groups are spinoff firms, firms with exports during the studied time period but not reaching the requirements of the born global definitions and, finally, the total bulk of new firms.[9]

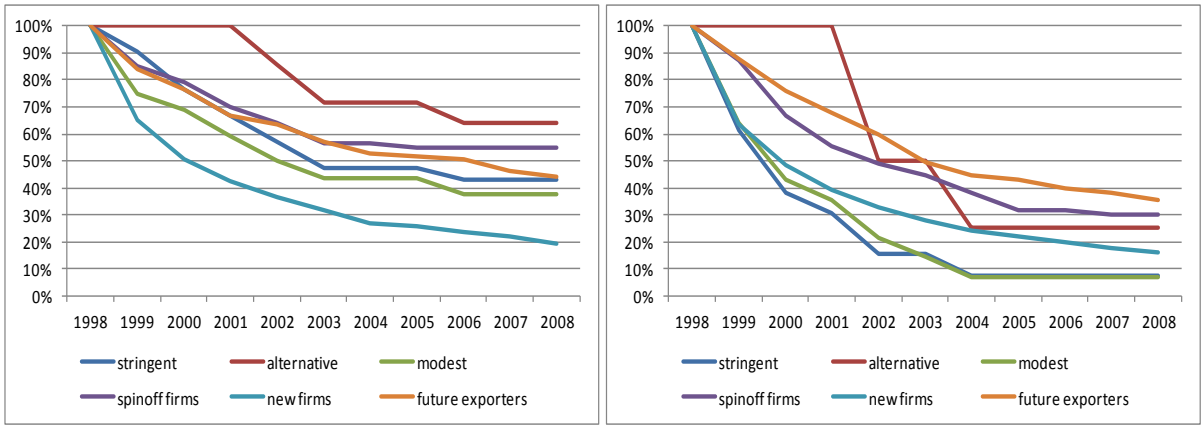
Since born global firms are defined as described above, it is only the beginning of the studied time period 1997-2008 that can be used when identifying new born global firms. Born global firms of the stringent definition are founded during the nine-year period 1998-2006, born global firms of the modest definition during the six-year period 1998-2003 and those firms satisfying the alternative definition during the seven-year period 1998-2004.

In order to get some preliminary idea of the survival of new firms, i.e. both born global firms and the described reference firms, figure 1 presents how the cohort of firms born in 1998 evolves over the 1998-2008 period. For both manufacturing firms and KIBS firms it is clear that survival rates are lowest during the early period of a firm's life. After an initial rapid decline, the slope of the above curves flattens out. However, despite this overall pattern, the different groups of firms in the 1998 cohort seem to have somewhat different characteristics

[9] The inclusion of spinoff firms as a comparison group is based on the many studies witnessing about superior survival rates of spinoff firms, e.g. Klepper and Sleeper (2005) and Agarwal et al. (2004).

in terms of survival rates. Born global firms of the alternative definition aside[10], the figures do not indicate that born global firms are performing superior in terms of survival rates[11]. A decade after birth, about 20 percent of all new manufacturing firms in the sample still exist, while around 40 percent of born global firms of the stringent and modest definitions remain in the manufacturing sample. Similar survival is found for new manufacturing firms with some exports during the time period of study. Manufacturing spinoff firms have a higher survival rate where 55 percent survive during the time period. For the KIBS firms in the right-hand chart of figure 1, the results are similar except for the downward shift of all curves.[12]

Figure 1 Evolution of firm lives for the 1998 cohort (percentage of firms surviving). The left-hand chart represents manufacturing firms and the right-hand chart KIBS firms. Stringent, alternative and modest represent the three born global firm definitions. The remaining three lines are the three reference groups.

