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Regional Characteristics and the Survival of New Firms

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REGIONAL CHARACTERISTICS AND THE SURVIVAL OF NEW FIRMS

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ABSTRACT

There is an abundant literature on industrial ecology aiming at explaining the survival propensity of recently started firms. The majority of the contributions concentrate on the characteristics of the entrepreneur, the new firm or the industry.

Only a small minority of the existing studies consider the influence of the location where the new firm has been started on survival probability. The evidence of the importance of location in the literature is mixed. However, only a limited share of these studies analyzes the importance of localized external economies of scale for the survival of newly founded firms. This relative lack of studies is intriguing since, for example, the “new economic geography” theory emphasizes the role that clusters of individual industries and of complementary industries within a distinct geographical area play in terms of proximity and network externalities.

Thus, a basic motivation for this paper is that the absolute majority of business survival studies disregard the fundamental facts that every new firm is started in a specific location. A second motivation is the fact that in many of the studies that include spatial factors as explanatory factors the representation of these factors are often not ideal. A third motivation is that the representation of geographical space has not taken into consideration of the importance of the hierarchical structure of geographical space.

The purpose of this paper is to test the influence of demand and supply conditions and general economic milieu in localities on the survival of newly founded firms while controlling for firm and industry characteristics and using a proper representation of the hierarchical structure of geographical space.

Keywords: Entry, Start-up size, Market Potential, Region, Industry, Sweden.

JEL-codes: L11, M13, C21, R11, R12

1 Introduction

The interest in new firm survival started in the 1980s (Lin & Huang, 2006) and new firm survival is an important topic within the large research field of firm demography (Caves, 1998). Today, there exists a rich literature on industrial ecology trying to explain the survival of newly started firms. Interestingly, the absolute majority of the contributions deal with the characteristics of the entrepreneur and his business strategy (see, e.g., Kimberly, 1979; Lumpkin & Dess, 1996; Henreksson & Johansson, 2010; Gottschalk & Niefert, 2011; Coad, et al., 2011), the characteristics of the new firm (see, e.g., Fichman & Levinthal, 1991; Mitchell, 1994; Hannan, 1998; Jovanovic, 2001; Farinas & Ruan, 2005; Colombelli, et al., 2013) and the characteristics of its industry (see, e.g., Dunne & Roberts, 1991; Audretsch, 1991 & 1995; Mata, et al., 1995; Patch, 1995; Tveteras & Eide, 2000; Helmers & Rogers, 2010; Geroski, et al., 2010; Holmes, et al., 2010). Only a small minority of the existing studies consider the influence of the location where the new firm has been started on survival probability (see, e.g., Audretsch & Vivarelli, 1995; Fotopoulos & Louri, 2000; Acs, et al., 2007; Fritsch, et al., 2010; Doms, Lewis & Robb, 2010; Nunes & Sarmiento, 2010; Huiban, 2011) and the evidence they report are very mixed. However, only a limited share of these studies analyse the importance of localised external economies of scale for the survival of newly founded firms.

Many of the studies that consider the effects of external economies of scale on the survival of newly founded firms use indirect area-based proxies for urbanization. These studies arrive to quite different results. A study of new firm survival in three US states found no evidence that the survival rates should be lower in rural areas compared to metropolitan areas (Buss & Lin, 1990). A study in Austria found that the survival rate for newly founded firms was the same in the Vienna region as in the rest of the country (Tödting & Wanserböck, 2003). In a study of Greece, it was found that firms founded in the greater Athens region had higher survival rates than firms founded in peripheral regions (Fotopoulos & Louri, 2000). Renski (2009), using a more refined distinction between urban/rural and metro/non-metro areas in the US, found the lowest survival rates of new manufacturing and professional service firms in the metropolitan urban core. His results are similar to those by Huiban (2011).

There are, however, a small number of studies analysing the relationship between new firm survival and external economies of scale using measures that are more direct. Brixy & Grotz (2007) found that population density had a negative influence on new firm survival in West German regions for both the manufacturing and the business services sector controlling for small business intensity and the concentration of skilled and R&D workers, which are factors that are assumed to be associated with the assumed beneficial aspects of urbanization. Wennberg & Lindqvist (2010) using a piecewise exponential hazard model found that entrants in knowledge-intensive manufacturing and service industries are more likely to survive if located in areas with a high concentration of workers and establishments in related industries and with a high population density. In a study of the effects of localisation and urbanisation economies on the survival prospects of new service sector firms in labour market areas in the US (LMAs), Acs, et al. (2007) found industry intensity had a positive and significant relationship with the regional survival rate but that log of population and the number of service firms per 1000 inhabitants had a significant negative relationship. Renski (2011) report for the US that industrial localization and regional industrial diversity has a positive influence on new firm survival in five out of eight industries but that the benefits of city size were limited to two industries, while city size was associated with diseconomies of scale for three industries.

This relative lack of studies considering the influence of location and spatial factors including external scale economies on the survival probability of newly founded firms is intriguing. This is in particular true not least since the “new economic geography” theory (Krugman, 1991) emphasizes the role that clusters of individual industries and of complementary industries within a distinct geographical area play in terms of proximity and network externalities. However, in this connection we must realize that factors promoting new firm formation differ from those that promote the post-entry performance and survival of early stage firms (Stuart & Sorensen, 2003). Furthermore, the limited set of studies of the determinants of firm survival that considers the role of spatial factors normally account only for a limited set of spatial factors and often report contradictory results concerning the effects of different spatial factors on the survival of newly founded firms.

Thus, a basic motivation for this paper is that the absolute majority of business survival studies disregard the fundamental facts that every new firm is started in a specific locality. A second motivation is the fact that in many of the studies that include spatial factors as explanatory factors the representation of these factors leaves a lot to wish. A third motivation is that the representation of geographical space in most earlier studies have been rather primitive and not taken into consideration of the importance of the hierarchical structure of geographical space (Lösch, 1954). A further motivation is of course that the survival probabilities varies very substantially between different localities and that we need a better understanding of this variation of both scientific and policy reasons. Data for 290 Swedish localities (municipalities) shows that the five-year survival ratio for new firms varies between 0.05 and 0.6. The data shows that the hazard facing new firms varies considerably between different locations raising questions concerning implications for industrial and regional policies. Firm survival is one parameter of a region’s entrepreneurial climate and is of particular relevance to regional development policies, which tend to have as one major at least implicit aim to foster a business environment that sustains new firms during their critical formative years and that promotes the growth of new firms.¹

The purpose of this paper is to test the influence of demand and supply conditions and general economic milieu in localities on the survival of newly founded firms while controlling for firm and industry characteristics and using a proper representation of the hierarchical structure of geographical space.

