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Emergence of firms: a sociogeographic demand side perspective

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Abstract: This paper presents an analysis of regional start-up rates in the knowledge intensive services and high-tech industries. To supplement prevailing frameworks focusing mainly on supply-side economic factors, we integrate insights from economic geography and population ecology to the entrepreneurship literature as to present a theoretical framework that captures both supply- and demand-side factors, with a specific emphasis on the demand side. Using a rich multi-level data material on all knowledge intensive start-ups across the 286 Swedish municipalities between 1994 and 2002, the empirical analysis focuses on how characteristics of the economic milieu of regions influence firm births. We find that economically affluent regions dominate entrepreneurial activity in terms of firm births, yet a number of much smaller rural region revealed high levels of start ups. Both economic and sociological variables such as knowledge spillovers from universities and firm R&D, and the political regulatory regime within the municipality, exhibit strong influences on firm births. These patterns points to strong support for the notion that 'the geographic connection' is important for analyzing entrepreneurial processes.

Keywords: Firm birth, Geography, Entrepreneurship
JEL: R11; R23; M13

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How does it matter where and when a start-up is founded for its subsequent evolution? Some argues that economic turmoil, such as during the dot-com bust of 2001-2002 or the current credit crunch of 2008- leads to overall economic stagnation, stifling the business conditions of large and small firms alike. Others argue that economic crises are necessary parts of the economic cycle and hallmarks of entrepreneurship as "creative destruction" in that economic downturns offer room for new entrepreneurial firms to enter and try out untested business ideas, in the long run potentially transform whole industries and how the economy function.

A substantial literature in entrepreneurship, population ecology, and economic geography suggests that geographic factors are important in shaping the evolutionary paths by which new entrepreneurial firm emerge, grow, or exit. Micro oriented entrepreneurship research has indicated how resources and environmental conditions present at the time of founding can influence new firms in long lasting ways, even if more resources are accumulated and environmental conditions change (Delmar, Hellerstedt, & Wennberg, 2006). This suggests that the entrepreneurial process by which individuals engage in the start, the growth, and the exit of a firm is strongly path-dependent. Fundamental to this line of research is the assumption that resource endowments, economic conditions, and cultural patterns present during founding will influence the firm's development even though the environment and the firm will continue to change. Such resources tend to be strongly linked to particular regions(Gianetti & Simonov, 2007). Of particular interest is the role of geography in the creation and evolution of new firms.

The empirical analysis in this paper focuses on how characteristics of the economic milieu of regions influence firm births. We utilize a rich data material providing information on all

knowledge intensive start-ups across the 286 Swedish municipalities between 1994 and 2002. Following the general outline of this paper, our theoretical framework aims to capture both supply- and demand-side factors, with a specific emphasis on the demand side. Much of the existing literature on the link between entrepreneurship and characteristics of regions focuses on supply-side factors. We therefore try to control for supply-side effects that pertain to knowledge and information.

The paper is organized as followed. We first start by discussing the literature on regional variation and new firm formation. We specifically investigate the importance of initial conditions at start as they are treated and explained in organizational ecology and I/O economics. We thereafter examine the literature on clusters and affect new firm evolution. A third section is a description of the substantial variation in start-up rates in Sweden across regions and in the knowledge intensive sectors. We thereafter perform a number of analyses to explain this variation.

Initial conditions and their effect on new firm evolution

A broad literature points to the importance of the initial conditions and resources available at the time of founding for firm evolution. We draw primarily on theoretical models from population ecology, industrial organization economics and entrepreneurship research to theorize about these patterns. The logic behind the role of initial conditions has been explained by the ecological theories of *density delay* and *red queen competition.* Density delay proposes that the number of competitors present at the time of firms' founding reduces the amount of resources for each firm, increasing the probability of exit throughout their

entire life course because the lower resource available in periods of high density tend to become self-reinforcing and amplify differences in exit rates of firms founded under different conditions (Carroll & Hannan, 1989). The theory of red queen competition, on the other hand, suggests that the number of competitors present at the time of firms' founding can increase the viability of firms that manage to remain in business (Barnett & Pontikes, 2008). Hence, density delay stresses *selection-based competition* whereas red queen competition stresses *adaptation from competition*. Both theories originate from the model of density-dependence in population ecology that investigates the dynamics of organizational entry, growth and exit from a macro sociological lens. In this line of research, organizational *density* is measured by the number of firms in a population, which include all firms with similar structural attributes (organizational form) but differ from the economic notion of industry (Boone & van Witteloostuijn, 1995). The equilibrium number of firms according to the density dependency model is called the *carrying capacity* which refers to the numbers of a specific organizational form that can be sustained in a particular environment in isolation from other populations (Hannan & Carroll, 1992, p. 29). When the actual number of firms in a market is larger than the carrying capacity, firms that are ill adapted will be pressured to exit. If the actual number of firms is smaller than the carrying capacity, this implies room for entry.

Also work in industrial organization economics and economic geography highlight the importance of initial conditions for new firm's evolution. The 'revolving door' theory presented by Audretsch (1995) explain the fact that entry and exit rates are higher in economic booms, indicating that the average quality of start-ups increases and inefficient firms are closed when their founders exit and move on to other activities, as labor market conditions are fertile. These patterns are also shaped by the life cycle of different industries, as economic downturns lead to accentuated decline in mature industries, such as is the case

with the automobile industry during the world-wide financial crisis in 2008. Key features of the life cycle theories are: young industries are dominated by a few early entrants who tend to demand high prices for their products. This spurs the entry of more firms with increasingly higher output and lower prices. As the rate of growth in combined output falls below the average growth rate of individual firms, many firms are forced to exit – causing a "shakeout" in the industry (Gort & Klepper; Jovanovic & MacDonald, 1994). While most industries goes through a product life cycle that captures the way many industries evolve through their early eras, when they have reached maturity, the industry's further development tends to be difficult to predict with the life cycle approach (Klepper, 1997).