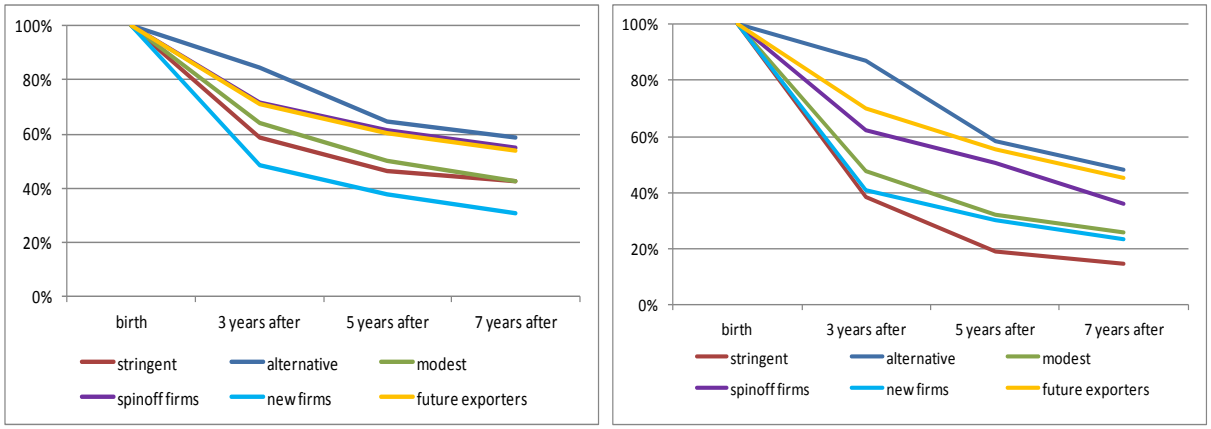


Instead of describing a single cohort, figure 2 is based on pooled data. The two charts represent the average share of firms surviving three, five and seven years for manufacturing firms and KIBS firms respectively. It is clear that almost all subgroups of firms have higher average survival rates than the comparison group of all new firms. It is only born global KIBS firms, defined according to the stringent definition, that perform worse than the total bulk of new firms. Comparing manufacturing firms to KIBS firms, we see that manufacturing firms on average survive longer than KIBS firms. Finally, it is noteworthy that new firms seem to

[10] The much less smooth line of the group of born global firms of the alternative definition is explained by the fact that this group only contains a few firms when narrowed down to a single year's cohort. Therefore, one should not put too much emphasis on the high survival rates among these firms.
[11] Remember the narrowness of a single cohort. However, similar results are found for other cohorts as well.
[12] For the born global firms, the smallness of the sample should be taken into consideration when interpreting KIBS firms. From beginning in 1998 the firms defined by the stringent, alternative and modest born global definitions are but 13, 4 and 14 firms respectively.

have the most difficulty in surviving the first couple of years after foundation. This liability of newness has been found in numerous studies, see for instance Dunne et al (1988) or Audretsch (1991).

Figure 2 Average share of firms surviving three, five and seven years based on pooled data. The left-hand chart represents manufacturing firms and the right-hand chart KIBS firms. Stringent, alternative and modest represent the three born global firm definitions. The remaining three lines are the three reference groups.



Divided on industry classes, table 1 presents data on the number of firms surviving three, five and seven years following firm foundation.[13] One could suspect that the more advanced and the higher the technology content of the industry is, the higher are the entry costs for new firms. Hence, firms entering such industries despite the entry costs could be expected to be stronger than the average entering firm. When looking at manufacturing firms, no such conclusive effect can be seen. For most of the subgroups of manufacturing firms we see that the medium segment in terms of technology content has the most survivors.[14]

[13] Due to the pooled data, the within parenthesis share of survivors could sometimes be higher, for instance, seven years after birth than five years after birth. The reason for this is the limited time frame of the dataset. Firms with the possibility to survive five years have to be born 1998-2003 whereas firms with the possibility to survive seven years have to be born 1998-2001. As an example, we could in the first case have five out of ten firms surviving while three out of five firms could be surviving in the latter case.

[14] Note again that some of the groups of born global firms contain very few firms. Therefore, some of the percentages might not be representative.

Table 1 Number of surviving firms divided by industry three, five and seven years following firm foundation. Within parenthesis the share of firms surviving three, five and seven years. The manufacturing industry classes are based on the OECD classification of technology content. The KIBS industries are SNI 72-74.

