CESIS Electronic Working Paper Series

Paper No. 339

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December, 2013

The Royal Institute of technology
Centre of Excellence for Science and Innovation Studies (CESIS)
http://www.cesis.se

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Abstract: Studies confirm a tendency where elder individuals are more prone to become entrepreneurs. Their motives are numerous ranging from feeling social included to maintain the same income level. Interesting as such, this paper contributes to the existing literature by taking this one step further and examine the surviving of new and existing firms that are run by elder individuals (one-employee firms) or have a high share of elderly individuals. Elderly individuals are defined as those above the age of 55 or 64. The results show that the average marginal effect on the probability of survival from individuals above 55 and 64 differs across firm size. Elderly individuals negatively influence the survival of smaller firms (below ten employees). For larger firms the negative effect from elderly individuals is smaller, zero or even positive. Exploring the data, we find that "elderly firms", defined as firms that have a majority of employees above the age of 55 or above the age of 64, have a lower survival rate and lower average number of employees but a higher value added per employee.

Keywords: ageing, firm survival, employer-employee matched data
JEL classification codes: J14, L26, R12, R30

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1. Introduction

"… research on older entrepreneurship remains underdeveloped …" (Wainwright and Kibler 2013, p. 5)

Many developed countries are facing an increasing share of elderly individuals. Hence, a smaller labour force has to carry the burden and support a larger number of individuals. This challenge has been recognised in many countries as well as at the European Union level. One basic policy area concerns the possibilities of extending the work careers of the ageing work force. One way to extend the work careers of older people might be for (some of) them to start a business, i.e. to become entrepreneurs. Previous studies confirm the tendency that elder individuals have a larger probability to become entrepreneurs. This paper adds to the existing literature by examining the performance of firms that are run or have a high share of elder individuals employed. Thus, this paper uses as a starting point that elder individuals are more prone to become entrepreneurs and extends the analysis by examining the performance of these firms.

There are a limited number of studies focusing firms run by elder individuals. Those that have, have found that the survival rates of businesses established by older entrepreneurs are higher than for those started by younger entrepreneurs (Cressy and Storey 1995), which may be due to more extensive and more varied experiences, superior networks and a stronger financial situation (Arkebauer 1995; Blackburn et al. 1998; Hindle and Rushworth 2002). It appears on the other hand as if businesses established by older entrepreneurs exhibit slower growth rates than the ventures undertaken by younger entrepreneurs (Peters et al. 1999). These results suggest that while the ability to establish and run a firm is higher at an older age there is an age after which the motivation for entrepreneurial behaviour and the ambitions to grow start to decline. The purpose of this paper is to make an empirical contribution to the literature on the effects of ageing populations on the survival of firms and thereby contribute to the current general discussion of the general economic effects of aging populations.

To answer this research question micro-data at the individual- and firm-level will be used. The data consist of employee-employer match data where the constellation (primarily age) of the employees in a firm will be used as determinant of firm survival. The empirical design will start with descriptive statistics showing where across space elderly are more prone to start firms and in which sectors that they are over-represented in Sweden. The findings in this paper emphasise the

difference across firms of different size when it comes to the influence from the presence of elderly individuals. The average marginal effect on the probability of survival coming from individuals above 55 and above 64 is negative for small firms (one-employee firms and those with less than ten employees). This holds for surviving over five as well as nine years. For larger firms the negative effect from individuals above 55 years is reduced or disappears and there is a positive effect from individuals above the age of 64. Hence, there is no clear-cut answer to the benefits/disadvantage of having many elderly individuals in firms. Looking at the descriptive statistics of "elderly firms", defined as firms that have a majority of employees above the age of 55 or above the age of 64, we see they have a lower survival rate and lower average number of employees but a higher value added per employee.

The paper is outlined as follows: Section 2 gives the conceptual background with previous studies and theoretical framework. Section 3 gives the empirical design with a description of the variables and method. Section 4 gives the empirical results and Section 5 concludes the paper.

2. Entrepreneur age and firm performance – a theoretical background

Our basic question in this study concerns whether firms run by older entrepreneurs differ in terms of survival[1] from firms run by younger entrepreneurs. The literature gives several empirical examples of such differences but no conclusive answers. Wagner and Sternberg (2004) and Mueller (2006) found that the survival rates of businesses established by older entrepreneurs are higher than for those started by younger entrepreneurs (Cressy and Storey 1995), which may be due to more extensive and more varied experiences, superior business networks and a stronger financial situation (Arkebauer 1995; Blackburn, et al. 1998; Hindle and Rushworth 2002).

It appears on the other hand as if businesses established by older entrepreneurs exhibit slower growth rates than the ventures undertaken by younger entrepreneurs (Peters, et al. 1999), which might be explained by that the age of the entrepreneur has a negative effect on the ambition to grow the new firm (Lau and Busenitz 2001; Bager and Schøtt 2004; Autio 2005; Verheul et al. 2010). Thus, younger entrepreneurs seem to be more likely to have a growth ambition than older entrepreneurs are. One reason might be that older entrepreneurs are less innovative, more likely to adhere to the *status quo,* and more risk adverse (Verheul and van Mil 2008). Research on older individuals also suggests a lesser capacity for creativity and innovation and thus for in-

[1] One can question if survival should be used as a proxy for business success (Lewis and Walker 2011).

novative entrepreneurship in that age group than among younger individuals (Bönte et al. 2009; Colovic and Lamotte 2013). The propensity of entrepreneurs to innovate is affected by an ageing process involving both physical and cognitive drivers, since aging induces an alteration of both physical and cognitive abilities (Meyer 2011; Desjardiins and Warnke 2012). Empirical studies using individual data show that older people generally are slower than younger people to adopt innovative tools, such as information and communication technology tools (Borghans and Ter Weel 2002; Friedberg 2003; Weinberg 2004; Koning and Gelderblom 2006). Research on innovation adoption shows that older individuals often have a more negative attitude to new technologies and often are among the last to adopt and use innovative products, services and ideas (Gilly and Zeithaml 1985; Lunsford and Burnett 1992). At the same time there is a substantial heterogeneity among older people in terms of attitudes towards innovation (Szmigin and Carrigan 2000). It seems as if younger entrepreneurs are more probable to adopt a competitive strategy focusing on innovation and marketing than older entrepreneurs are (Ruis and Scholman 2012).