The life cycle model suggests that there are benefits from starting during early in an industry's development as this will provide new firms the time to develop capabilities that might lower risk of failure during a shakeout, similar to the density delay model in population ecology. However, research in economic geography suggests a more fine-grained model is where the entry of new firms in regions already characterized by many firms feeds into a self-reinforcing process that forms an agglomeration of related firm, cooperating and competing with each other (Feldman, Francis, & Bercovitz, 2005). Here, influenced played by the agglomeration offers a more micro-oriented model of how environmental conditions shape firm births and evolution than the macro oriented models in population ecology and industrial organization life cycle analysis.

To explicate how our theoretical pillars of population ecology, industrial organization economics and entrepreneurship are compatible with each other, it should first be pointed out that the density dependency's model of the time trajectory of number of firms in a population clearly resembles the notion of the industry life cycle in industrial organization (van Wissen,

2004). However, the ecological interpretation of competition is not directly transferable into notions of agglomeration economies. The ecological process of competition is generally stated as "the negative effect of the presence of one or more actors on the life chances or growth rates of some focal actor" (Carroll & Hannan, 2000, p. 225). This view of competition basically states that given a fixed resource space (e.g. in a consumer market), competition rises geometrically with the number of firms in a population. This concept of competition does not assume the notion of profit maximization as the driving motivation for firms, or as in Cave's (1998, p.1947) words, ignoring "the need to cover costs to keep a firm's coalitions together". In organizational ecology, this role is rather taken by forces of natural selection and organizational inertia. A final distinction between the entry models suggested by population ecology and industrial organization economics is that population ecology focuses both on economic (carrying capacity) and socio-cognitive barriers (legitimacy) whereas industrial organization economics is more concerned with distinct economic barriers such as how concentrated an industry is, and whether there are other barriers to entry such as legal regulations and high set-up costs. Nevertheless, we believe that both agglomeration economics and population ecology are essential insights for our analysis of demand side effects on entrepreneurial processes. Hence, the empirical examinations in this and subsequent papers strive to integrate the essential factors advocated by these theories.

While both work in economics and population ecology highlights the importance of *external* conditions in shaping the evolution of new firms (Carroll & Hannan, 1989; Jovanovic & MacDonald, 1994), also work in entrepreneurship suggest that individual firms resources can work in path-dependent and reinforcing ways. On the individual firm level, new firms started with higher initial capital (Bates, 1990), an established legal entity (Delmar & Shane, 2004), more extensive number of product offerings (Kalleberg & Leicht, 1991) and more employees

during founding (Bates, 1995; Delmar, Hellerstedt, & Wennberg, 2006) have been found more resilient and have higher survival chances. On the macro level, more general economic conditions have also been found to affect the evolution of new firms. Economic conditions influence the profitability of the entrepreneurial venture, but also the amount of job opportunities available elsewhere (Phillips & Kirchoff, 1989). For example, empirical studies suggest that firm survival decrease when the economy is in decline, such as when unemployment or bankruptcy rates increase (Andersson, 2006; Carrasco, 1999; Taylor, 1999). In this paper we will engage in a broad investigation of how initial conditions shape the emergence of new firms, focusing first specifically on the role of geography. The importance of geography as shaping business activities has been one of the strong emerging strands in economic research – especially noted in the "new economic geography" research advocated by Paul Krugman and others.

The geographic connection: Emergence of firms

In economic geography, Marshall (1920) defined three broad forces leading to a geographic concentration of industries: labor market pooling, availability of intermediate inputs into production processes, and spillovers of knowledge between firms. All of these are supply-side forces, stimulating the entry of new firms into regions that have already accumulated many firms. Because supply-side sources are relatively immobile (Tassey, 1991) the entry of new firms in regions already characterized by existing agglomeration feeds into a self-reinforcing process that can amalgamates agglomerated industries into an economic cluster. The literature suggests that clusters might affect entrepreneurship in several ways:

- Cluster characteristics may reduce the barriers of entry for new firms (Sternberg & Litzenberger, 2004). Lower entry barriers might affect the cognitive perceptions of

success and thus induce entrepreneur to risk taking the difficult step from being a potential founder to being a nascent entrepreneur (Sorenson & Audia, 2000).
- Further, in agglomerations there is generally stronger job-matching opportunities and service economies of scale and scope (Gordon & McCann, 2000)
- Clusters are characterized by lower search costs which facilitate entrepreneurs' efforts of finding buyers, and to be found (Stuart, 1979). Agglomerated regions therefore offers greater communicational advantages as firms develop better knowledge of each other (Saxenian, 1985) over time and thus continuously decrease search costs over time.
- Clusters are further characterized by lower transaction-costs, which can be seen as a variation of Marshall's specialization argument (Rocha, 2004). In an industrial agglomeration, the proximity of buyers reduces the transaction costs which arise from vertical disintegration.
- Lower exit barriers: Porter (1990) means that under-performing entrepreneurs can more easily find alternative employment, and would be more likely to leave the industry. This leads to higher churn rates, but it also means that the average performance of the remaining firms increases.

A common and important definition of agglomerations and clusters is that they include *both competition and cooperation* among new or existing firms. Firms have industrially linked suppliers in a region that share between them tradable resources (Kogut et al., 1994), but they also share knowledge that is part and parcel of the social community, acting as a public good for many or all firms in the region. In many high-technology clusters, competitors have formed intricate networks of interdependencies (Porter, 1990; Scott, 1989). They share ties to a research base such as universities, skilled labor, highly qualified suppliers, and venture capitalists (Pouder & St. John, 1996). These interrelationships spur the initial formation of an economic cluster, and the very same relationships also contributes to holding the cluster together over time (McCann & Folta, 2008).

The competitive pressure that arises from agglomerations is likely to differ between firms of different sizes and with distinct market strategies. Studies in organizational ecology have addressed such differences for firms that are considered generalists – firms targeting several

markets – and firms that are specialist specialists – firms targeting a specific market niche (Swaminathan, 1995; Mezias & Mezias, 2000). This line of research suggest an evolutionary theory of resource partitioning, in which markets dominated by a small number of large generalists firms, smaller specialists enjoy greater relative opportunities and will therefore benefit more higher by co-locating than generalists (Carroll, 1985). Conversely, in markets dominated by many different specialized firms, competition between these firms for resources will be higher and therefore co-locating will be less beneficial. So, the proximity of similar firms might adversely affect the survival capabilities of these firms due to heightened competition, but to the extent that that the agglomeration depends on a concentrated industry where large generalists and small specialists neighbouring firms have inter-linked demand structure, co-location will instead increase their performance (Barnett & Carroll, 1987; Porter, 1990). Resource partitioning theory might explain both why some clustered regions enhances the performance and survival of new entrepreneurial firms whereas other clusters decrease the performance of new firm, and how a cluster that is beneficial for new firms evolves into a cluster that is detrimental to their survival.