Manufacturing firms			
Born global firms (Stringent)	*After 3 years*	*After 5 years*	*After 7 years*
High tech	7 (41%)	3 (33%)	2 (50%)
Mid high tech	20 (65%)	14 (52%)	10 (48%)
Mid low tech	21 (72%)	14 (52%)	8 (40%)
Low tech	23 (48%)	12 (34%)	10 (40%)
Born global firms (Alternative)	*After 3 years*	*After 5 years*	*After 7 years*
High tech	4 (80%)	2 (67%)	1 (100%)
Mid high tech	13 (93%)	10 (83%)	7 (88%)
Mid low tech	21 (95%)	15 (71%)	9 (60%)
Low tech	21 (75%)	13 (52%)	10 (50%)
Born global firms (Modest)	*After 3 years*	*After 5 years*	*After 7 years*
High tech	7 (47%)	5 (33%)	2 (29%)
Mid high tech	30 (64%)	25 (53%)	16 (44%)
Mid low tech	32 (71%)	23 (51%)	16 (50%)
Low tech	36 (60%)	29 (48%)	17 (40%)
New firms	*After 3 years*	*After 5 years*	*After 7 years*
High tech	192 (49%)	95 (35%)	43 (25%)
Mid high tech	494 (53%)	278 (42%)	168 (36%)
Mid low tech	1117 (54%)	644 (43%)	378 (36%)
Low tech	1903 (44%)	1021 (34%)	558 (26%)
New firms exporting	*After 3 years*	*After 5 years*	*After 7 years*
High tech	48 (59%)	28 (51%)	14 (42%)
Mid high tech	144 (75%)	93 (64%)	63 (58%)
Mid low tech	164 (76%)	109 (64%)	74 (59%)
Low tech	246 (68%)	164 (58%)	106 (51%)
Spinoff firms	*After 3 years*	*After 5 years*	*After 7 years*
High tech	35 (67%)	25 (66%)	17 (63%)
Mid high tech	122 (76%)	87 (69%)	51 (58%)
Mid low tech	145 (68%)	96 (56%)	59 (47%)
Low tech	167 (67%)	106 (55%)	66 (47%)

KIBS firms			
Born global firms (Stringent)	*After 3 years*	*After 5 years*	*After 7 years*
Computer and related services	3 (21%)	2 (14%)	0 (0%)
R&D	5 (56%)	3 (50%)	2 (50%)
Other business activities	14 (36%)	5 (15%)	4 (16%)
Born global firms (Alternative)	*After 3 years*	*After 5 years*	*After 7 years*
Computer and related services	4 (100%)	3 (75%)	1 (33%)
R&D	4 (100%)	4 (100%)	2 (100%)
Other business activities	12 (80%)	5 (38%)	4 (44%)
Born global firms (Modest)	*After 3 years*	*After 5 years*	*After 7 years*
Computer and related services	8 (40%)	6 (30%)	4 (24%)
R&D	6 (67%)	6 (67%)	4 (67%)
Other business activities	21 (46%)	13 (28%)	7 (21%)
New firms	*After 3 years*	*After 5 years*	*After 7 years*
Computer and related services	2416 (38%)	1235 (28%)	633 (22%)
R&D	130 (40%)	62 (30%)	31 (22%)
Other business activities	8871 (42%)	4658 (31%)	2336 (24%)
New firms exporting	*After 3 years*	*After 5 years*	*After 7 years*
Computer and related services	115 (64%)	85 (57%)	54 (48%)
R&D	29 (74%)	13 (52%)	8 (44%)
Other business activities	337 (71%)	199 (54%)	124 (44%)
Spinoff firms	*After 3 years*	*After 5 years*	*After 7 years*
Computer and related services	215 (59%)	143 (48%)	68 (34%)
R&D	11 (44%)	6 (30%)	3 (23%)
Other business activities	376 (65%)	234 (53%)	125 (42%)

The variables included in the Cox proportional hazard model are described in table 2. Since the focus of the paper is on individual employee characteristics and how these matter for firm survival, the variables of interest available in the dataset are on human capital, gender, age, personal income and immigration status. Furthermore, firm level data on size, sales, profitability, productivity and equity share are also included in order to control for performance and debt structure. The four performance measures are expected to positively influence chances of survival whereas indebted firms (low equity shares) are believed to absorb funds, which are taken away from other productive uses leading to reduced survival chances. The entry share variable is a variable on competition.[15] According to the population ecology theories developed by Hannan and Freeman (1989), the likelihood of a new firm surviving is lower in populations where there are a greater number of other competing new

[15] It is constructed year by year in the following way. Each year the median entry share is calculated. Firms belonging to industries below this median are assigned the dummy value 1 and those above 0.

entrants. The firm level variables are winsorized in order to remove extreme outliers. The one percent largest and smallest observations are hereby given the 99th and 1st percentile values respectively.