Rather few empirical studies seem to have related the age of the founders of firms to survival and other traditional measures of firm performance. One might suppose that the start-up age of an entrepreneur is negatively related with his/her time horizon. This would imply that entrepreneurs that start a new firm at the age of, say, 55 might be less likely actively to pursue a growth strategy than entrepreneurs at the age of 35 are. However, conclusive empirical evidences are mostly missing. Most studies that investigate the relationship between the age of the founder and employment creation tend to include age as a control variable but refrain from discussing the implications of their findings related to age within the context of ageing populations (Schutjens and Wever 2000; Bosma et al. 2004; Cowling et al. 2004; Henley 2005; Stam et al. 2008). Schutjens and Wever (2000) found no evidence for a direct effect of age of the entrepreneur on employment growth in firms younger than four years old. However, using the same data set, but studying employment growth during the first ten years of existence, Stam et al. (2008) detected a negative effect of age on the likelihood of employment growth. The study by de Kok et al. (2010) suggests that an ageing population is expected to negatively affect employment creation by newly started firms.[2] The explanations behind the result of this study are that entrepreneurs who start at an older age are less likely to work full-time in their new firm, are less willing to take risks and have a lower perception of their entrepreneurial skills. This implies that the decision to hire em-

[2] Caroll et al. (1999) found that age has a negative relationship with the decision to hire employees.

ployees is influenced by different characteristics of the founder including age. Ruis and Scholman (2012) report very small differences in employment growth between younger and older entrepreneurs. The results by Millán (2008) suggests that there may be an indirect effect of age, through experience, on becoming an employer. Summing-up the existing results concerning the relationship between the age of the founder and employment growth, we find that they seem to be inconclusive, since many other factors than age of founder influence the decisions to become an employer and to let the firm grow (de Kok, et al. 2010).

Ruis and Scholman (2012) report that younger entrepreneurs reported an increase in turnover more often than older entrepreneurs. Concerning the change in profits (between two years only), they found that older entrepreneurs performed better than younger entrepreneurs did but the relationship seemed to be non-linear. Their results also indicate that young entrepreneurs are more investment oriented than older entrepreneurs are.

These results suggests that while the ability to establish and run a firm is higher at an older age, there is an age after which the motivation for entrepreneurial behaviour and the ambitions to let firms grow start to decline, which is in line with the results in a study from Norway (Rotefoss and Kolvereid 2005). If we control for basic background factors, such as industry, location, business cycle, etc., we can identify four basic factors that might generate differences in performance, namely, i) the age of the entrepreneur, ii) the motivations of the entrepreneur to start a firm, iii) the capabilities of the entrepreneur, and iv) the resources of the entrepreneur (Bates 1995; Dunn and Holtz-Eakin 2000; Hout and Rosen 2000; Beugelsdijk and Noorderhaven 2005; Thurik et al. 2008).

2.1 The age of the entrepreneur

Age is perhaps the factor most clearly influencing entrepreneurship (Parker 2004). Studies show an inverse U-shaped relationship between the age of an individual and the probability that he/she will start a new firm (Mueller 2006; Millán 2008; Bönte, et al. 2009). One reason for this functional form is the assumption that the opportunity cost of time increases with age. When people pass a certain age their inclination to devote their time to activities that generate returns in the medium or long term, such as creating a new firm decreases (Lévesque and Minetti 2006), declines, since time is a scarce resource. However, the inclination might make a structural shift upwards when they reach retirement age, since now the opportunity cost of time declines at the

same time, as there is a decrease of income, since pensions are normally significantly lower than the income of work.

However, the age of the entrepreneur might also have an independent effect on the performance of a new firm, since older entrepreneurs might be exposed to age discrimination from banks, suppliers and customers.[3] There exists empirical evidence indicating that older individuals be discriminated due to age by financiers and customers (Weber and Schaper 2004). This result in that older entrepreneurs find it difficult to borrow money or have to pay a higher interest rate on their loans, since banks see them as more risky borrowers. If this is the case, than older entrepreneurs might find it more difficult to grow their firms than younger entrepreneurs do.

2.2 The motivations of the entrepreneur

It seems natural to assume that the motivations behind becoming an entrepreneur might differ between younger and older entrepreneurs. In the literature, a distinction is often made between necessity-based and opportunity-based entrepreneurship (Verhuel, et al. 2010). We find this distinction too simple and too limited to form the basis for empirical research (Arias and Pena 2010; Giacomin et al. 2011). The motivations for starting a firm are normally much more complicated and it is difficult to think that someone starts a firm out of necessity without seeing an opportunity. An alternative interpretative model for the analysis of the motives behind the formation of a new firm is the push-pull theory (Gilad and Levine 1986; Amit and Muller 1995). The formation of a new firm is the result of a pull dynamic when the potential entrepreneur considers it as a source of profit. On the other hand, it is the result of a push dynamic, when the new firm formation results from a conflict between the situation the potential entrepreneur actually finds him(her)self in and the one he(she) looks for (Uhlaner and Thurik 2007). Also this distinction is too simple for empirical studies of simple reason that the decisions of potential entrepreneurs to become entrepreneurs are influenced by a mix of pull and push dynamics (Solymossy 1997; Hughes 2003).