Both the density dependence model in ecology and the concept of agglomeration economies in economic geography involve some form of positive feedback between size of the population and the entry and growth of firms, indicating a number of clear similarities with industrial organization and ecological theories (Boone & van Witteloostuijn, 1995; van Wissen, 2004). For example, the suggested mechanisms within ecological process of legitimation whereas an organization receives a "social taken-for-granted character" (Carroll & Hannan, 2000, p. 223) resemble in many respects the emergence of agglomeration economies in the 'new economic geography' research (Gordon & McCann, 2000). Organization ecology suggests that the more firms that enter increase legitimation of the

population since it is perceived a viable way of organizing and producing an output, which is close to the concept of *learning regions* and regional knowledge accumulation in the industrial districts literature (cf. van Wissen, 2004). Both organizational ecology and agglomeration economics highlights factors related to localization economies: the size of the customer base, marketing, the size and quality of the labour pool, and a network of producers that share common knowledge and experience. And as van Wissen (2004) point out, the element of creating a social structure of an industry is similar to the defining features of a new industrial district as an area based on a common social and cultural background. A final similarity that has received little attention is that while some theories of agglomeration economies in principle assume no upper limit, recent work highlights the potential negative externalities of agglomeration in the form of 'congestions cost' (Arthur, 1990; Brezis & Krugman, 1993). These potentially non-linear effects of agglomeration/firm density are more theoretically accentuated in organizational ecology where there is a natural upper 'carrying capacity' after which the positive effects of density turns negative. However, the concepts of legitimation and competition is in the density-dependent model is conceptualized as factors related to the size of the *own* population, implying that they are only the result of localization economies. This ignores the inter-industry linkages and urbanization economies that are considered crucial in industrial districts (Fujita, Krugman & Venables, 1999)

The Geographic Variation in new firm formation in Sweden

The empirical setting for our test of these theoretical arguments is the country of Sweden, a relatively small but geographically dispersed nation with a high variation in economic activity. In Sweden, famous cases of clusters or industrial districts consist of biotechnology firms in Copenhagen-Lund and Uppsala-Stockholm (Wennberg & Lindqvist, 2010). The

Stockholm area is particularly dynamic, and similar to other European cities like Berlin and Munich has evolved from a city driven by public institutions, education and research to a metropolitan area increasingly driven by entrepreneurship in a large variety of economic sectors (Acz, Bosma & Sternberg, 2008). In 1994, the year in which our investigation commences, the greater Stockholm area comprised 30% of Sweden's GNP and the annual start up rate of knowledge-intensive firms per inhabitants ranged between 0.3% and 0.6% in the largest Stockholm municipalities, more than three times the national average. Also in real counts of knowledge-intensive start-ups, the sheer size of Stockholm's economy and population makes is stand out as a entrepreneurial hotspot (see Appendix A).

Insert Figure 1 here

Insert Table 1 here

It is however interesting to note in Table 1 above that a number of much smaller regions also have a relatively large start-up rate. Among these regions are both affluent areas with a large share of Stockholm expatriates and seasonal workers (Åre and Båstad) but also much smaller rural areas that are not economically affluent or dominated by industrial production. In particular, several municipalities in the rural area of Dalarna (Malung and also Ljusdal and

Leksand in 1992-1993) are also found among the top municipalities in knowledge intensive start-ups. Dalarna has been depicted as a region with a weak industrial base and also lacking a knowledge inducing sector of colleges and universities. Our data shows that the average level of education in these municipalities is quite low and the number of engineers and scientists in the lower 3rd percentile of the whole country. What, then, can explain the high rate of start up activities in these regions? One potential explanation is culture, another is political regulations (Gianetti & Simonov, 2007). The public government in these municipalities switched on average two times during the 1990s, indicating that significant changes in socio-political governance structure might have occurred. It should be pointed out that this association between political governance and entry rates is correlational in nature and not necessarily causal. That is, it might not be the shift in political governance to a right-wing majority but rather a trend towards deregulation or other pro-market forces that are indirectly associated with political governance, that are the true determinant for the higher entry rates in municipalities such as Malå, Malung, Ljusdal and Leksand in the mid-1990s. Another potential explanation pertains to the local culture. According to Johnson's (2008) study of entrepreneurial regions, the socioeconomic heritage in Dalarna of low incomes and a "do it yourself" culture of mixed farming, seasonal work and home-based small manufacturing has lead to a generally strong tradition of small business activities in Dalarna compared to other similar regions. In such areas, the tradition of combining employment and self-employment as a mean to make enough earnings as again become more important as the industrial economy is gradually replaced by a knowledge intensive economy (Folta, Delmar & Wennberg, 2010). But there are even more striking examples of entrepreneurial municipalities in table 1. A foremost example is the country of Arjeplog, one of the northernmost municipalities in Sweden. Here, the cost of transportation to other areas is huge, the average education is low, and there are few nearby colleges or industrial hubs suggesting the potenital of knowledge

spillovers. Yet, in 2001 Arjeplog had the 7th highest number of start ups per inhabitants and in 1994 it topped the list for overall Sweden.[1] This small hub of entrepreneurial activity can be attributed to the development in the 1980s of a car testing facilities for extreme temperatures. Within a few years, subsidiaries of multinational car corporations as well as independent start-ups gathered in Arjeplog to take advantage of the cheap land and basic labor costs, but with close accessibility to world-class research and testing facilities. Today more than 1,000 people from the car testing industry work at Arjeplog, and the industry's investment exceeds 55mil. €, a prima mode example of how entrepreneurial hotspots can emerge in any region, even the extremely remote ones, through knowledge spillovers.