Table 2 Description of variables included in the Cox proportional hazard model.

Variable	Definition
Survival	A dummy indicating whether the firm exists the following year
Female	Share of female employees
Age	Average age of employees
Income	Average income of employees, both wage income and business income
Immigrant	Share of immigrants among employees
Schooling1	Share of employees with an upper secondary diploma as highest education
Schooling2	Share of employees with a post secondary education of maximum two years as highest education
Schooling3	Share of employees with a post secondary education of at least three years as highest education
Size	Number of employees
Lp	Labor productivity
Sales	Sales per employee
Profits	Profits over sales
Equity share	Equity over total assets
Entry share	A dummy indicating whether the firm belongs to an industry with an entry share below the median in a particular year

In order to describe the variables included in the Cox proportional hazard model table 3 presents descriptive statistics three years after birth both for manufacturing firms and KIBS firms.[16] Based on this table, a few things are worth mentioning about the characteristics of born global firms. Beginning with the manufacturing sample, we see that, together with spinoff firms, employees in born global firms seem to have higher average incomes than the total bulk of new firms. This is probably explained by the more educated employees in born global firms. We also see that born global manufacturing firms are larger, more productive and generating higher sales per employee than the reference groups of firms three years after firm birth.[17] The profitability measure is, on the contrary, indicating less profitable born global firms.

When looking at the KIBS sample, much of these differences between born global firms and other types of firms disappear. Noteworthy here is the higher share of immigrants among born global firms and future exporters. This is not surprising since it, for exporting firms, could be advantageous to have employees with experience from foreign countries. Turning to the differences between manufacturing firms and KIBS firms, the most striking is the negative

[16] Since the Cox proportional hazard model evaluates surviving firms multiple times, three years after birth is chosen to provide the reader with some descriptives on the sizes of the included variables.
[17] When comparing size to spinoff firms one should keep in mind that spinoff firm are naturally large from the beginning.

profitability among KIBS firms.[18] Compared to manufacturing firms, KIBS firms are smaller on average and we also see that KIBS employees have higher income and are better educated than manufacturing employees.

Table 3 Descriptive statistics for surviving firms three years after birth.

Manufacturing firms												
	Stringent 183 obs		Alternative 175 obs		Modest 323 obs		New firms 4162-4208 obs		Futrure exporters 687-695 obs		Spinoff firms 523 obs	
	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Survival	0,90	0,31	0,90	0,30	0,92	0,28	0,89	0,31	0,92	0,28	0,92	0,27
Female	0,23	0,24	0,25	0,25	0,23	0,26	0,25	0,40	0,21	0,32	0,21	0,21
Age	43,8	7,3	43,9	7,4	43,7	7,6	44,3	10,2	43,64	9,37	43,3	6,1
Income	255921	124898	252002	131279	246560	115118	170414	193077	220621	274861	270175	134992
Immigrant	0,11	0,18	0,12	0,19	0,11	0,20	0,11	0,29	0,11	0,26	0,10	0,16
Schooling1	0,56	0,27	0,55	0,27	0,56	0,29	0,61	0,45	0,57	0,40	0,59	0,25
Schooling2	0,12	0,17	0,13	0,19	0,13	0,20	0,11	0,28	0,14	0,28	0,11	0,15
Schooling3	0,13	0,22	0,13	0,23	0,11	0,22	0,08	0,25	0,10	0,26	0,07	0,14
Size	26,2	29,3	27,2	29,7	20,9	26,5	1,9	3,4	3,66	7,37	22,7	24,2
Lp	536376	331253	524557	337854	518679	392326	309359	390633	434600	515648	497173	311594
Sales	2206676	2198254	2366469	3250671	2116963	2643675	786788	1211993	1514037	2174122	1596476	1922957
Profits	0,02	0,21	0,02	0,22	0,04	0,19	0,23	0,84	0,08	1,06	0,04	0,12
Equity share	0,25	0,24	0,23	0,23	0,24	0,23	0,07	1,11	0,20	0,25	0,24	0,23