A more natural starting point is the assumption of utility maximizing individuals, who compare the utility of being an entrepreneur with the utility of the alternative (being employed, unemployed, retired, etc.) considering the risks involved in the two alternatives (Kihlstrom and Laffont 1979). Thus, individuals make their occupational choice based on the expected utility of the available (selected) alternatives (Carroll, et al. 1999; van Praag and Cramer 2001; Cowling, et

[3] Very young entrepreneurs might face a similar type of discrimination.

al. 2004; Parker 2004). This implies that the decision to become an entrepreneur is influenced by a diversity of positive and negative personal and contextual circumstances, objectives, and personal motivations (Shapero and Sokol 1982; Bhola et al. 2006; Hechavarria and Reynolds 2009; Kirkwood 2009). We might suppose that there exists systematic differences between younger and older entrepreneurs in terms of objectives, types of firms, risk attitudes (Holtz-Eakin et al. 1994), risk valuation, start-up scale and scope, valuation of time, time horizon, value of being one's own boss, etc. (Singh and DeNoble 2003). In terms of objectives, it seems as if older entrepreneurs have slightly more preferences for the objectives continuity of the firm and independence, while younger entrepreneurs show preferences for the objectives making a profit and achieving growth (Ruis and Scholman 2012). It has, for example, to be observed that older entrepreneurship is not without specific age-related risks (Lévesque and Minetti 2006), including upcoming health problems (Curran and Blackburn 2001) and age discrimination (Kautonen et al. 2011).

2.3 The capabilities of the entrepreneur

Potential entrepreneurs differ in their capabilities as entrepreneurs. There exist systematic differences between younger and older entrepreneurs in terms of education and training, knowledge, skills, competence and experiences but also in terms of energy, health and productivity. In the literature, it is often assumed that these differences are such that older entrepreneurs have advantages compared to younger entrepreneurs. These advantages include: i) personal and work skills, experience and knowledge (Curran and Blackburn 2001; Platman 2003; Weber and Schaper 2004; Patel and Gray 2006; PRIME 2007), ii) higher self-confidence, autonomy and motivation (Kean et al. 1993; Fraser et al. 2009), iii) having experienced more and more varied learning opportunities (Patel and Gray 2006), iv) greater preparation (e.g. completed a budget, business plan and market research) (Barcleys 2001), and v) being less prone to over-confidence (Forbes 2005). One might here remark that age is not necessarily 'a proxy for wisdom' (Staudinger 1999) and that possessing certain skills and experiences and using them are two different things (Haynes 2003).[4] It is also important to stress that starting and running a firm requires specific knowledge and skills that many people might not have acquired even if they are old (Patel and Gray 2006; Lewis and Walker 2011).

[4] It might be that the knowledge and ability of potential entrepreneurs is a better predictor of firm survival if they start a firm than of the probability that they will actually start a firm (Gartner et al. 1999).

Older individuals may possess more human capital than younger ones due to life-long learning and on-the-job-training (Singh and DeNoble 2003; Weber and Schaper 2004). Formal education and training is likely to enhance firm performance since these individuals have more skills due to the function of education in sorting people by ambition and assertiveness (Kim et al. 2006). Older individuals have also gained more and more varied expertise and professional experiences through their professional life (Brüderl et al. 1992; Light and Rosenstein 1995; Gray 1998; Parker 2004; Bergmann and Sternberg 2007) including i) technical knowledge (Jones-Evans 1996), ii) prior industrial experience (Storey 1994; Shane 2003), iii) managerial experience (Steiner and Solem 1988; Boden Jr and Nucci 2000; Kim, et al. 2006), and iv) prior experience of starting a business (Shane 2003). Thus, they may have become better at identifying and evaluating business opportunities and they may know more about how to start and run a business, which will reduce the start-up costs, the start-up time, and the running costs. It seems, for example, that the social and human capital acquired by older individuals may reduce the rate of business failure (Botham and Graves 2009) indicating that they might be better equipped than younger entrepreneurs to manage the risks associated with business venturing (Wainwright and Kibler 2013).

On the other hand, we must acknowledge that older individuals have overall lower levels of formal post-secondary education and their human capital has a lower discounted value due to knowledge depreciation (Robinson and Sexton 1994; Lussier and Pfeifer 2001; Weber and Schaper 2004). They may also face challenges in the form of lower levels of health, energy and productivity (Curran and Blackburn 2001; Weber and Schaper 2004).

2.4 The resources of entrepreneurs

Potential entrepreneurs also differ in terms of the resources they dispose and once again, we can assume that there are systematic differences between younger and older entrepreneurs with regard to savings, networks (private, professional, business, etc.) and access to social capital. Even in this case, there is an assumption in the literature that older entrepreneurs have advantages in terms of access to resources, including i) a higher likelihood of the accumulation of financial resources (Hart et al. 2004; Department of Labour 2009), and greater social capital – a result of more extensive private, business and professional networks (Cannon 2008; Rogoff 2008). The relationship between financial capital and entrepreneurship has been studied by Millán (2008). An entrepreneur with a larger capital of his own is less dependent upon external financing. A larger start-up capital allows a larger start-up size, which increases the probability of survival. On

average we can expect older entrepreneurs to have a larger capital of their own than younger entrepreneurs. The networks of entrepreneurs are important in the sense that they might provide access to external financing, and information, knowledge and expertise critical for starting and running a new business. Generally, we can assume that older entrepreneurs have richer networks than younger entrepreneurs do.