However, with the exception of Dalarna and Arjeplog, the main urban areas of Malmö, Göteborg, and in particular Stockholm dominate the picture for knowledge-intensive start-ups. The predominant role of Stockholm as an engine of entrepreneurial growth in Sweden can be generalized to other contexts with the help of theoretical models of economic geography and population ecology depicted above. Because agglomerations are often much higher in urban areas, the increasingly 'spatial' nature of entrepreneurship and especially growth-oriented entrepreneurship mean that the level of *ambition* in entrepreneurship rises where competition and local growth-prone institutions are existent (Autio & Acs, 2007). This can be seen around the world through the increasing rates of entrepreneurship in urbanized region. This pattern is strongly accentuated in Sweden where a few metropolitan areas, in particular Stockholm, comprise a large and increasing share of entrepreneurship and economic growth. The benefits of urban size for new firms are many: Large urban economies

[1] The figures also for other years are high, in 1993 Arjeplog had the 3rd largest number of start ups and other years it was among the higher percentiles within the country

bring with them greater industrial and occupational diversity that facilitate the transfer of new innovations across industries (Jacobs, 1969; Rosenthal & Strange, 2005).

Theoretical predictions

Before plunging deeper into geographic analyses of birth rates in Swedish regions, we now return shortly to our theoretical outline in this paper as to motivate the choice of explanatory variables we use to analyze birth rates. Both the density dependence model in ecology and the concept of agglomeration economies in economic geography involve some form of positive feedback between size of the population and the entry and growth of firms (Boone & van Witteloostuijn, 1995; van Wissen, 2004). For example, the suggested mechanisms within ecological process of legitimation whereas an organization receives a "social taken-for-granted character" (Carroll & Hannan, 2000, p. 223) resemble in many respects the emergence of agglomeration economies in the 'new economic geography' research (Sorenson & Audia, 2000). Organization ecology suggests that the more firms that enter increase legitimation of the population since it is perceived a viable way of organizing and producing an output, which is close to the concept of *learning regions* and regional knowledge accumulation in the industrial districts literature (cf. van Wissen, 2004). A related sociological theory maintains that firm births are facilitated by socio-economic legitimacy (Baum & 1996) in that other societal constituents such as consumers, regulators, and suppliers have predetermined ideas of what constitute 'proper' modes of business activities and the coercive pressure from such constituents may hamper or facilitate the start-up activities of local firms. Some recent work provides support for this theory also in the Swedish context: Gianetti and Simonov (2007) examined self employment entry in all Swedish municipalities between 1995 and 2000 and found that the past political domination in a focal country exhibited strong influence on the level of entries. Hence, our analysis of demand side factors will include not

only economic variables but also variables pertaining to the political situation in specific regions.

Both organizational ecology and agglomeration economics highlights factors related to localization economies: the size of the customer base, marketing, the size and quality of the labour pool, and a network of producers that share common knowledge and experience. And as van Wissen (2004) point our, the element of creating a social structure of an industry is similar to the defining features of a new industrial district as an area based on a common social and cultural background. A final similarity that has received little attention is that while some theories of agglomeration economies in principle assume no upper limit, recent work highlights the potential negative externalities of agglomeration in the form of 'congestions cost' (Arthur, 1990; Brezis & Krugman, 1993). These potentially non-linear effects of agglomeration/firm density are more theoretically accentuated in organizational ecology where there is a natural upper 'carrying capacity' after which the positive effects of density turns negative. Hence, it is important to allow for such non-linearities in analyzes of firm births, which we try to do my integrating explanatory variables from population ecology and agglomeration economic research alike.

Method

Our empirical analysis focuses on how characteristics of the economic milieu of regions influence firm births. For this purpose we draw upon three unique databases maintained by Statistics Sweden (SCB): RAMS, which provides yearly data on all firms registered in Sweden; privately and publicly held firms, incorporations as well as partnerships and proprietorships. We used RAMS to sample all privately owned firms that started of any type

between 1994 and 2002. Three considerations were behind the time period chosen: (i) several of our predictor variables are not available until 1994; (ii) the time period 1990-1993 was an extreme period with the lowest economic activity in Sweden since the Great depression. Since we are interested primarily in how variation in contextual factors across regions affects firm births, basing our analysis on such a period could severely taint the result (iii) several years of start-up history are needed to avoid cohort effects. For analyzing the contextual influences on firm births it is first necessary to create a measure of births at the regional level. We did this by aggregating all yearly startups to the municipality level for each of the years 1994 to 2002 by summing all firm entries into a total value for the municipality. A value of 23 thus implies that 23 births occurred in municipality i at time j. We use a slightly narrower time frame than in the preceding papers since some of the important predictor variable where only available from 1994 onwards.

Dependent variable and analysis. The level of analysis in this investigation is the individual municipality (there are 286 municipalities in Sweden), and the focal variable of interest is firm births. To analyze how the regional characteristics described above affect firm births we use of the Negative Binomial (NEGBIN) regression model. This model is commonly used for analyses of count data (see e.g. Cameron & Trivedi 1998) and is appropriate if the mean exceeds the variance in birth. The number of start-ups are clearly count data and take on discrete vales 0,1,2… ,etc. up to a maximum of 3,174, which is the highest number of births in a municipality (Stockholm in 1999) during the time period of investigation. The average number of births is 32 but the median number is only 13, hence indicating highly skewed values as shown in the kernel density figure below. This substantiates the usage of count data analysis.

Insert Figure 2 here

Independent variables. Our analytical model is constructed such that it captures both supply- and demand-side factors, with a specific emphasis on the demand side. Much of the existing literature on the link between entrepreneurship and characteristics of regions focuses on supply-side factors. We therefore try to control for supply-side effects that pertain to knowledge and information. The bulk of papers on differences in entrepreneurship across regions pay particular attention to the impact of concentrations of human capital and knowledge investments in space.[2] These often builds on the 'knowledge spillover theory of entrepreneurship' (Acs et al., 2007), focusing on the sources of knowledge that leads to the creation and development of new firms. The essence of the theory is that spillovers of knowledge and information are more frequent in regions with high densities of human capital and knowledge investments. Because of this, potential and existing entrepreneurs have higher probability of accessing knowledge and information that can constitute the basis for a new firm, such that accessibility to knowledge sources trigger start-ups. On the supply-side we include the overall knowledge-intensity of the workforce in the municipality. This variable is defined as the share of workers with a university education of at least three years. We also include a dummy for the presence of university R&D and a dummy for the presence of business R&D. These three variables are included in view of the knowledge-spillover theory of entrepreneurship (see e.g. Acs et al., 2007) and controls for whether proximity to knowledge sources spurs knowledge-intensive entrepreneurship.