KIBS firms												
	Stringent 39 obs		Alternative 39 obs		Modest 93 obs		New firms 12018-12284 obs		Futrure exporters 565-572 obs		Spinoff firms 645-542 obs	
	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Survival	0,85	0,37	0,87	0,34	0,92	0,27	0,87	0,34	0,85	0,37	0,92	0,27
Female	0,26	0,32	0,21	0,27	0,23	0,30	0,31	0,43	0,26	0,32	0,27	0,28
Age	42,3	8,39	42,7	8,2	43,3	8,9	47,0	11,1	42,26	8,39	40,6	6,6
Income	323811	132808	320245	119872	324461	129281	269424	197164	323811	132808	367619	181577
Immigrant	0,18	0,28	0,14	0,24	0,16	0,29	0,07	0,25	0,18	0,28	0,07	0,14
Schooling1	0,42	0,40	0,47	0,40	0,34	0,36	0,34	0,45	0,42	0,40	0,35	0,29
Schooling2	0,17	0,28	0,17	0,28	0,24	0,32	0,23	0,40	0,17	0,28	0,25	0,23
Schooling3	0,33	0,36	0,28	0,33	0,35	0,36	0,37	0,46	0,33	0,36	0,34	0,32
Size	8,1	12,00	8,00	11,91	6,41	8,98	1,5	1,6	8,05	12,00	11,4	14,0
Lp	524524	489568	520475	507731	513113	434363	451014	460033	524524	489568	656001	442366
Sales	2762756	3964144	3034466	4103204	2230842	2945028	785487	1049570	2762756	3964144	1476486	2565444
Profits	-0,06	0,40	-0,07	0,43	-11,10	86,15	-196,46	16447,17	-0,06	0,40	-1,28	31,80
Equity share	0,28	0,42	0,28	0,43	0,39	0,49	0,19	1,74	0,27	0,36	0,24	0,43

4. Methodology

The main reason to why conventional statistical methods, such as OLS, are inappropriate for the study of firm survival is that the time window of study is but a snapshot of the lifespan of many firms. Those firms not failing within this time period are called right-censored because the analyst cannot determine what happens to those firms beyond the end of the studied time

[18] It is, especially, the very large negative average profitability among born global firms of the modest definition and for the total amount of new firms that is striking. These figures are, however, very skewed since the medians show 0.03 and 0.38 for these two samples respectively.

period. This problem is not accounted for by standard estimation procedures with biased and inconsistent estimates as a consequence. This problem is circumvented using hazard models.

This paper adopts the Cox proportional hazard model (introduced in a seminal paper by Cox, 1972).[19] Like all survival analysis, the Cox model examines the time it takes for an event to occur, which in our case is the exit of firms. The Cox model is probably the most widely used method for survival analysis, not only within the field of economics but perhaps most frequently in medicine.[20] Survival analysis focuses on the distribution of survival times and, typically, one examines the relationship of the survival distribution to covariates.

Let T denote the survival time, i.e. the time to death, with the cumulative distribution function $F(t) = Pr(T \leq t)$ and probability density function $f(t) = dF(t)/dt$. The complement to the cumulative distribution function is called the survival function, S(t).

$$S(t) = Pr(T > t) = 1 - F(t)$$

The survival function simply denotes the probability of survival beyond the time t. The instantaneous rate of failure at time t, conditional on survival to that time, is represented by the hazard function, denoted h(t):

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr[(t \leq T < t + \Delta t) | T \geq t]}{\Delta t} = \frac{f(t)}{S(t)}$$

The lower the hazard rate, the lower the risk of failure at that exact moment. There are a number of ways to model the hazard function. For instance, a constant hazard, $h(t) = \nu$, implies that the survival times are exponentially distributed with density function $f(t) = \nu * \exp(-\nu t)$.[21] The interest of this paper is on how a number of covariates influence the