Older individuals normally have accumulated a larger capital due to savings, inheritances, and investments in their own home (Arkebauer 1995; Blackburn, et al. 1998; Blanchflower and Oswald 1998; Lussier and Pfeifer 2001; Singh and DeNoble 2003; Weber and Schaper 2004), which reduces the need to borrow money to start and run the business and thus leads to lower capital costs. This implies that the liquidity constraint becomes less of a constraint for self-employment as people become older (Evans and Leighton 1989).

Older individuals also have had time to develop richer private, professional and business networks (Birley 1985; Dubini and Aldrich 1991; Larson 1991; Baucus and Human 1994; Arkebauer 1995; Blackburn, et al. 1998; de Bruin and McLaren 2002; Aldrich and Cliff 2003; Singh and DeNoble 2003; Weber and Schaper 2004) which will tend to reduce start-up costs and possibly lead to larger sales due to links to many potential customers. We may observe that it has been argued that successful entrepreneurs are those that possess the most relevant market information (Barkham 1994) and good networks provide such market information. The relationship between social capital and entrepreneurship has been studied by Millán (2008).

If we summarize the arguments above it is clear that it is difficult to come up with conclusive hypotheses concerning whether firms started by older entrepreneurs perform better or worse than firms started by younger entrepreneurs do. It is obviously an empirical question, if there are systematic differences and the direction of these differences.

3 Empirical design

The data used in this paper originates from statistics Sweden and covers all firms in Sweden that are active (report VAT or taxes). Since all employees are matched to their firms, it is possible to find out the characteristics of the firms in terms of the work force including the age of the employees. As already discussed, the primary interest in this paper is the age of the employees. One drawback with the data is that is we cannot distinguish the CEO or owner from other employees. For firms with only one employee this does not cause any problem and for these firms we look at

firms that are run by individuals above the age 55 or 64 (64 is the average retirement age in Sweden) (Eurostat 2009). For firms with more than one employee we examine the share of employees above the age of 55 and 64. If the majority of the employees are elder individuals then the firm is classified as an elderly-firm.

To examine thoroughly the influence of elder individuals on firm survival we conduct logit estimation where survival is the dependent variable. We examine if firms started/existed in 2001 also exist in 2006 and 2010, where we control for firm and regional characteristics. The independent variables are measured in 2001. Since firms of different size differ in their growth path, ambitions and survival probability, we choose to separate firms according to size: (i) one-employee firms, (ii) above one employee and less than ten, (iii) above ten and less than fifty, and (iv) those with fifty employees and above. Further, we separate out new firms started in 2001 and analyse how elderly individuals influence their survival probability.

3.1 Variables

The dependent variables is a binary variable (*Survival*) which score 1 if the firms survived (through 2006 or 2010), 0 otherwise. The independent variable that are of key interest is the share of elder employees, those above 55 (*Elderly (55)*) and those above 64 (*Elderly (64)*) (64 is the average retirement age in Sweden). To capture other firm characteristics we control for size (*Size*) and marginally decreasing effects from size ($Size^2$). The share of employees with at least a bachelor degree (Education) and the average experience of the employees (Experience) capture human capital. The capital invested per employee (*capital per employee*) is another factor that might influence firm performance, but with varying importance across industries. As new firms may face special difficulties this is controlled for by separating these with a dummy, newly formed firm (*NFF*). As different industries experience different opportunities and difficulties, this is controlled for by including an industry dummy at the two-digit SIC level (*Industry*).

Since the economic environment is of importance for firm performance such as survival, we capture this by controlling for variables at both the neighbourhood level and municipal level. The neighbourhood level is captured by the SAMS (Small Areas for Market Statistics) level. There are approximately 9000 SAMS areas in Sweden and each of them has roughly 1000 inhabitants but of different geographical size. The local level of clustering of new firms (*Local new firm formation*) is captured at the SAMS level. Municipalities are the lowest level of geographical unit with its own governance in Sweden of which there are 290. At the municipality level, we

control for specialization at the two-digit SIC level by means of location quotients (*Specialization*). Most firms act at the local market and sell the majority of their products to local customers. This implies that the change in the local demand (Δ*demand*) and the level of the local demand (*Size*) can be expected to influence firm performance. The industrial structure in the municipality is captured by the average firm size (*MES*) and firm intensity (*Firms per capita*). The next table shows the description of the variables along with the summary statistics.