[2] Audretsch and Lehman (2006) suggest some theoretical reasons why proximity to knowledge sources might enhance entrepreneurial performance emanate in their "resource theory" of entrepreneurship.

We also investigate sociological variables pertaining to demand-side factors known to affect entrepreneurship (Thornton, 1999). Specifically, we use the four variables suggested as imperative in the density dependency model of population ecology: number of similar firms in existence during the time of founding, both at the national level and in the focal municipality (and their squared terms to investigate non-linearities). [3] The inclusion of variables counting the number of similar firms both nationally and regionally is motivated by the density-dependency model's integral focus on the often counteracting forces cognitive legitimacy versus competition in shaping birth rates: With an increasing number of firms in a new industry – such as IT consulting or Web design in our case – information and publication acceptation of this type of business spreads regionally, nationally and globally through media, business activities, and other types of information flow. With increasing information this type of business becomes cognitively more accepted, hence alleviating investors and customers' skepticism of the business and easing entrepreneurs ability to realize their idea in the socio-economic sphere of daily life. Since information spreads more quickly than actual business activities, the increasing prevalence of IT consulting firms or Web design firms in large regions such as Stockholm or Gothenburg might also facilitate firm births in far away regions. Hence, the national count of firms approximates the legitimacy side of the density dependency model rather than its competitive side (Torres et al., 1995). The regional count of firms also captures legitimacy – it is easier to find role models on the other side of the street than in a far away city – however the regional count variable also is a strong indicator of competition, your neighboring firm might turn out to be your strongest competitor as well as a role model. The squared terms of both variables are included to investigate non-linearities, i.e.

[3] In our chapter investigating firm exits we return to this model and supplement it as to also include explanatory variables from the density delay model in order to investigate the path-dependency of entry conditions in explaining firm survival.

when the negative hypothesized effect of competition on firm births overtake the positive effect of legitimacy.

We also include a variable indicating the political dominance in each municipality. Our interest in this variable comes from the socio-economic models of firm emergence developed in organization theory (c.f. Lounsbury, 2007). In such models, the birth and demise of organizations is not determined solely by economic forces but is portrayed as a highly social process shaped by institutional actors such as governments, industrial associations and trade unions, that strives to advance their respective interests via persuasion and coercion (DiMaggio & Powell, 1983). The validity of the variable denoting political control of a municipality hinges on the notion that local authorities wields coercive pressure that can hamper or facilitate the start-up activities of local firms, for example by indirectly or influencing public administrators to avoid or delay application procedures and approval of operation in cases such applications are necessary. Obviously, this does not imply corruption but merely that socio-cultural practice depends on the people set to administer such practices, and who dictates local parliamentary matters for administration and legislation. The interpretation of this variable should be taken with some caution since we cannot ascertain the exact theoretical mechanism by which the variable operation. Change in local governance might provide a source of socio-political legitimacy and/or simultaneously lead to some factual institutional reforms, and we cannot distinguish between the two. Similar to Gianetti and Simonov (2007) this variable takes the value -1 for socialistic majority, 1 for right-wing majority, and 0 for a mixed (coalition) majority.

Control variables. Finally, we include a number of control variables: We control for the general economic size of each municipality by including a measure of Gross Regional Product

(GRP) We also control for the median income per capita (approximates both supply of potential entrepreneurs and demand for their services) and two dummy variables denoting regional characteristics of the local economy: one for public sector dominance, another for agricultural dominance. Since the data constitutes a repeated cross-sectional time series panel, we include dummy variables for each year of analysis to control for unobservable effects pertaining to the economic cycle. All variables are time varying between 1994 and 2002, updated yearly for each municipality. The variables are summarized in table 2. The maximum and minimum values, mean values, and their internal correlations are displays in appendix B.

Insert Table 2 here

Results

Table 3 shows negative binomial regression models of firm births across all Swedish municipalities during the time period of analysis. We show separate models for high-tech start-ups and knowledge-intensive business services (KIBS), the latter by far representing the majority of firm births. Results show that both supply- and demand-side factors matter for KIBS start-ups by the category of individuals studied, but that demand-side factors seem to dominate. In terms of local conditions, the coefficients for both municipality GRP and median income among residents show positive effects on firm birth for both high-tech and business services start-ups. The positive effects are most pronounced in the coefficient for median income. Although this is primarily a control variable, the effect is supportive of the notion that demandy side factors are important determinants of firm births. The dummy variable denoting

the presence of a large agricultural sector in a municipality reveal negative effects on all types of firm birth, however the presence of a large public sector in a municipality has a positive effect, contrary to expectation. This indicates that a high level of public spending do not necessarily crowd out entrepreneurship in the municipality.

Insert Table 3 here

We now turn to investigate the theoretical variables of interest: ecological conditions, knowledge spillovers, and the effect of the local regulatory regime. Ecological conditions enter our analysis according to the density-dependency model with linear and squared coefficients for the number of firms in the same industry present in the overall country.[4] The density model predicts that linear effect should be positive for the emergence of new organizations due to the enhancing effect of legitimacy through a 'safety in numbers' logic, but that the quadratic effect should be negative due to the competition that follows with large numbers of similar firms vying to occupy a part of the market space. Tables 3 and 4 shows support of both effects for the birth of knowledge intensive service firms, and high-tech manufacturing firms respectively. The effects are especially pronounced for high-tech manufacturing firms despite the fact that the number of service firms is vastly higher.

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[4] We experimented also with density variables on both the national and regional level but this made the models difficult to converge. Quite possible, the number of firms in a small country such as Sweden is too limited to be measured locally. This is not a theoretical problem, since the arguments behind competition and legitimacy in the density dependency model suggest that competition can be both local and national while the effect of legitimacy operates much more nationally – or even internationally (Torres et al. 1995).