[19] The Cox hazard model is proportional in that all subjects face the same underlying hazard which only proportionally is changed as a set of explanatory variables change.
[20] In economics, firm survival has been estimated using the Cox proportional hazard model by, e.g. Mata and Portugal (1994) and Audretsch and Mahmood (1995).
[21] Other common hazard models include $\log h(t) = \nu + \rho t$ which leads to the Gompertz distribution of survival times, and $\log h(t) = \nu + \rho \log(t)$ which would render the Weibull distribution of survival times. (See Cox and Oakes, 1984 for a more thorough description of these hazard models.) In both the Gompertz and Weibull distributions, the hazard can either increase or decrease with time; moreover, in both instances, setting $\rho = 0$ yields the exponential model.

probability of failure. Therefore, a multivariate model of life duration of firms will be adopted with a linear model for the log hazard.

$$\log h_i(t) = \alpha + \beta_1 x_{i1} + \beta_2 x_{ik} + \ldots + \beta_k x_{ik}$$

or, equivalently, with the baseline hazard function $h_0(t)$ unspecified[22],

$$h_i(t) = h_0(t) * \exp(\beta_1 x_{i1} + \beta_2 x_{ik} + \ldots + \beta_k x_{ik})$$

The covariates are represented by the x:s, i is a subscript for observation and the β:s are the coefficients to be estimated. It is clear that the baseline hazard $h_0(t)$ is the hazard rate that corresponds to the x:s being equal to zero. The Cox proportional hazard model is semi-parametric by nature because while the baseline hazard can take any form, the covariates enter the model linearly. The advantage of the Cox proportional hazard model is its unspecified baseline hazard function. By assuming a specific form, possibly improperly chosen, parametric models might produce unreliable estimates. (Heckman & Singer, 1984). Hence, the potential problem of unobserved heterogeneity that might be present when the baseline hazard function is not properly specified is overcome by the choice of the Cox proportional hazard model (Dolton & van der Klauw (1995)).[23]

5. Results

The results from the Cox proportional hazard estimations are found in table 4 for the manufacturing sample and in table 5 for the KIBS sample.[24] The tables present hazard ratios.[25] A hazard ratio larger than one means that there is a lower likelihood of survival while a hazard ratio smaller than one implies a higher likelihood of survival.

[22] The unspecified baseline hazard function is one of the characterizing features of the Cox model. The natural log of the baseline hazard rate can be considered a constant in the model. This component expresses the hazard rate changes as a function of survival time, whereas the covariate vector expresses the natural log of the hazard rate as a function of the covariates. (Hosmer & Lemewhow, 1999).

[23] However, the Cox model involves a loss of efficiency compared to the correct parametric model, if one has access to such.

[24] Note that, in table 5, the estimation using born global firms of the alternative definition produces no results. This is due to a too small sample variance.

[25] Efron approximation is used to calculate ties.

Addressing the results for born global firms primarily, very few variables seem to influence survival rates significantly. For two of the three born global definitions, large shares of immigrants impact survival rates negatively. This contradicts the Becker (1957) model of discrimination which was used in hypothesis 1. Hence, this hypothesis cannot be sustained. Born global KIBS firms show low hazard ratios for the *Schooling3* variable. Firms with high shares of employees holding degrees from a long post-secondary education seem, therefore, to survive longer. Except for this finding, no other human capital variables show up significant. If one could see an employee's income as reflecting human capital, there is, however, some additional evidence on a positive impact of human capital found in the sample of born global manufacturing firms of the modest definition. Therefore, despite not being conclusive, some evidence is found supporting the second hypothesis. Among the firm level performance measures, *Size* comes out significant in the manufacturing samples and, for productivity and equity share for the KIBS samples of born global firms, occasional significance is found. All these mentioned hazard ratios are below one and, therefore, influencing survival positively as expected.