Table 1. Description of variables and summary statistics, firm level

Name	Definition	Exp. sign	Mean	St.dev
Dependent variables				
Survival	=1 if firm exists in 2006 and/or 2010; = 0 if firm exited the market		0.579 0.446	0.493 0.497
Independent variables				
Firm level (2001)				
Elderly (55)	Share of employees above the age of 55	+	0.246	0.372
Elderly (64)	Share of employees above the age of 64	+	0.043	0.183
Size	Number of employees	+	8.365	55.157
$Size^2$	(Number of employees)^2	-	-	-
Education	Share of employees with at least three years of higher education. The distinction of three years of higher education is used, since it normally takes at least three years to achieve a bachelor's degree in Sweden.	+	0.123	0.284
Experience	Average experience of the employees in the firm. Experience is defined as the employee' age minus six, minus the number of years of education	+	26.821	10.723
Capital per employee	Amount of capital invested in tangible assets per employee, thousands of SEK	+	555.538	12538.840
NFF	Dummy for firms established in 2001	+/-	0.133	0.339
Industry	Dummy based on the two-digit SIC-code, 60 in total		-	-
Neighbourhood level (2001)				
Local new firm formation	Number of new firms divided by the total stock of firms, SAMS level	+/-	0.160	0.064
Municipal level (2001)				
Specialisation	Location quotient at the two-digit SIC-code level	+/-	-	-
Δ*demand*	Annual change in the sum of the inhabitants' wages, in million SEK[a]	+	176.653	684.628
Size	Access to wages, in thousand SEK[b]	+	1.370e7	2.081e7
MES	Mean establishment size (# employees)	-	7.275	2.253
Firms per capita	Number of firms divided by the population	+	0.053	0.010

a Calculated as the wages that the inhabitants that live in the municipality earn.

[b] Calculated as the accessibility to wages (what the inhabitants that live in each municipality earn). The accessibility measure is compiled by the intra-municipal, inter-regional and extra-regional accessibility to wages accounting for distance decay effects, following Johansson et al. (2002; 2003).

The average survival rate of firms in this sample is approximately 58 percent over a five year period 2001 to 2006 and 45 percent over nine years 2001 to 2010. The average size of the firms is 8 employees and the average share of employees over the age of 55 is 25 percent, which is rather high. The average share of employees above the age of 64 is much lower and is approximately four percent. The tendency of having a rather old set of workers is reinforced by the average number of experience years in a firm of almost 27 years. This is the overall picture and it is most likely that there are substantial differences across industries. Before the empirical results from the logit estimation are presented and examined some more descriptive statistics are put forward. The following table shows firm performance and education intensity where elderly-firms are separated out and compared to the rest of the firms. "Elderly firms" are those where a majority of the employees are above the age of 55. All values are from 2001.

Table 2. Firm performance, elderly-firms versus other firms

	"elderly firms"				Other firms			
	One employee	2-10 employees	11-50 employees	>50 employees	One employee	2-10 employees	11-50 employees	>50 employees
Survival (mean), 2001-2006	0.343	0.580	0.778	0.708	0.468	0.699	0.834	0.894
Survival (mean), 2001-2010	0.134	0.361	0.669	0.666	0.359	0.563	0.750	0.832
Value added per employee (mean)	41 590.89	39 593.77	31 359.99	2260.99	17 468.96	22 029.40	13 175.63	4065.32
Employees (mean)	1	3.162	17.871	93.292	1	4.223	21.571	147.993
Education (mean)	0.147	0.119	0.194	0.317	0.123	0.099	0.139	0.209
N (% of total)	70 001 (29%)	16 118 (9.7%)	835 (2%)	24 (0.2%)	167 634 (71%)	150 095 (90, 3%)	50 334 (98%)	12 756 (99.8%)

Table 2 shows significant differences among the group of "elderly firms" compared to other firms. The survival rate of "elderly firms" is consistently lower for both periods and at a larger magnitude for the longer period of nine years. Turning to the performance measure, the "elderly firms" have higher value added per employee but they are generally smaller in terms of number of employees. The education intensity (share of employees with at least a bachelor degree) is overall higher for "elderly firms" irrespectively of the size. The "elderly firms" contribute to a significant share in the case of one-employee firms. We might observe, as the size of the

firms increases the share of "elderly firms" decreases significantly. Less than half a percent of the big firms is defined as an elderly firm (majority of employees are above the age of 55). The industry that has the largest number of "elderly firms" is the KIBS industry (the two-digit SIC level: 74, including for example consultancy, graphical design, ICT). Turning to the share of "elderly firms", the industry where they are over-represented is household services (the two-digit SIC level: 95).

The following maps shows the share of firms (out of the total number of firms) that are governed by elder individuals at the municipality level in Sweden (left, Figure 1a) and the share of firms that survive over a five year period (right, Figure 1b). A darker colour indicates a larger share of elderly or surviving firms. Starting with the geographical distribution of "elderly firms" there is no clear pattern in Sweden. "Elderly firms" are present in the sparsely populated north as well as in the more dense regions of Stockholm and the very south of Sweden. The survival rate, on the other hand, shows a more clustered spatial pattern. The surviving rates are higher in north-east of Sweden and in the middle-south. The surviving rate in the Metropolitan areas (Stockholm, Gothenburg and Malmö) is low.