Insert Table 4 here

The multivariate analysis of firm births in the knowledge intensive sector revealed strong support for our demand-based model of firm births. Both ecological conditions and knowledge spillovers, as well as the local regulatory regime exhibited strong influence on the number of new firms across Swedish municipalities. Can we say of the relative size of these effects? This is done by calculating marginal effects (the relative change in the outcome variable given a one unit increase in the predictor variable, also called Instant Incident Ratios, IIR). Calculation of marginal effects for our key predictor variables shows that holding all other variables constant at their means, the shift in political dominance in a country from left wing to right wing increase the number of KIBS startups by 6%, but has no effect on high-tech manufacturing start-ups. A likely explanation is that entry and exit barriers are higher for manufacturing firms, hence their set-up costs are higher and the short-term influence of a change in regulatory regime (regardless of whether this provide a source of socio-political legitimacy or simultaneously lead to some factual institutional reforms) is little. This represents 29 new firms for the average municipality. Similarly, the presence of business R&D in the municipality (measured by a dummy variable) increase the number of KIBS startups by 42%, while the presence of strong University R&D in the municipality increase the number of KIBS startups by a whopping 52%. The effects for high-tech start-ups is similar but more closely linked to University R&D (57% marginal effect) compared to business R&D (28%). The marginal effects size thus reveal substantial influence of both economic and sociological demand-side variables on firm birth, substantiating the relevance of research exploring the geographic source of demand-side factors affecting entrepreneurial processes. It should also be mentioned that since our unit of analysis in this paper has been the local municipality, our model conceals a substantial heterogeneity in what type of firms that is

founded. It might be possible that the demand-side variables of economic and sociological type identified are contingent depending on the size, composition, and scope of activities of the new firm. More advanced analysis would be necessary to investigate such contingencies.

Discussion

In this paper we have investigated the role of geographic factors for the birth of new knowledge intensive firms. To challenge prevailing frameworks focusing mainly on supply-side economic factors, we tried to integrate insights from economic geography and population ecological research on firm births in our analytical framework. The empirical analysis of birth rates of knowledge intensive firms across all Swedish 286 municipalities during the period 1994-2002 revealed a number of interesting patterns. We found that the level of firm births varied strongly across municipalities. Large and economically dominant regions such as greater Stockholm, and Malmö-Lund dominated entrepreneurial activity in terms of firm births, yet a number of much smaller rural municipalities revealed high levels of start ups. We could see that both economic and sociological variables of demand-side type exhibited strong influences on firm births across Swedish municipalities. Knowledge spillovers from universities and firm R&D apparently played a strong role by positively influencing the number of births, as did the regulatory regime within the municipality. It should be stressed that this is a statistical association that is correlation but not necessarily causal in nature and that regulatory regime is present on the local regulatory level. It is also possible that your findings in relationship to the local regulatory regime being influenced by a left or right leaning government can be attributed to other, hitherto unmeasured, factors. While these types of analyses are still rare in the literature, a somewhat similar study by Wagner and Sternberg (2004) investigated startup behaviour on ten German planning regions and found that startup behaviour was more frequent in densely populated and faster growing regions, while it did not

matter whether the region has a left or right leaning government. These are interesting findings that should be taken as tentative and worthy of further investigation. In unreported models estimated separately for each year of analysis we found the effect of regulatory regime to be strongest in 1994, 1995 and 1996 and then diminished during the latter half of the observation period. That indicates that during the 1990s, the regulatory regime became less important for start-up efforts among knowledge intensive firms, indicating that the public legitimacy of entrepreneurship likely increased in Sweden as a whole.

All of these patterns points to strong support for the notion that 'the geographic connection' is an important one for analyzing entrepreneurial processes. Our analysis also indicates a number of research questions for further investigation. The large variety in firm birth rates between municipalities suggests that more intricate analyses of outliers – both low entrepreneurial and high entrepreneurial such, could provide interesting evidence. But we would like to add that it is specifically regions that 'goes against the tide', that is, low-entrepreneurship regions where firm births suddenly increases, that merits specific investigation. The prevalence of a high start up rates in a number of much smaller rural municipalities suggests that more fine-grained social-cultural or historical analyses of such regions might be fruitful. These interesting outliers notwithstanding, our overall analyses suggests strong path-dependency in firm births which is in tandem with recent economic studies focusing on the 'persistence in start-up rates' across regions (Andersson & Koster, 2009). Also, research in organization theory maintains that the spatial dimensions for the emergence and spread of new firms remain an under-researched topic (Cattani, Pennings & Wezel, 2002; Hedström, 1994). Such theories have suggested that social networks of individuals and firms might play a role in 'spreading' entrepreneurial efforts. From a

historical perspective, how patterns of firm births evolve across regions and how persists over longer periods of time – even decades – remains an interesting question for future research.

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Figure 1: Municipalities with highest relative entry rate (shaded) 1994-2002

Figure 2: Kernel density estimate of knowledge-intensive start-ups in Swedish municipalities 1994-2002.