Turning to the results from the reference groups, we see some more significant hazard ratios. Those significant for the samples of born global firms are very much the same for these three groups. Except for sales performance among the KIBS samples of spinout firms and future exporters, some more evidence on firm level performance, especially profitability being beneficial for survival, is found. The last column of tables 4 and 5 show the results from the whole sample of new firms. It is only the variable on gender in the manufacturing sample that does not show a significant impact on hazard ratios when the entire sample of new firms is investigated. Evidence supporting hypotheses two and three is found, albeit the hazard ratio for the age variable used in the second hypothesis is very close to one.[26] Again, the sign of the immigrant variable is found to contradict what was hypothesized. However, for the KIBS sample containing the total bulk of new firms, higher shares of female employees seem to enhance survival rates. Contrary to the immigrant variable, this finding is in line with the first hypothesis. The results on the firm level controls are as expected, except for the labor productivity measure which seems to be detrimental for firm survival. The final remark on the results is that firms belonging to industries with low entry rates show higher likelihood of

[26] As an alternative to the age variable, three age group variables are used indicating the share of employees below the age of 30, between 30 and 50 and above 50 years old. The hazard ratios on these alternative variables for the last column of table 4 and 5 show higher likelihood of survival for firms with higher shares of employees aged 30 to 50. This is also in accordance with the age-productivity findings described in Skirbekk (2008).

survival. This is identified by the entry share variable showing a significant hazard rate below one.

Table 4 Results from the Cox proportional hazard estimations. Manufacturing firms.

Manufacturing firms						
	Stringent	*Alternative*	*Modest*	*Spinoff firms*	*Future exporters*	*New firms*
Employee variables						
Female	0.611	0.972	0.775	0.840	1.204	1.075
	[0.292]	[0.724]	[0.413]	[0.323]	[0.173]	[0.044]
Age	0.999	1.056	1.010	0.990	1.006	0.997***
	[0.019]	[0.054]	[0.018]	[0.013]	[0.005]	[0.001]
Income	0.892	0.879	0.708*	0.745**	0.968	0.961***
	[0.092]	[0.387]	[0.146]	[0.105]	[0.068]	[0.010]
Immigrant	2.706**	1.933	2.570***	1.568	1.473**	1.152***
	[1.362]	[2.020]	[0.774]	[0.695]	[0.237]	[0.053]
Schooling1	1.138	0.897	1.340	0.592	0.949	0.844***
	[0.652]	[0.777]	[0.478]	[0.244]	[0.157]	[0.034]
Schooling2	1.085	0.701	0.986	0.520	0.930	0.759***
	[0.107]	[0.880]	[0.426]	[0.293]	[0.206]	[0.042]
Schooling3	1.058	1.805	0.833	1.234	0.715	0.744***
	[0.767]	[2.502]	[0.684]	[0.814]	[0.173]	[0.044]
Firm level variables						
Size	0.621**	0.579	0.483**	0.737***	0.631***	0.756***
	[0.119]	[0.213]	[0.145]	[0.058]	[0.067]	[0.032]
Lp	1.007	1.024	0.982	1.018	0.988	1.014***
	[0.023]	[0.046]	[0.025]	[0.025]	[0.008]	[0.003]
Sales	0.961	0.831	1.133	1.085	1.162**	0.896***
	[0.159]	[0.239]	[0.151]	[0.107]	[0.069]	[0.012]
Profits	0.978	0.968	0.947	0.938***	0.966***	0.969***
	[0.034]	[0.059]	[0.040]	[0.014]	[0.012]	[0.004]
Entry share	0.928	1.259	1.149	0.796	1.024	0.771***
	[0.938]	[1.379]	[0.883]	[0.189]	[0.251]	[0.035]
Equity share	1.045	2.860	1.280	0.551**	0.991	0.983***
	[0.737]	[2.741]	[0.949]	[0.166]	[0.012]	[0.006]
Observations	645	501	1152	3868	4962	33550

Time dummies, industry class dummies and regional dummies are included in all estimations.
Robust standard errors in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5 Results from the Cox proportional hazard estimations. KIBS firms.