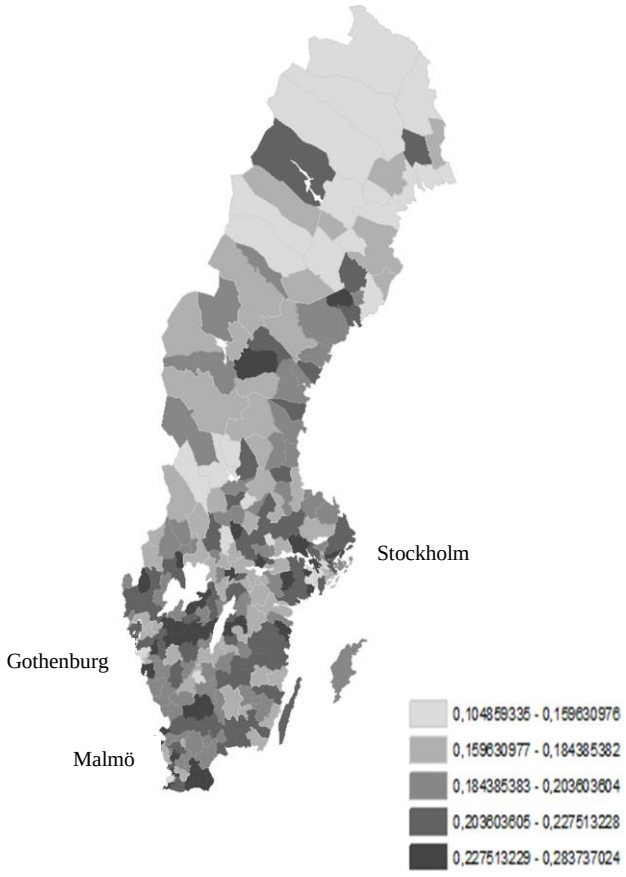

Figure 1a. Share of "elderly firms" (firms with a majority of employees over the age of 55), municipalities, 2001

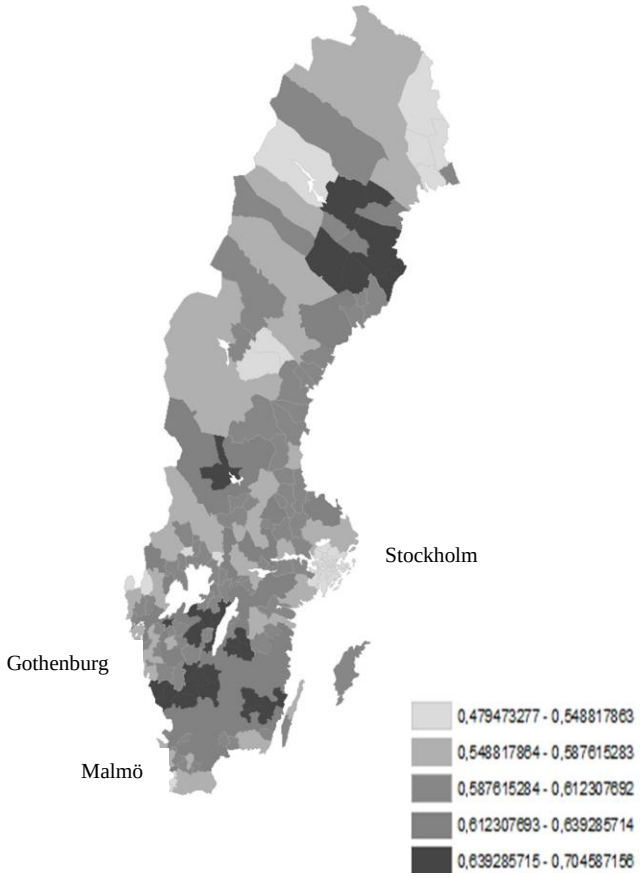

Figure 1b. Share of surviving firms over a five-year period, 2001 to 2006, municipalities

4 Empirical findings

In this section, we present the results from our empirical analysis. Table 3 shows the results from the logit estimation. Two different periods are examined 2001 to 2006 and 2001 to 2010. The sample is also split according to firm size in order to control for variance over firm size. Firms of different size are therefore not pooled in the estimations but estimated separately; (i) one-employee firms, (ii) above one employee and less than ten, (iii) above ten and less than fifty, and (iv) those with fifty employees and above. Due to the high bivariate correlation between two of the control variables mean establishment size (*MES*) and the firm density, these variables are run in separate estimation. They are however illustrated in the same table to save space. The other variables are presented when estimating mean establishment size. However, they are robust across the two different estimations.

Table 3. Estimation results, logit estimation. Dependent variable: binary variable equals 1 if firm exists in 2006/ 2010; and 0 if firm exited the market