This paper is organized as follows:

2 The influence of spatial factors on the survival of newly started firms

In this section, we discuss the possible influence of spatial factors on the survival of newly started firms. The spatial factors that we analyse are partly agglomeration factors, which can be assumed to contribute to new-firm survival through (i) demand effects related to regional population, incomes and general business activity, (ii) supply factors related to the quality of the regional labour supply and (iii) characteristics of the general regional economic milieu, such as general agglom-

¹ It is important to observe that the closure of a new firm may be a rational thing that should not be associated with failure. The start-up of a new firm is an entrepreneurial experiment, which by necessity is based upon incomplete information. The only way to test the business idea and the ability of the entrepreneur is to put the firm into operation. If the idea turns out to be inferior and/or the abilities of the entrepreneur too low, an exit is the relevant action that implies that the resources in the firm can be used for other purposes. Society gains information and knowledge from the experiment, which is of value for other potential entrepreneurs and for policy-makers dealing with regional development policy.

eration effects² and business climate (Ciccone & Hall, 1996).³ It is important to stress here that a good understanding of the effect of spatial factors on regional variations in new firm formation certainly is not enough to understand what spatial factors are responsible for spatial variations in new firm survival. The reason is that such knowledge says little about the processes that affect the performance of new firms in the critical years after their birth (Renski, 2011). This is a critical distinction for the reason that those regional conditions that stimulate new firm formation may not necessarily provide the best conditions to support and promote their survival (or growth) (Brixy & Grotz, 2007). It might even be the case, at least in the short-run, that new firm entry and new firm survival might be at odds with each other, if a rapid new firm formation increases competition (Sorensen & Audia, 2000; Stuart & Sorensen, 2003) making it difficult for new firms to grow and survive. This of course begs the question: why would so many new firms enter regions where the survival probability is low due to intense intra-regional competition? One obvious answer is lack of information. Potential entrepreneurs are unable to evaluate the strength of their business idea and their abilities as entrepreneurs and thus their chances of success before starting their firm. New entrepreneurs learn about their potential as entrepreneurs and the potential of their business idea only after they have put their firm into operation according to the entrepreneurship learning model presented by Jovanovic (1982) and those that have been overoptimistic are punished and have to exit.

In the sequel, we sketch a basic theoretical framework for explaining spatial variations in new firm survival containing three major spatial factors potentially influencing new firm survival at the regional level: (i) demand conditions, (ii) supply conditions and (iii) general regional economic milieu.⁴ However, we start with a more general discussion of why location matters for new firms.

2.1 Why does location matter for new firms?

Surveying mainstream entrepreneurship research, one gets the impression that location is a non-issue for new firms, since most of what has been published on entrepreneurship shows little interest in the basic fact that entrepreneurship is localized. A standards reference, such as Parker (2009), only devotes three pages to the role of regional factors. This bias in the entrepreneurship literature is astonishing and points at a fundamental gap in this literature. General speaking, studies on entrepreneurship and industrial dynamics pay too little attention to the role of location (Raspe & van Oort, 2011). This is a serious shortcoming, since entrepreneurial activity varies substantially across geographical space (Santirelli & Vivarelli, 2007). Certainly, this issue has been taken up in the regional science literature but obviously are most mainstream entrepreneurship researchers unaware about the contribution to entrepreneurship research by regional scientists. However, too little is still known about the impact of location on entrepreneurship and firm performance and the linkages between the characteristics of geographical space and the behaviour on entrepreneurs and firms.

So, why does location matter for new firms? New firms are exposed to particular problems and difficulties in the sense that they face a general lack of all kinds of resources (Audretsch, 1995). They also often face cost disadvantages, since many of them are started at a size that is below the

² It should be noticed that relative little is known about the importance of agglomeration economies for entrepreneurship and the performance of firms (Acs & Armington, 2004), which is interesting since the theories explaining agglomeration economies are microeconomic in nature (Brakman, et al., 2009).

³ There exist studies that have found that spatial concentration contributed to firm failure (Sorensen & Audia, 2000).

⁴ Bosma, et al. (2006) summarize the general regional economic conditions for entrepreneurship as (i) demand and supply factors, and (ii) cultural or policy environmental determinants.

minimum efficient scale of their respective industries (Pe'er & Vertinsky, 2006). However, those firms that are started in a region offering the “right” type of regional economic milieu can take advantage of what that region offers in terms of demand, supply and general other characteristics. It is for a new firm easier to overcome its initial liabilities, if it is located in a region offering (i) a proper demand for the specific product that it supplies, (ii) a labour supply with the relevant skills, (iii) a supply of the most important specialised services it needs, etc. Location in such a region increases the probability to catch a demand that is large enough to allow the new firm to take advantage of economies of scale and to reduce hiring and transaction costs.

2.2 The influence of demand conditions on the survival of newly started firms

It seems natural to assume that demand conditions are critical for the survival of newly started firms. If the accessible demand is too small no new firm can survive, since they carry the burden of fixed start-up costs, which implies that there exist a minimum demand under which a profitable operation is impossible. Thus, we may draw the general conclusion that all other things equal the higher the accessible demand the higher the survival probability of newly started firms. The size of the accessible demand decides to what extent newly started firms can exploit internal economies of scale. Newly started firms normally have very limited resources to serve distant markets. Hence, they are dependent on the accessible demand in the region, where they are located and in particular on the accessible intra-regional demand. Naturally, the effect is strongest for firms producing contact-intensive or perishable products. Generally, we expect that the survival probability of newly started firms increase with the size of the accessible intra-regional demand. For a newly started firm to be located in a region with a large accessible demand implies that it is easier to find customers but also to find new customers, if some customers are lost. However, it is also easier for customers to find the new firm in a large region, since it is rational for customers who search for suppliers to start search in the largest regions, where the probability of finding the right supplier is largest.