KIBS firms						
	Stringent	*Alternative*	*Modest*	*Spinoff firms*	*Future exporters*	*New firms*
Employee variables						
Female	0.468	-	0.633	1.196	0.932	0.933***
	[0.248]	-	[0.299]	[0.233]	[0.173]	[0.013]
Age	0.997	-	0.993	0.984**	0.997	0.987***
	[0.022]	-	[0.018]	[0.008]	[0.006]	[0.001]
Income	0.922	-	0.891	0.862***	0.901**	0.966***
	[0.159]	-	[0.126]	[0.043]	[0.037]	[0.004]
Immigrant	2.524*	-	2.176*	1.754*	1.137	1.079***
	[1.234]	-	[0.919]	[0.544]	[0.222]	[0.027]
Schooling1	0.403	-	0.443	0.897	0.505***	0.777***
	[0.252]	-	[0.316]	[0.410]	[0.132]	[0.024]
Schooling2	0.449	-	0.551	1.081	0.616*	0.797***
	[0.327]	-	[0.391]	[0.470]	[0.162]	[0.027]
Schooling3	0.184**	-	0.216**	0.854	0.396***	0.764***
	[0.124]	-	[0.155]	[0.367]	[0.108]	[0.023]
Firm level variables						
Size	0.873	-	0.811	0.651***	0.915	0.702***
	[0.364]	-	[0.237]	[0.052]	[0.095]	[0.019]
Lp	0.959**	-	0.969	0.994	0.987	1.017***
	[0.028]	-	[0.027]	[0.011]	[0.010]	[0.002]
Sales	0.871	-	0.892	1.452***	1.136**	0.851***
	[0.147]	-	[0.148]	[0.098]	[0.066]	[0.005]
Profits	0.997	-	0.991	0.939***	0.951***	0.979***
	[0.046]	-	[0.045]	[0.010]	[0.011]	[0.002]
Equity share	0.084***	-	0.676	0.681**	0.926***	0.998***
	[0.065]	-	[0.500]	[0.124]	[0.024]	[0.000]
Observations	242	-	476	4904	3862	108624

Note that the estimations in the second column produce no results due to smallness of the sample.
Time dummies, industry dummies and regional dummies are included in all estimations.
Robust standard errors in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%

6. Conclusions

Survival of firms must be seen as a selection process where stronger and more competitive firms outperform less efficient ones. Survival can be seen as the most important and ultimate performance indicator of firms. It is only the surviving firms that are able to perform in other dimensions leading to a profitable firm in the longer run. Similarly, it is only the surviving firms that are able to contribute to employment growth, innovation activities, tax revenues etc. for an individual country. Hereby, studies on the determinants of firm survival are highly motivated.

This paper has investigated how employee characteristics influence survival rates with a special focus on born global firms. To the best of my knowledge, no previous attempt has been made to characterize the impact of these determinants on survival rates for the small group of born global firms. Furthermore, instead of applying qualitative data to these firms as is done in much of the literature, this paper is based on quantitative data. The methodology of choice was the Cox proportional hazard model, which has become the dominant model in studies of firm survival.

The findings in the paper show little significance of employee characteristics having an impact on firm survival among born global firms. However, when increasing the sample of new firms to include spinoff firms, low-export firms and, ultimately, all new firms, more evidence is found on the importance of having the correct mix of employees for firm survival. This is particularly true for the large sample including the total bulk of new firms. The significant and expected results on almost all the variables' hazard ratios in this sample indicates that the hypothesized findings are driven by non-exporting firms of often limited size. Hence, the importance of employee characteristics as determinants of survival seems to be higher for such firms than for more export-oriented firms such as born global firms.

Since almost no evidence on employee characteristics having influence over born global firms' survival probabilities is found, future studies should try to investigate other groups of covariates to enhance the understanding of factors that determine survival of born global firms. Furthermore, since the born global literature has been predominantly qualitative by nature, all fields of this literature should benefit from applying a quantitative approach. In light of the more and more globalized reality for many firms, studies trying to explain the conditions influencing the life cycle of born global firms are of importance. Many of the qualitative studies on born global firms have focused on the traits of the entrepreneur. Since data sources in many countries are steadily improving and providing researchers with better and longer time series, the linking of quantitative data on firms to their founders and entrepreneurs would, in future studies, imply a better understanding of who becomes a born global entrepreneur.

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