	From 2001 to 2006				From 2001 to 2010			
	One employee	2-10 employees	11-50 employees	>50 employees	One employee	2-10 employees	11-50 employees	>50 employees
Firm level								
Elderly (55)	-0.790** (0.026)	-0.901** (0.039)	-0.523** (0.156)	-1.288 (0.705)	-1.647** (0.045)	-1.432** (0.041)	-0.459** (0.133)	-0.875 (0.601)
Elderly (64)	-1.637** (0.056)	-1.027** (0.078)	3.955** (0.453)	4.550** (2.272)	-1.375** (0.059)	-0.492** (0.055)	2.533** (0.423)	6.107** (2.096)
Size	-	-0.006 (0.010)	0.022** (0.005)	0.002** (4e-4)	-	-0.004 (0.009)	0.022** (0.005)	0.002** (2e-4)
Size^2	-	-0.025** (0.001)	-2.85e-4** (0.001)	-8.56e-8 (1e-7)	-	-0.026** (0.001)	-2.44e-4** (1e-4)	-2.63e-7** (6e-8)
Education	0.016 (0.025)	0.123** (0.039)	0.214** (0.087)	0.207 (0.230)	0.028 (0.023)	0.133** (0.041)	0.340** (0.066)	0.459 (0.230)
Experience (ln)	0.424** (0.016)	0.569** (0.025)	0.096 (0.060)	0.143 (0.287)	0.438** (0.014)	0.543** (0.025)	0.117** (0.050)	-0.008 (0.224)
Capital per employee	1.25e-6 (1e-6)	1.58e-7 (2e-7)	2.46e-6 (3e-6)	6.12e-5** (2e-5)	1.73e-6 (1e-6)	-7.25e-8 (3e-7)	-5.94e-7 (3e-6)	5.87e-6 (1e-5)
NFF	-0.822** (0.014)	-0.849** (0.027)	-0.907** (0.083)	-0.909** (0.382)	-0.774** (0.018)	-0.755** (0.023)	-0.816** (0.079)	-0.903** (0.355)
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Neighbourhood level								
Local new firm formation	-0.427** (0.110)	-0.662** (0.126)	-1.572** (0.305)	0.496 (0.683)	-0.448** (0.113)	-0.701** (0.124)	-1.458** (0.257)	-0.133 (0.556)
Municipal level								
Specialisation	0.001 (0.001)	0.002** (0.001)	-0.002 (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.003 (0.001)	-0.002* (0.001)	-0.001 (0.001)
Δdemand	-1.31e-6** (3e-6)	-1.54e-5** (3e-6)	-1.60e-5** (7e-6)	-1.91e-5 (1e-5)	-1.83e-5** (3e-6)	-1.07e-5** (3e-6)	-1.35e-5** (6e-6)	-1.83e-5 (1e-5)
Size (ln)	0.009 (0.011)	-0.032** (0.010)	-0.118** (0.027)	-0.143** (0.058)	0.006 (0.011)	-0.041** (0.010)	-0.115** (0.023)	-0.186** (0.050)
MES	-9.28e-4 (0.004)	-0.017** (0.004)	-0.020** (0.009)	-0.080** (0.015)	-0.001 (0.004)	-0.015** (0.004)	-0.020** (0.008)	-0.051** (0.015)
Firms per capita	-0.002 (0.178)	1.177** (0.236)	1.322* (0.688)	9.083** (2.077)	0.072 (0.189)	1.086** (0.216)	1.543* (0.574)	9.083** (2.077)
Constant	-0.499* (0.254)	1.567** (0.263)	4.604** (0.699)	4.909** (1.661)	-1.035* (0.254)	1.224** (0.258)	3.837** (0.640)	5.254** (1.617)
N	158 831	126 457	30 729	6 314	158 831	126 457	30 729	6 314
Wald Chi^2	18679	19 859	1 533	1703	17 286	20 202	1 665	1 819
Pseudo R^2	0.08	0.07	0.06	0.08	0.11	0.07	0.05	0.07

Notes: ** significant at 1 percent, * significant at 5 percent. Cluster (municipality) standard errors in parenthesis. Independent variables are from 2001. The size variables at the firm level have been cantered to avoid the problem of multicollinearity (Smith and Sasaki 1979). The bivariate correlation between the share of elderly workers and the average level of experience is below 0.6. We have also tested to run these variables in separate estimations with similar results.

The results indicate that the share of elderly has a clear impact on the firm performance (in this case survival) but that the influence clearly differs across different firm sizes. In most cases, the results imply a negative influence from the share of elder individuals on the probability

of survival. The share of individuals above the age of 55 is negative in all cases except for firms with more than 50 employees where it is insignificant. The share of individuals above the age of 64 is negative for firms with up to ten employees and positive for firms with more than ten employees. We see the same pattern for the variables of interest (*share (55)* and *share (64)*) for the different periods, 2001 to 2006 and 2001 to 2010, but the size of the influence differs. To get a better understanding of the magnitude of the variables the next table shows the average marginal effect for these variables.

Table 4. Estimation results, average marginal effects, logit estimation. Dependent variable: binary variable equals 1 if firm exists in 2006/ 2010; and 0 if firm exited the market

	From 2001 to 2006				From 2001 to 2010			
	One employee	2-10 employees	11-50 employees	>50 employees	One employee	2-10 employees	11-50 employees	>50 employees
Firm level								
Elderly (55)	-0.194** (0.006)	-0.178** (0.008)	-0.064** (0.019)	-0.124 (0.069)	-0.301** (0.006)	-0.352** (0.010)	-0.083** (0.024)	-0.131 (0.069)
Elderly (64)	-0.346** (0.008)	-0.205** (0.015)	0.490** (0.055)	0.438* (0.216)	-0.219** (0.006)	-0.121** (0.014)	0.458** (0.076)	0.911** (0.308)

The marginal effects are more informative in nonlinear models compared to the coefficients. The marginal effects show the marginal change in probability due to a unit change in the regressor, in this case a percentage increase in the share of employees above the age of 55 or 64. Hence, for firms run by an elderly individual (in the case of one-employee firms) the probability of survival is decreased by 0.19 for five years and 0.30 for nine years. This is for those above the age of 55 for those above 64 the magnitude of the parameters are even larger. This is perhaps not surprising, since these individuals are already retired or are approaching their retirement age, where they might have other priorities and value leisure differently. These firms might not be less successful but may be ended due to personal and not market factors. The same story does not apply for firms with more than one-employee. In these cases, the elderly individuals are part of the team and we do not know if they are also the owner of the firm. This lack in the data is a clear deficiency. In the case of firms with more than one employee but less than ten employees the share of elderly, the share of elderly above 55 and 64, respectively, deceases the probability of survival at a magnitude of approximately 0.20 over five years. However, for the nine-year period, the probability of survival is significantly lower for firms with a high share of individuals above 55 years compared to the share of those that are above 64. Hence, in these small firms a large

share of elderly individuals is not beneficial. This could be explained by the homogeneity of employees. Many studies show that firms with a more heterogeneous workforce perform decisions of a higher quality and have a higher rate of problem solving, since there are many perspectives (knowledge) represented and a more critical analysis of issues can be performed (Jackson 1992; Watson et al. 1993; Tallman and Li 1996; Richard 2000; Page 2007).