A second demand factor of importance for the survival of newly started firms is the growth rate of the accessible demand (cf., Fritsch, et al., 2010). A growing accessible demand is a general sign of a healthy and prosperous region. It is of course easier to survive if a new firm can take a share of a growing demand instead of having to take market shares from incumbents. Thus, we conclude that the higher the growth rate of the accessible demand, the higher the survival probability of newly started firms.

2.3 The influence of supply conditions on the survival of newly started firms

Certainly many different supply conditions affect the survival probability of newly started firms. We here limit the discussion to four factors: (i) the accessibility to business services, (ii) the accessibility to financial services, (iii) the accessibility to labour, (iv) labour costs, and (v) accessibility to knowledge. Precisely as with demand accessibility, there are very substantial spatial variations in these factors.

All firms but in particular newly started firms are dependent upon access to various types of business services, such as accounting, marketing, transport, technical consultants, and product development. Newly started firms do not have the capacity to employ all the different kinds of service specialists that they need and thus, we assume that the higher the accessibility to business services, the higher the survival probability of newly founded firms. However, not all business services are equally important for newly founded firms. We assume that it in particular is accessi-

bility to knowledge-intensive business services (KIBS) that are critical for the survival of newly founded firms.⁵

Financing is a classical problem in entrepreneurship. It is often assumed that financing is available everywhere for profitable projects but empirical studies show that the regional accessibility to financial actors exhibits a spatial variation and that this variation contributes to explain the spatial variation in new firm formation (Backman, 2013). It seems natural to assume that this variation in the accessibility to financial actors also influences the survival probability of newly started firms. Theoretical models showing that financial variables play a key role in firm dynamics and a new firm's post-entry success (Brito & Mello, 1995; Cooley & Quadrini, 2001; Albuquerque & Hopenhayn, 2004) support this assumption. There is a special motivation to this assumption. It seems to be well established in the entrepreneurship literature that it is common that new firms are started at a scale that is below the minimum efficient scale (MES) in the particular industry. To survive these firms must grow up to or beyond the MES, and to do that they often need financing that goes beyond internal financing.

The labour supply varies substantially between regions in terms of size, educations, experiences, skills, occupations, etc. For all new firms beyond the lone entrepreneur firm, the accessibility of the right types of labour is of critical importance if the new firm shall function properly and if it shall be able to grow and be productive. In the knowledge economy, the accessibility to highly educated labour is a critical supply factor and since highly educated labour is a semi-immobile production factor, this factor might critically influence the survival probability of newly founded firms. A well-educated labour force in a region implies access to human capital that embodies general and specific qualities, skills and competences. Such human capital is critical for implementing new ideas for creating and growing new firms (cf., Acs, et al., 2007). Educated workers have ample opportunities to absorb and use information (Lucas, 1988; Mathur, 1999) and are generally associated with better access to innovation (Wozniak, 2006), better ability to implement new ideas (Bartel & Lichtenberg, 1987) and faster adoption of new technologies (Staiger, & Skinner, 2005; Doms & Lewis, 2006; Lin, 2011). We assume that a well-educated labour force can be expected to contribute to a higher survival probability for newly founded firms. Such a labour force also increases the potential for intra-regional knowledge spillovers, which contributes to the initiation of more start-ups and probably also to lower failure risks of new firms due to a higher quality of start-ups. Acs, et al. (2007) in their study found that regional human capital was positively related to new-firm survival but that the strength of the effects varied with the business cycle.⁶

A fourth supply side factor to consider is labour costs and not least the growth of labour costs. We assume all other things equal that the higher the labour costs the lower the survival probability of newly founded firms.

The knowledge base as well as the accessibility to external knowledge varies between regions. Innovation and technological change has today come to the fore in the discussion on firm survival (Colombelli, et al., 2013). A new firm's innovative potential is besides the internal knowledge base a function of the knowledge base of the region where it is located and its characteristics in terms of variety, i.e., technological differentiation, coherence, i.e., degree of complementarity and similarity, i.e., the degree to which the knowledge pieces are close to each other. The knowl-

⁵ However, Acs, et al. (2000) found in their empirical study that the intensity of service establishments had a negative effect on the new-firm survival rate.

⁶ Doms, Lewis & Robb (2010) find no effect of labour force education on business survival.

edge base of a region is a function of its history, the volume of private and public knowledge production and its openness for new knowledge created elsewhere. The knowledge base of a region influences the survival of new firms via its effect on product and process innovation in newly started firms.

2.4 The influence of the general regional economic milieu on the survival of newly founded firms

Concerning the influence of the general regional economic milieu on the survival probability of newly founded firms, we first turn to the influence of general agglomeration economies. Krugman (1991, 5) makes the remark that the most striking feature of the geography of economic activity is concentration. This indicates that co-location and thus agglomeration brings some special advantages to firms. It seems natural to assume that these special advantages also affect the survival probability of newly started firms positively.⁷ Since Ohlin (1933), two different types of agglomeration economies are distinguished: localization and urbanisation economies that offer external economies of scale, which may compensate newly founded firms in agglomerations for the scale diseconomies that act as a structural barrier (Bain, 1956) to survival. The result is higher productivity and higher profitability for new firms in agglomerations compared with similar firms located elsewhere (Renski, 2011).

Lösch (1954) stressed the importance of industry localization in his work on location theory. Localisation economies prevail when a region has become specialised in one particular industry resulting in a geographically concentrated cluster. Co-located firms in such clusters share common technologies, skills, knowledge, inputs, customers and regional institutions (Delgado, Porter & Stern, 2010) and can benefit from three basic types of localized and spatially constrained advantages for the actual firms in the industry in the region generating external economies of scale. These advantages include: (i) a rich supply of non-traded regional inputs including public goods, such as specialised regional infrastructure, implying lower transaction costs (Rocha, 2004), (ii) a regional supply of labour with specialized skills relevant for the actual industry, so-called labour pooling, which lowers the search costs for specialised labour and increases the flexibility of firms, and (iii) intra-regional spillovers of industry-relevant information and knowledge concerning markets, new ideas and possible improvements related to products, technology and/or organization (Marshall, 1920). However, the strength and importance of the localization externalities may vary between industries (Duranton & Puga, 2000).