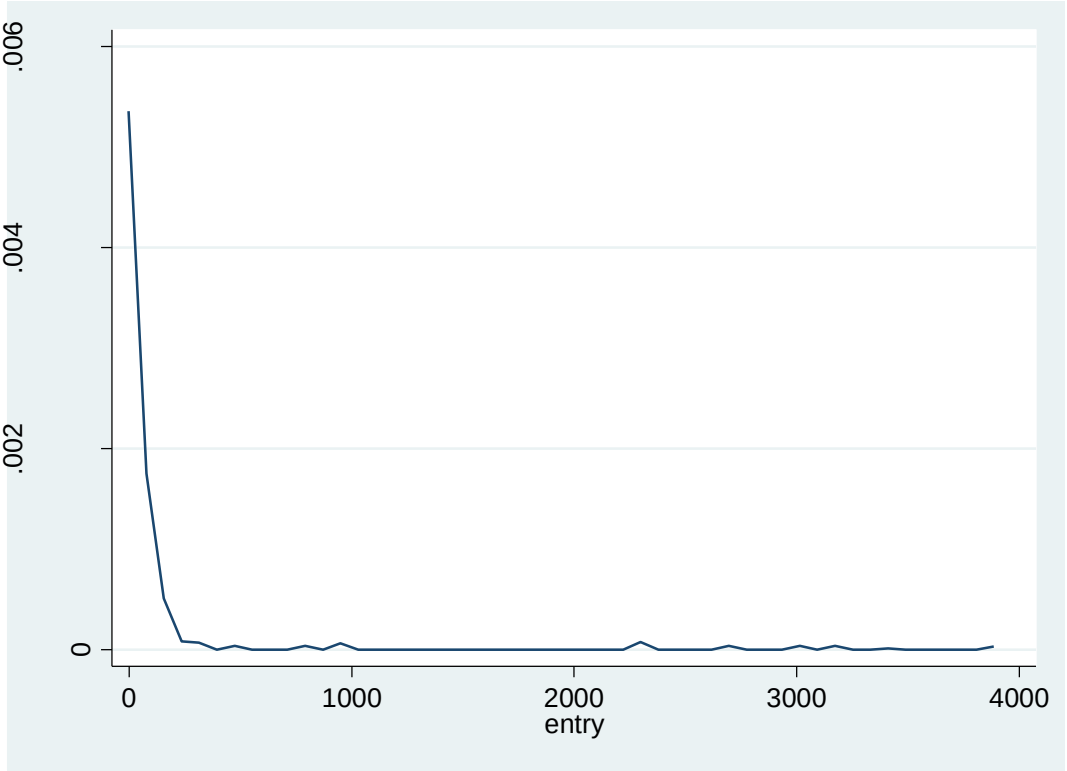

Table 1: The 10 municipalities with highest relative entry rate 1994-2002

1994		1995		1996		1997		1998		1999		2000		2001		2002	
Sollentuna	0.32%	Nyköping	0.32%	Nacka	0.31%	Vallentuna	0.40%	Solna	0.35%	Strömstad	0.31%	Göteborg	0.35%	Höganäs	0.37%	Vellinge	0.36%
Vallentuna	0.33%	Sollentuna	0.32%	Sollentuna	0.31%	Österåker	0.40%	Sollentuna	0.38%	Sollentuna	0.32%	Sollentuna	0.36%	Vellinge	0.37%	Lomma	0.36%
Solna	0.37%	Håbo	0.32%	Båstad	0.32%	Nyköping	0.41%	Malå	0.38%	Nacka	0.36%	Värmdö	0.40%	Malung	0.40%	Värmdö	0.39%
Nacka	0.37%	Nacka	0.32%	Ekerö	0.33%	Nacka	0.41%	Vallentuna	0.39%	Ekerö	0.37%	Solna	0.42%	Arjeplog	0.45%	Sollentuna	0.41%
Täby	0.44%	Vallentuna	0.33%	Lomma	0.33%	Ekerö	0.46%	Täby	0.46%	Åre	0.38%	Nacka	0.44%	Täby	0.51%	Vaxholm	0.42%
Vaxholm	0.48%	Vaxholm	0.39%	Täby	0.41%	Vaxholm	0.47%	Vaxholm	0.50%	Vaxholm	0.42%	Vaxholm	0.49%	Nacka	0.52%	Nacka	0.44%
Lidingö	0.51%	Täby	0.49%	Vaxholm	0.42%	Täby	0.55%	Nacka	0.53%	Täby	0.43%	Täby	0.54%	Vaxholm	0.57%	Täby	0.49%
Stockholm	0.54%	Lidingö	0.50%	Lidingö	0.45%	Lidingö	0.67%	Stockholm	0.65%	Lidingö	0.47%	Lidingö	0.55%	Danderyd	0.59%	Lidingö	0.58%
Danderyd	0.55%	Stockholm	0.53%	Danderyd	0.49%	Stockholm	0.70%	Lidingö	0.65%	Stockholm	0.57%	Danderyd	0.65%	Lidingö	0.61%	Danderyd	0.62%
Arjeplog	0.55%	Danderyd	0.63%	Stockholm	0.50%	Danderyd	0.76%	Danderyd	0.68%	Danderyd	0.58%	Stockholm	0.81%	Stockholm	0.73%	Stockholm	0.70%

Note: Entry rate computed as start up rate of knowledge-intensive firms per number of inhabitants

Table 2: Explanatory variables in the empirical analysis (conditions across municipalities).

Type of variable	**Variable**	***Explanation***
Local conditions	GRP	Gross Regional Product
Local conditions	Median Income	Median income per capita in municipality
Local conditions	Agriculture	Dummy for a large agriculture sector (35% employment) in municipality
Local conditions	Public sector	Dummy for a large public sector (>35% employment) in municipality
Ecological conditions	Density	Number of firms (KIBS or high tech manufacturing firms, respectively) in municipality
Ecological conditions	Density^2	Squared number of firms (KIBS or high tech manufacturing firms, respectively) in municipality
Knowledge spillovers	College Educated	Proportion of College Educated in the municipality
Knowledge spillovers	University R&D	Dummy for the presence of university R&D in the municipality (1 of positive R&D investments, 0 otherwise)
Knowledge spillovers	Business R&D	Dummy for the presence of business R&D in the municipality (1 of positive R&D investments, 0 otherwise)
Regulatory Regime	Politics	Political majority in municipality (-1= socialistic majority, 0= mixed majority, 1=right wing majority)