It is interesting to see that for firms with more than ten employees the share of individuals above the age of 55 has a rather small negative or zero influence on the surviving probability while the share of individuals above the age of 64 has a positive impact. These firms obviously benefit from having experienced individuals in the work team that can make decisions and add knowledge to current problems that the firms are facing. This is likely to differ across industries where some industries are facing a more rapid external environment where knowledge and education are depreciation fast. In these industries, elderly individuals perhaps contribute less. The results can also be influenced by the fact that it is cheaper for firms to hire individuals above the age of 64 since the firms does not have to pay pension contributions and the payroll tax is significantly lower.

Turning to the control variables at the firm level we confirm the pattern that size is of importance for surviving even after separating firms into different size categories. The marginal effect from size is however decreasing. To have a higher education level is positive for firm survival for small firms (below ten employees but not one-employee firms). However, it is insignificant for the survival of the largest firms with 50 or more employees. The experience level is positive for small firms, up to ten employees for five-year survival and up to 50 employees for survival over nine years. This is interesting as it also reflects the age of the actual individuals. Hence, it is beneficial for firms to have experienced personnel (employees of an older age) but only up to a certain point since the share of elderly is negative. Irrespectively of size, if the firm started in 2001 it has a lower probability of survival, consistent with theoretical and empirical findings stating that there is a higher degree of firm dynamics for new firms (Audretsch 1991; Mata and Portugal 1994; Andersson and Klepper 2013). The economic environment is also influencing the survival of firms where firms localized in neighbourhoods with a high degree of entry are less likely to survive. Hence, these are locations with a high degree of competition, which makes it less likely for firms to survive. This is also reflected in the change in demand and size of potential demand of which both are negative in most cases. On the other hand, a higher number

of firms per capita in the municipality increase the chances of survival of firms. This reflects the industry structure where many firms indicate possible knowledge spillovers, a possible tradition of entrepreneurship and a larger reliance on small (new) firms. This result is confirmed since firms have a lower rate of survival in municipalities with on average larger firms.

In the next step, we separate out the new establishments in 2001 and analyse how the share of elderly individuals influence the survival probability. Due to lower number of observations, the firms can only be separate into three categories: (i) one-employee firms, (ii) above one employee and less than ten, and (iii) those with ten employees and above. The next table shows the average marginal effects from the variables of interest (share of individuals above the age of 55 and 64). The other independent variables follow the same sign and magnitude as in Table 3.

Table 5. Estimation results, average marginal effects, logit estimation. Dependent variable: binary variable equals 1 if firm exists in 2006/ 2010; and 0 if firm exited the market

	From 2001 to 2006			From 2001 to 2010		
	One employee	2-10 employees	> 10 employees	One employee	2-10 employees	> 10 employees
Firm level						
Elderly (55)	-0.135** (0.008)	-0.145** (0.031)	0.058 (0.305)	-0.162** (0.006)	-0.160** (0.032)	0.089** (0.401)
Elderly (64)	-0.226** (0.010)	-0.152** (0.066)	0.869 (0.858)	-0.134** (0.013)	-0.112 (0.067)	-0.787 (1.140)

The average marginal effect from elderly individuals is negative and significant for new firms that had less than ten employees when they started. For the larger new firms the effect is insignificant. This pattern holds for both periods: 2001 to 2006 and 2001 to 2010. However, the effect is smaller compared to the figures for all firms in Table 4. Hence, those firms that are started by elderly individuals (one-employee firms) and those that have a high share of elderly individuals are less likely to survive. Many studies confirm that elderly individuals are more prone to become self-employed or start new firms when they approach their retirement age contributing to society. This study shows that even if this is true, the new firms tend to be less likely to survive over a five or nine year period.

5 Conclusion

The tendency in many developed countries as well as in Sweden is an increasing share of elder individuals. This implies that a smaller share of individuals have to carry the burden and pay for a

higher share of individuals. Many previous studies have focused on the entrepreneurial ability of elderly people, confirming that elder individuals can contribute a lot by starting new firms or become self-employed. This paper examines how elderly individuals influence the survival of firms. Elderly individuals are defined as those above the age of 55 or 64, respectively. We also control for the average experience of the employees in the firm. Thus, this paper adds to the existing literature by analysing what happens after elder individuals have started a firm or are part of a firm as employees.

The results show, that the influence from having a high share of these individuals differ across firm sizes. The average marginal effect on the probability of survival from individuals above 55 and 64, respectively, are negative for small firms (one-employee firms and those with less than ten employees). This holds for firms surviving over five as well as nine years. For larger firms the negative effect from individuals above 55 years is reduced or disappears, and there is a positive effect from individuals above the age of 64. Hence, there is no clear-cut answer to the benefits/disadvantage of having many older individuals employed. The results depend on the workforce composition in the firm where many employees with similar characteristics (in terms of for example age) may lead to less qualified decision-making and problem solving. The same pattern is observed when new firms are separated out and the effect from older individuals is estimated. Hence, those firms that are started by older individuals (one-employee firms) and those that have a high share of older individuals are less likely to survive. Looking at the descriptive statistics of "elderly firms", defined as firms that have a majority of employees above the age of 55 or above the age of 64, we see that "elderly firms" have a lower survival rate and lower average number of employees but a higher value added per employee. Thus, looking at different performance measures we see different patterns. There is no clustering of municipalities with a high share of "elderly firms" across geographical space in Sweden.

In future studies it would be interesting to see the task of these older individuals and what impact that makes on firm performance. It is easy to assume that these individuals are rather high up in the hierarchy and then have a large impact on firm performance.

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