Clusters are generally assumed to facilitate new firm formation and the growth of successful start-ups by lowering the costs of entry among other things allowing new firms to leverage regional resources to expand more rapidly (Delgado, Porter & Stern, 2010). Thick input markets make vertical integration unnecessary, allowing firms to concentrate on their core business while simultaneously taking advantage of the specialization of regional input suppliers (Stigler, 1951; Richardson, 1972; Goldstein & Gronberg, 1984; Scott, 1986). The proximity in a specialised cluster facilitates the formal and informal exchange of tacit knowledge, which is supposed to promote innovation (Jaffe, et al., 1993; Feldman & Audretsch, 1999), the adoption of new production technologies (Gabe, 2005) and faster rates of regional technological change (Koo, 2005).

The Marshall-Arrow-Romer (MAR) model⁸ suggest that regional industrial specialization stimulates knowledge spillovers between the firms in the industry in the region (Arrow, 1992; Romer,

⁷ Interestingly, Fritsch, et al. (2010) assume that the impact of agglomeration as such on the survival of newly founded firms to be unclear *a priori*.

⁸ Porter (1990) presents a perspective that mirrors the MAR-model.

1986 & 1990), which generate a positive dynamic externality leading to increasing returns within the geographical boundaries of the region (cf., Glaeser, et al., 1992). Knowledge spillovers will potentially allow new firms in agglomerations to learn about market conditions, innovations and new technologies and to learn from the mistakes and successes of others sooner than if they had been started in regions of relative isolation (Maskell, 2001). The business survival literature emphasizes that external knowledge and learning are critical for the long-run business survival by reducing the uncertainty faced by new firms (Minniti, 2005). The given conclusion here is that proximity to external sources of relevant information and knowledge can be expected to increase the survival probability of newly founded firms (Renski, 2011).

Thus, if we summarize one could on the one hand expect that strong location economies should increase the survival probability of newly founded firms in the actual industry in the cluster. However, on the other hand, we must acknowledge that the presence of strong location economies implies the presence of many firms in the actual industry, which indicate a hard competition generating a lower survival probability for newly founded firms in the industry in the region. New firms in geographical clusters, though benefitting from among other things knowledge externalities may suffer from the competition that comes from a heavy concentration of both incumbents and other new firms producing similar products (Raspe & van Oort, 2011). This implies that very strong clusters might produce adverse effects due, for example, to congestion and rising land and labour costs due to hyper-competition for resources and personnel among the cluster firms (Wennberg & Lindqvist, 2010). However, we assume on theoretical grounds and in line with Fritsch, et al. (2010) that the positive location economies dominate over the negative competition effect in the case of new firm survival.^{9,10}

Urbanization economies are those positive external scale economies passed to firms because of savings from large-scale operation of large regions.¹¹ Thus, they prevail in larger regions¹² hosting clusters of many different actors, industries, and organizations, such as universities, industry research laboratories, trade associations and other knowledge-generating organizations, leading to a strong diversity in terms of different industries. Diversity implies a rich variety of suppliers, customers and different types of private and public organizations, which are not only economic in character but also social, political and cultural and which support the production and absorption of knowledge, and stimulate innovative behaviour and regional growth (Harrison, et al., 1997). Such diversity promotes inter-industry knowledge spillovers across geographically close industries stimulating R&D, innovation and product development (Jacobs, 1969). Diverse regions are characterised by the presence of specialised suppliers and producers of complementary goods and services, which lower the costs of firms and thus contribute to their survival chances. Large di-

⁹ There are a number of studies that have come to the result that clusters promote the entry, growth and survival of new firms (Stough, et al., 1998; Beaudry & Swann, 2001; Dumais, et al., 2002; Rosenthal & Strange, 2005; Pe'er & Vertinsky, 2006; Wennberg & Lindqvist, 2010).

¹⁰ Some studies have found that location in a cluster reduces the survival chances of new firms (Sorensen & Audia, 2000; Folta, et al., 2006). The study by Acs, et al. (2007) concluded that industrial specialization does not increase the survival probability of newly founded firms, since knowledge spillovers and networking contribute more strongly to the formation of short-lived firms than to the formation of surviving firms. Fritsch, et al. (2010) found that a specialized regional production structure increases the failure risk for newly founded firms but that this negative effect is decreasing for higher levels of regional industrial specialization. The reason for this result might be that closures are less likely in those regions that belong to the current geographical centres of an industry, which over time will tend to increase industrial geographical concentration.

¹¹ Large-scale regions may also generate urban diseconomies in the form of pollution, crime, congestion and high wages and land prices, which result in a dispersion of population and firms.

¹² Of course, large size may not always result in positive externalities, since there might be diseconomies related to size of (urban) regions (Krugman, 1996).

verse regions tend, according to spatial incubation theory, to offer a more beneficial breeding ground for starting-up firms (Vernon, 1960; Leone & Struyck, 1976; Duranton & Puga, 2001; Peña, 2002), which also might contribute to a higher survival probability for new firms in such regions. We expect all other things equal that a strong diversity in a region increases the survival probability of newly founded firms in all industries in the region.

A third critical factor in the general economic milieu is the start-up rate or rather the number and frequency of entrepreneurial experiments. Such experiments imply that a learning process is going on in different regions irrespective of if the experiments are successful or not. Regions with more of such experiments will offer better learning opportunities for active as well as potential entrepreneurs and lead to the development of a larger entrepreneurial human capital (Karlsson & Gråsjö, 2013), which will increase the quality of new start-ups and increase the survival probability of newly founded firms. Of course, there is a risk that a high level of entry in a region will lead to relatively high competition levels and increase the shake out of newly founded firms through market selection (cf., Fritsch et al., 2010).