Table 3: NEGBIN Models of Births of High-Tech Manufacturing Firms

	Model 1	**Model 2**	**Model 3**	**Model 4**
GRP in region	0.00***	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Median Income in region	0.01***	0.01*	0.01**	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
Metropolitan area (0/1)	0.19	-3.72***	-3.57***	-3.63***
	(0.34)	(0.31)	(0.34)	(0.34)
Large Public Sector (0/1)	0.37***	0.27***	0.29***	0.30***
	(0.06)	(0.06)	(0.06)	(0.06)
Large Agricultural Sector (0/1)	-0.81***	-0.42***	-0.39***	-0.36***
	(0.09)	(0.09)	(0.09)	(0.09)
Firm Density		0.06***	0.05***	0.05***
		(0.00)	(0.00)	(0.00)
Firm Density²		-0.00***	-0.00***	-0.00***
		(0.00)	(0.00)	(0.00)
% College educated		0.00	-0.01	-0.01
		(0.01)	(0.01)	(0.01)
Business R&D in region			0.18*	0.17*
			(0.07)	(0.07)
University R&D in region			-0.01	-0.02
			(0.08)	(0.08)
Political Majority in region				-0.05
				(0.04)
Constant	-2.00***	-1.93***	-2.12***	-2.25***
	0.48	0.42	(0.44)	(0.45)
(ln)alpha				
Alpha Constant	-0.27**	-2.08***	-2.16***	-2.15***
	0.09	0.24	(0.26)	(0.26)
Pseudo R-2 (McFadden's)	0.14	0.24	0.24	0.24
Chi-2 statistic :	879.32	1451.52	1458.16	1460.18
Chi-2 p-value:	0.001	0.001	0.001	0.001

Notes: Year dummies included but not reported. Huber White Standard Errors in Parenthesis.

Table 4: NEGBIN Models of Births of KIBS Firms

	Model 1	**Model 2**	**Model 3**	**Model 4**
GRP in region	0.00***	0.00***	(0.00)	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
Median Income in region	0.03***	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Metropolitan area (0/1)	-2.46***	-4.23***	-3.54***	-42***
	-0.21	-0.21	-0.21	-0.21
Large Public Sector (0/1)	0.34***	0.18***	0.18***	0.19***
	-0.03	-0.03	-0.03	-0.03
Large Agricultural Sector (0/1)	-0.20***	-0.17***	-0.13***	-0.17***
	-0.04	-0.03	-0.03	-0.03
Firm Density		0.00***	0.00***	0.00***
		(0.00)	(0.00)	(0.00)
Firm Density²		-0.00***	-0.00***	-0.00***
		(0.00)	(0.00)	(0.00)
% College educated		0.02***	0.02***	0.02***
		(0.00)	(0.00)	(0.00)
Business R&D in region			0.30***	0.30***
			-0.03	-0.03
University R&D in region			0.25***	0.27***
			-0.04	-0.04
Political Majority in region				0.08***
				-0.02
Constant	-1.96***	0.17	-0.25	-0.17
	-0.25	-0.25	-0.25	-0.25
(ln)alpha				
Alpha Constant	-0.60***	-1.07***	-1.13***	-1.14***
	-0.03	-0.03	-0.03	-0.03
Pseudo R-2 (McFadden's)	0.15	0.20	0.21	0.21
Chi-2 statistic	3555.7	4616.82	4748.13	4770
Chi-2 p-value:	0.001	0.001	0.001	0.001

Notes: Year dummies included but not reported. Huber White Standard Errors in Parenthesis.

Appendix A: 10 municipalities with highest absolute entry rate 1994-2002

1994		**1995**		**1996**		**1997**		**1998**		**1999**		**2000**		**2001**		**2002**	
Örebro	147	Helsingborg	153	Örebro	119	Örebro	176	Helsingborg	161	Linköping	131	Linköping	164	Lidingö	142	Örebro	153
Lund	155	Örebro	154	Linköping	122	Nacka	178	Västerås	162	Lund	136	Helsingborg	181	Linköping	145	Västerås	165
Helsingborg	156	Lund	160	Nacka	133	Västerås	183	Linköping	166	Västerås	139	Västerås	182	Helsingborg	177	Täby	177
Nacka	156	Västerås	169	Västerås	137	Lund	183	Täby	169	Helsingborg	152	Täby	194	Täby	185	Helsingborg	197
Täby	158	Linköping	174	Täby	150	Täby	199	Lund	178	Täby	157	Nacka	201	Lund	229	Lund	200
Västerås	204	Täby	177	Lund	172	Linköping	201	Nacka	234	Nacka	159	Lund	203	Nacka	239	Nacka	203
Uppsala	250	Uppsala	262	Uppsala	257	Uppsala	342	Uppsala	322	Uppsala	290	Uppsala	358	Uppsala	321	Uppsala	318
Malmö	358	Malmö	371	Malmö	311	Malmö	463	Malmö	428	Malmö	370	Malmö	500	Malmö	473	Malmö	500
Göteborg	775	Göteborg	790	Göteborg	753	Göteborg	949	Göteborg	954	Göteborg	736	Göteborg	1015	Göteborg	898	Göteborg	856
Stockholm	2302	Stockholm	2299	Stockholm	2204	Stockholm	3174	Stockholm	3013	Stockholm	2694	Stockholm	3884	Stockholm	3541	Stockholm	3405

Appendix B: Modal values and correlation matrix for variables in analyses of firm births

	Mean	S.D.	Min	Max	Births	GRP	Median Income	Metropolitan area (0/1)	Public Sector	Agricultural Sector	Firm Density	Firm Density^2	% College educated	Business R&D	University R&D
Births	39.06	178.9	1	3782											
GRP	7139	21838	1	4E+05	0.969										
Median Income	175.1	21.04	126.7	273.8	0.076	0.076									
Metropolitan area (0/1)	0.01	0.1	0	1	0.743	0.799	-0.02								
Public Sector	0.44	0.5	0	1	-0.03	-0.038	-0.02	-0.091							
Agricultural Sector	0.31	0.46	0	1	-0.112	-0.151	-0.24	-0.07	0.023						
Firm Density	278.1	1153	2	22972	0.994	0.981	0.085	0.761	-0.03	-0.119					
Firm Density^2	1E+06	2E+07	4	+05	0.945	0.879	0.054	0.6	-0.053	-0.045	0.938				
% College educated	3.6	3.99	0	29.07	0.344	0.368	0.249	0.206	0.018	-0.301	0.349	0.211			
Business R&D	0.62	0.49	0	1	0.118	0.185	0.071	0.082	-0.127	-0.235	0.129	0.052	0.274		
University R&D	0.16	0.37	0	1	0.277	0.367	0.021	0.238	0.179	-0.19	0.294	0.149	0.259	0.205	
Political Majority	-0.12	0.85	-1	1	0.018	-0.03	0.012	-0.03	-0.083	0.223	0.015	0.011	0.075	-0.066	-0.099