A fourth factor of critical importance is the density of regions and in this case in particular the density of population, labour, firms, entrepreneurs and self-employed. Population density can be interpreted as measuring the wider existence of either agglomeration economies or agglomeration diseconomies, which are related to the costs of premises, labour and accessibility/congestion (Keeble & Walker, 1994). We can note that the denser a region in this respect, the larger the opportunities for entrepreneurs and potential entrepreneurs to be inspired of and learn from active and earlier entrepreneurs. Dense regions with a well-developed supporting transport infrastructure offer generally better opportunities for frequent personal contacts, and social and professional interactions and the build-up of strong and active personal, professional and business networks. Denser regions offer better conditions for developing trust between individuals, which will reduce the transaction costs of interaction, transferring information and knowledge, cooperating and doing business (Goldstein & Gronberg, 1984; Martin & Ottaviano, 2001; Love & Roper, 2001) and as a result generate positive proximity and network externalities. The benefit of collaborating with other firms in a dense region emerges from the fact that geographical proximity facilitates both planned and serendipitous interactions, which foster not least the exchange of tacit knowledge (Knoben & Oerlemans, 2006). We expect that denser regions offer better survival conditions for newly founded firms than less dense regions.¹³

The level of private and public R&D investments in different regions is a fifth factor that can affect the survival of newly founded firms. A high level of R&D investments might be conducive to the survival of new firms through a high level of regional knowledge spillovers. At the same time, we must acknowledge that highly innovative regional economic milieus make entry more risky, which might have a negative effect on new firm survival (Brüderl, et al., 1992; Audretsch, 1995; Audretsch, et al., 2000). This implies that the effect of a high level of R&D investments in a region on the survival of new firms cannot be determined *a priori*.

An important characteristic of the general regional economic milieu is the rate of unemployment. We can assume that a higher unemployment rate in a region all other things equal should lead to a higher new-firm survival, since a high unemployment rate signals that it is difficult to find other jobs in the region for entrepreneurs and self-employed.

¹³ Interestingly, Fritsch, et al. (2010) found that the exit risk for new firms was higher in high-density areas, all other things equal.

A further factor of importance is the regional business climate (Acs, et al., 2007). A supportive regional business climate can stimulate innovative activities, the frequency of start-ups and probably also improve the survival probabilities of newly founded firms.

Regional institutions, formal as well as informal (cf., North, 1990)¹⁴, can also be assumed to influence the survival probability of newly started firms. Well-designed institutions that clarify property rights and reduce transaction costs, for example, reduce the start-up costs of firms and make it possible for them to more rapidly reach break-even. A closely related factor to institutions is social capital. Regions vary in terms of the extent and the types of their social capital (Karlsson, 2012). Regions better equipped with social capital should generally have a higher survival probability of newly founded firms.

3 The empirical models

To be expanded...

Introduction to the empirical part of the paper...

In this section, we introduce the methods of analysis and specific models based on the preceding discussions.

In the present analysis, we will focus on conditions confronting firms at the time of start-up.

We look at start-ups in four sector-aggregates based on the Eurostat aggregation of sectors according to NACE Rev 1.1.¹⁵ The four aggregates are:

- High-tech manufacturing
- Low-tech manufacturing
- Knowledge-intensive services
- Less knowledge-intensive services

The analysis focuses on the Swedish cohort of firms starting up in 2003. Using only firms starting up in the same year avoids potential problems of so-called left truncation. Therefore, we observe all firms from the start of the possibility of any firms exiting.

The study period start in 2003 and we observe the firms until 2011. Thus, we observe the firms at a maximum of nine years.

In the empirical analysis, we start by simply estimating the probability of survival from the time of start-up until a specified year. This is accomplished by estimating a logit model where the dependent variable will simply be survival or death over a period.

In the second approach, we estimate a hazard model.

The logit model is specified..... (expand and explain)

$$P(\text{survival}) = f(F, I, R)$$

F = firm characteristics

I = Industry characteristics

¹⁴ Estrin & Prevezar (2010) survey the role of institutions for new firm entry in emerging markets.

¹⁵ The division follows the document: Eurostat indicators of High-tech industry and Knowledge-intensive services, Annex 2 – High-tech aggregation by NACE Rev. 1.1.

R = Regional characteristics

The Cox regression

One of the more popular models used in survival analysis is the Cox proportional hazard regression model (Cleves et. al. 2010, pp. 129-133), this is the one used in the present study.

The Cox model asserts that the hazard rate for the i th firm is:

$$h(t|x_i) = h_0 \exp(x_i \beta_x)$$

where the regression coefficients, β_x are estimated from the data. Here T is the survival duration of a start-up, x_1 to x_k are the explanatory variables hypothesized to influence survival probabilities.

$P(t \leq T \leq t + \Delta t | T \geq t)$ denotes the probability of death at time t given survival until at least t .

Then $h(t)$ and h_0 is the baseline hazard rate. Etc..... (look in Cleves et. al. pp7)

We want to know which of the independent variables influence the life-duration of new firms. In the estimation of the Cox model, we use the `stcox` command in STATA.

Explanatory variables

Firm characteristics at start-up:

Size – number of employees working in the firm in the founding year

Average age – average age of the persons working in the firm in the founding year

Share highly educated – share of persons working in the firm in the founding year with at least three years of university schooling.

Regional characteristics in the region where the firm starts up:

Market potential – accessibility to wage-sums in the start-up region

Labour market – share of people in working age (20-64) that have a job.

Share of small firms – share of firms without employees.

4 Data and descriptive statistics

This section introduces the data and we offer some introductory descriptive exploration.

In figure 4.1 the survival rates for each time period is shown. On the horizontal axis, we have the number of years since the firms started up. All firms we follow start up in the year 2003. After one year just fewer than 70 percent of the firms are still active, after two years the survival rate is down to just above 50 percent, and so on. In the last year we observe, 2011, only 25 percent of the firms in our cohort are still up and running.

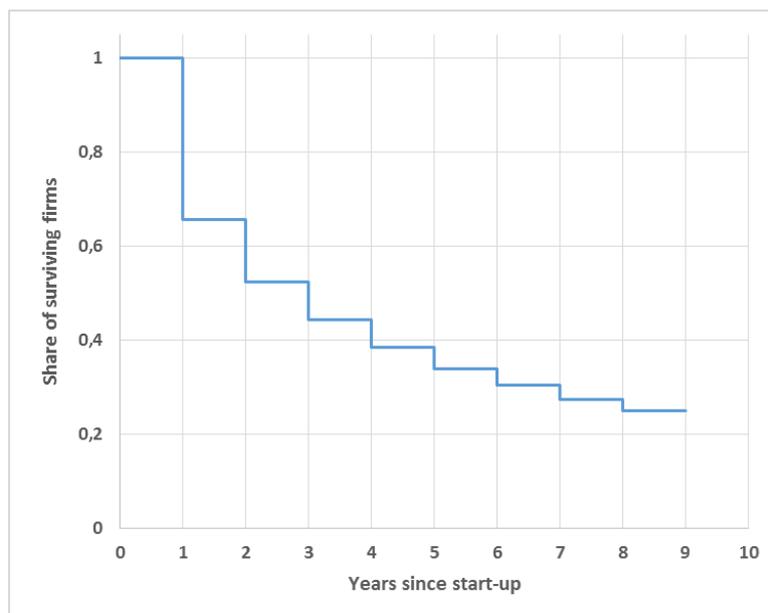


Figure 4.1: *Survival rates over time*

In Table 4.1, all the variables used in the analysis are presented. The variables *surv2004* until *surv2011* are dummy variables denoting if a firm is still active in 2004, ..., 2011 and so on. These variables will be used as dependent variables in the subsequent logit estimations. The remaining variables are the explanatory variables as introduced above.

Table 4.1: *Descriptive statistics*

	Min	Max	Mean	Std. Dev.
<i>surv2004</i>	0	1	0.66	0.475
<i>surv2005</i>	0	1	0.52	0.499
<i>surv2006</i>	0	1	0.44	0.497
<i>surv2007</i>	0	1	0.39	0.487
<i>surv2008</i>	0	1	0.34	0.474
<i>surv2009</i>	0	1	0.30	0.460
<i>surv2010</i>	0	1	0.27	0.446
<i>surv2011</i>	0	1	0.25	0.433
Market potential	7.26	13.09	11.509	1.212
Labour market	0.542	0.86	0.747	0.044
Share of small firms	0.587	0.824	0.675	0.044
Initial size	1	1052	2.660	11.198
Average age	16	84	40.757	11.809
Share highly educated	0	1	0.197	0.375

5 Results

This section is devoted to empirical analyses trying to shed light on the importance of the characteristics of the region where the new firms are started and its survival prospects.

Table 5.1 shows the results of the eight logit estimations. The first column in the table shows the influence of the different explanatory variables on the probability that the firms survive the first year, i.e. the probability that firms founded in 2003 are still active in 2004. Going from left to right we find the corresponding results for the firms being active in 2005, 2006, ..., 2011.

The values of the explanatory variables are measured at the starting year, 2003. This means that we can say something about how long into the future conditions at the time of start-up influence the probability of survival.

Starting with our main explanatory variable, market potential, we observe an interesting pattern. For short time periods from the timing of start-up, the effect is positive, for the medium run the effects is insignificant and for longer periods, the effect is negative.

This is a very interesting result and we interpret this....

Table 5.1: *Estimated survival probability over different time periods for firms founded in 2003 (logit model) All industries*

	Probability of survival until							
	2004	2005	2006	2007	2008	2009	2010	2011
Market potential	0.0340*** (0.00933)	0.0207** (0.00888)	0.00441 (0.00893)	-0.00550 (0.00912)	-0.0145 (0.00936)	-0.0176* (0.00964)	-0.0244** (0.00994)	-0.0355*** (0.0102)
Labour market	0.935*** (0.249)	0.816*** (0.237)	0.898*** (0.239)	0.907*** (0.244)	0.764*** (0.251)	1.044*** (0.259)	1.142*** (0.268)	1.125*** (0.276)
Share small firms	0.506* (0.277)	0.423 (0.264)	0.126 (0.265)	-0.0278 (0.270)	0.0251 (0.277)	-0.175 (0.285)	-0.444 (0.294)	-0.655** (0.303)
Initial size	0.0537*** (0.00327)	0.0436*** (0.00252)	0.0384*** (0.00220)	0.0398*** (0.00214)	0.0364*** (0.00199)	0.0330*** (0.00187)	0.0322*** (0.00183)	0.0334*** (0.00183)
Average age	0.00432*** (0.000835)	0.00305*** (0.000795)	0.00247*** (0.000800)	0.000650 (0.000818)	-0.00159* (0.000842)	0.00264*** (0.000869)	0.00464*** (0.000898)	0.00595*** (0.000929)
Share highly educated	0.113*** (0.0272)	0.0427* (0.0258)	0.0409 (0.0260)	0.0462* (0.0267)	0.0449 (0.0275)	0.0514* (0.0283)	0.0552* (0.0293)	0.0711** (0.0302)
Low-tech man.	0.0262 (0.0905)	0.000711 (0.0844)	0.0375 (0.0836)	0.0319 (0.0844)	-0.0150 (0.0856)	-0.0358 (0.0875)	0.0196 (0.0899)	0.0213 (0.0923)
Know.-int. Serv.	-0.224*** (0.0815)	-0.245*** (0.0760)	-0.235*** (0.0753)	-0.255*** (0.0761)	-0.286*** (0.0771)	-0.278*** (0.0788)	-0.247*** (0.0811)	-0.251*** (0.0833)
Less know.-int. Serv.	-0.0321 (0.0817)	-0.0550 (0.0762)	-0.0571 (0.0755)	-0.0766 (0.0762)	-0.129* (0.0773)	-0.140* (0.0789)	-0.117 (0.0812)	-0.115 (0.0834)
Const.	-0.960*** (0.276)	-1.115*** (0.262)	-1.089*** (0.263)	-1.031*** (0.268)	-0.915*** (0.275)	-1.070*** (0.283)	-0.977*** (0.292)	-0.776*** (0.301)
No. obs.	47,979	47,979	47,979	47,979	47,979	47,979	47,979	47,979
Pseudo R2	0.0106	0.00882	0.00950	0.0105	0.0105	0.00993	0.0107	0.0112

The conditions on the regional labour market as measured as the employment rate have a positive effect through the whole time frame from the first active year of the firm through to the last year we observe.

The share of small firms in the region has a largely insignificant effect. Only the first and last period give significant results. In the first period, the effect is positive and in the last period, the effect is negative.

Turning to the firm-specific variables we see that the initial size of the firm measured as the number of employees in the starting year has a positive influence on survival on all measured time-scales.

Interestingly, the average age of the employees at the time of start-up seem to have a similar pattern of effects as the market potential variable. For shorter periods, the effect is negative and for longer periods, the effect is negative. Interpretation...

The education of the work force has a generally positive effect on survival probabilities.

Figure 5.1 below highlights the result of the changing effect of market potential on survival probabilities. The effect goes from positive to negative through the periods. The solid line represents the estimated coefficients and the dotted lines represent approximately two standard deviations above and below the solid line. Thus, when all three lines are above zero, the effect is significantly positive and when all three lines are below the effect is significantly negative.

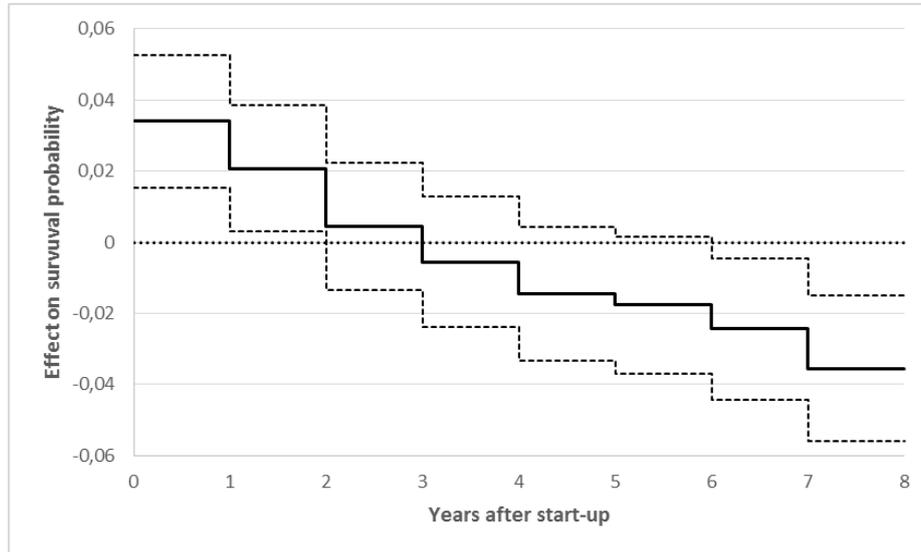


Figure 5.1: *Effect of Market Potential on survival over different periods*

In the appendix, we show the same type of estimations for the four sub-sectors, high-tech manufacturing, low-tech manufacturing, knowledge-intensive services and less knowledge-intensive services.

Table 5.2: *Estimated life-span of firms started in 2003 (Cox hazard regressions) All industries and the four sub-categories*

	All firms	High-tech man.	Low-tech man.	Know.-int.serv.	Less know.-int. serv.
Market potential	0.00603 (0.00463)	-0.0476 (0.0421)	0.0143 (0.0185)	0.00831 (0.00569)	0.00519 (0.00786)
Labour market	-0.519*** (0.122)	0.120 (0.809)	-0.604 (0.539)	-0.387** (0.151)	-0.681*** (0.191)
Share small firms	0.0745 (0.152)	-1.390 (0.915)	0.0480 (0.591)	-0.0476 (0.211)	0.285 (0.230)
Initial size	-0.0291*** (0.00685)	-0.00354 (0.00250)	-0.0148** (0.00656)	-0.0281*** (0.00957)	-0.0442*** (0.00731)
Average age	0.000975* (0.000510)	0.0110*** (0.00375)	0.00479*** (0.00170)	0.00160** (0.000675)	-0.00113 (0.000692)
Share highly educat.	-0.0369*** (0.0127)	0.203 (0.126)	0.107 (0.0823)	-0.0689*** (0.0161)	0.0549** (0.0259)
Industry dummies	Yes	No	No	No	No
No. obs	47,979	748	2,672	25,157	19,402
Pseudo R2	0.000997	0.00194	0.000966	0.00104	0.00120

6 Conclusion and discussion of results

The general results presented in this paper indicate that founding conditions are important predictors for exit and survival. Furthermore, these effects seem to be important also in the long

run; however, the effects are not the same, but opposite, in the short and the long run respectively.

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Appendix: Results for different industries

	Probability of survival until							
	2004	2005	2006	2007	2008	2009	2010	2011
Market potential	-0.0257 (0.0782)	0.0527 (0.0730)	0.0351 (0.0722)	0.0431 (0.0733)	0.0981 (0.0745)	0.108 (0.0760)	0.157** (0.0783)	0.104 (0.0798)
Labour market	1.340 (1.999)	0.510 (1.878)	-0.792 (1.862)	0.280 (1.889)	-0.673 (1.912)	-2.069 (1.943)	-1.363 (1.998)	-0.0625 (2.053)
Share of small firms	-2.344 (2.026)	0.298 (1.892)	1.357 (1.877)	1.840 (1.901)	3.877** (1.936)	5.357*** (1.978)	4.775** (2.035)	3.297 (2.070)
Initial size	0.00568 (0.00630)	0.00598 (0.00543)	0.00595 (0.00498)	0.00660 (0.00495)	0.00807 (0.00506)	0.00494 (0.00421)	0.00512 (0.00428)	0.00530 (0.00434)
Average age	-0.00118 (0.00746)	-0.00374 (0.00697)	-0.00593 (0.00692)	-0.0195*** (0.00710)	-0.0203*** (0.00723)	-0.0218*** (0.00740)	-0.0251*** (0.00765)	-0.0236*** (0.00779)
Share highly educated	-0.264 (0.279)	-0.342 (0.266)	-0.430 (0.270)	-0.387 (0.277)	-0.434 (0.285)	-0.519* (0.297)	-0.468 (0.305)	-0.339 (0.307)
Const	1.749 (2.066)	-0.707 (1.928)	-0.483 (1.909)	-1.368 (1.932)	-2.775 (1.963)	-2.917 (2.002)	-3.639* (2.060)	-3.228 (2.101)
No. obs	748	748	748	748	748	748	748	748
Pseudo R2	0.00424	0.00442	0.00615	0.0136	0.0184	0.0223	0.0234	0.0184

	Probability of survival until							
	2004	2005	2006	2007	2008	2009	2010	2011
Market potential	0.0405 (0.0404)	0.0264 (0.0378)	0.0322 (0.0375)	0.0166 (0.0379)	-0.000610 (0.0385)	-0.0284 (0.0395)	-0.0499 (0.0403)	-0.0649 (0.0413)
Labour market	2.750** (1.081)	2.302** (1.019)	1.372 (1.012)	0.720 (1.022)	0.881 (1.041)	0.623 (1.064)	0.162 (1.085)	0.707 (1.114)
Share of small firms	1.368 (1.118)	0.999 (1.042)	0.637 (1.032)	0.218 (1.041)	0.0196 (1.058)	0.196 (1.081)	-0.214 (1.103)	-0.717 (1.128)
Initial size	0.0480*** (0.0121)	0.0214*** (0.00657)	0.0151*** (0.00537)	0.0166*** (0.00527)	0.0123*** (0.00473)	0.0143*** (0.00479)	0.0160*** (0.00486)	0.0179*** (0.00495)
Average age	0.00776** (0.00373)	0.000741 (0.00348)	-0.00267 (0.00346)	-0.00463 (0.00350)	-0.00681* (0.00357)	-0.00918** (0.00366)	-0.0135*** (0.00377)	-0.0133*** (0.00386)
Share highly educated	-0.0407 (0.156)	-0.214 (0.147)	-0.257* (0.148)	-0.283* (0.151)	-0.296* (0.156)	-0.170 (0.159)	-0.214 (0.165)	-0.221 (0.170)
Const	-3.101*** (1.128)	-2.526** (1.054)	-1.773* (1.043)	-0.977 (1.052)	-0.858 (1.070)	-0.564 (1.095)	0.362 (1.117)	0.327 (1.145)
No. obs	2,672	2,672	2,672	2,672	2,672	2,672	2,672	2,672
Pseudo R2	0.0140	0.00750	0.00477	0.00519	0.00464	0.00566	0.00870	0.00986

	Probability of survival until							
	2004	2005	2006	2007	2008	2009	2010	2011
Market potential	0.0250*	0.0190	0.00149	-0.0162	-0.0111	-0.0240*	-0.0390***	-0.0424***
	(0.0128)	(0.0123)	(0.0125)	(0.0128)	(0.0132)	(0.0136)	(0.0141)	(0.0145)
Labour market	0.434	0.308	0.531	0.565	0.325	0.961***	1.262***	0.829**
	(0.345)	(0.331)	(0.336)	(0.346)	(0.356)	(0.369)	(0.383)	(0.394)
Share of small firms	0.807**	0.833**	0.462	0.301	0.298	-0.214	-0.540	-0.564
	(0.396)	(0.381)	(0.385)	(0.396)	(0.408)	(0.421)	(0.435)	(0.449)
Initial size	0.0480***	0.0309***	0.0353***	0.0367***	0.0368***	0.0337***	0.0321***	0.0327***
	(0.00394)	(0.00274)	(0.00270)	(0.00262)	(0.00255)	(0.00241)	(0.00233)	(0.00232)
Average age	0.00258**	0.00207*	0.00156	4.50e-05	-0.00141	-0.00309**	-0.00632***	-0.00677***
	(0.00113)	(0.00109)	(0.00110)	(0.00113)	(0.00117)	(0.00121)	(0.00126)	(0.00130)
Share highly educated	0.113***	0.0783***	0.0739**	0.109***	0.0868***	0.108***	0.130***	0.127***
	(0.0312)	(0.0299)	(0.0302)	(0.0311)	(0.0320)	(0.0330)	(0.0342)	(0.0353)
Const	-0.832**	-1.182***	-1.206***	-1.120***	-1.117***	-1.191***	-1.042***	-0.768*
	(0.366)	(0.352)	(0.357)	(0.366)	(0.377)	(0.390)	(0.403)	(0.416)
No. obs	25,157	25,157	25,157	25,157	25,157	25,157	25,157	25,157
Pseudo R2	0.00903	0.00652	0.00846	0.00956	0.0107	0.0109	0.0115	0.0122

	Probability of survival until							
	2004	2005	2006	2007	2008	2009	2010	2011
Market potential	0.0302**	0.0127	0.00210	-0.00267	-0.0189	-0.0144	-0.0163	-0.0242
	(0.0148)	(0.0139)	(0.0139)	(0.0142)	(0.0145)	(0.0149)	(0.0153)	(0.0157)
Labour market	0.976**	1.142***	1.086***	1.326***	1.199***	1.427***	1.466***	1.489***
	(0.389)	(0.369)	(0.370)	(0.377)	(0.386)	(0.398)	(0.410)	(0.422)
Share of small firms	-0.00986	-0.248	-0.384	-0.444	-0.415	-0.495	-0.745*	-0.865*
	(0.424)	(0.401)	(0.401)	(0.408)	(0.417)	(0.428)	(0.441)	(0.453)
Initial size	0.124***	0.0903***	0.0776***	0.0764***	0.0619***	0.0474***	0.0477***	0.0459***
	(0.00886)	(0.00643)	(0.00554)	(0.00525)	(0.00466)	(0.00411)	(0.00406)	(0.00396)
Average age	0.00674***	0.00555***	0.00529***	0.00375***	0.00143	-0.000131	-0.00115	-0.00158
	(0.00135)	(0.00127)	(0.00127)	(0.00129)	(0.00132)	(0.00136)	(0.00140)	(0.00144)
Share highly educated	-0.0568	-0.0992*	-0.0920	-0.127**	-0.127**	-0.102*	-0.124*	-0.118*
	(0.0594)	(0.0565)	(0.0569)	(0.0585)	(0.0603)	(0.0619)	(0.0643)	(0.0663)
Const	-0.835**	-1.046***	-1.095***	-1.358***	-1.179***	-1.428***	-1.376***	-1.327***
	(0.415)	(0.392)	(0.391)	(0.398)	(0.407)	(0.418)	(0.431)	(0.443)
No. obs	19,402	19,402	19,402	19,402	19,402	19,402	19,402	19,402
Pseudo R2	0.0151	0.0131	0.0125	0.0137	0.0116	0.00909	0.00993	0.0101