

Introduction and Summary of the Thesis

1. Foreward

The present volume contains four essays on the subject of entrepreneurship. This brief introduction is organized in the following manner: Section 2 is a gentle overview of why researchers are (and are becoming increasingly more) interested on the topic of entrepreneurship, Section 3 outlines the current state of the theory of entrepreneurship, while Section 4 describes how this thesis contributes to the literature. Section 5 discusses the main data source used throughout this volume and some methodological issues are presented in Section 6. Section 7

contains a summary of each essay while Section 8 presents a more in-depth discussion on how the four essays are related, and Section 9 concludes this introduction by summing up the lessons learned from this research.

2. Why study entrepreneurship?

The importance of entrepreneurship for economic growth and technological change was strongly disputed in the post-World War II period. The scale advantage of large firms was considered too significant for small firms, that were regarded as counter-productive, to compete against (Schumpeter, 1942; Galbraith, 1956). Today the situation has been reversed almost completely and entrepreneurship has come to be perceived as an engine of economic and social development throughout the world (Baumol, 1993; Audretsch, 1995; Klepper, 1996; McGrath, 1999; Acs and Audretsch, 2001; Audretsch et al., 2006).

Early findings suggesting that new firm creation plays an important role in economic growth through the provision of new jobs (Birch, 1979; Birley, 1987; Reynolds, 1987) contributed in rekindling researchers' interest in entrepreneurship. There are several ways in which competition by entry of new firms can stimulate local markets by spurring competition and market selection leading to an increase of productivity (Fritsch, 2008): stimulation of efficiency and productivity increase by contesting established market positions (Baumol et al., 1988); acceleration of structural change (Schumpeter, 1934, 1942); amplified innovation, particularly the creation of new markets (Acs and Audretsch, 1990; Audretsch, 1995; Baumol, 2004); and greater variety of products and problem solutions.

Holtz-Eakin and Kao (2003) find that entrepreneurship, in the form of firm births, is positively related to changes in productivity while Audretsch and Keilbach (2004) estimate a production function model including several different measures of entrepreneurship capital and find that it is a significant and important factor in shaping output and productivity. Moreover, Geroski (1995) notes how high rates of entry are often associated with high rates of innovation and increases in productivity (Baptista and Swann, 1999). Note that the positive correlation found between entry and innovative performance in markets (Geroski, 1989, 1991a, 1991b; Acs and Audretsch, 1990) and high entry rates and productivity growth (Geroski, 1989, 1991b; Baldwin and Gorecki, 1991) does not necessarily imply that new entrants are responsible for these effects but suggests that high entry rates stimulate the performance of the industry as a whole.

3. Connection to the theory

Despite the increased awareness of the importance of entrepreneurship for economic growth the field of entrepreneurial research suffers from a high degree of fragmentation and a lack of a coherent theoretical foundation. Gartner (2001) describes the field of entrepreneurship as a ‘cacophony of results and ideas’, and Shane and Venkataraman (2000) as a ‘hodgepodge’. Braunerhjelm (2010) describes the occupational choice models (Evans and Leighton, 1989; Banerjee and Newman, 1993; van Praag and Cramer, 2001) as the closest contemporary attempt to model entrepreneurship, however he does not consider them particularly satisfactory or more valuable than an eclectic approach based on empirical observations.

An important recent development has been the introduction of Shane's (2003) general theory of entrepreneurship, called *The Individual Opportunity Nexus*. This contribution has directed entrepreneurship research in analysing "how, by whom and with what consequences opportunities to produce future goods and services are discovered, evaluated, and exploited" (Shane and Venkataraman, 2000) providing researchers with a common focus. As our knowledge of these processes improves we are getting one step closer to formulating an integrated theoretical framework of entrepreneurial behaviour. Making the supply of entrepreneurial opportunities endogenous would be a considerable breakthrough. In this context the knowledge spillover theory of entrepreneurship (Acs et al., 2009) stresses not only the connection between existing knowledge and the supply of entrepreneurial opportunities but also the role of the entrepreneur in creating new knowledge. The implications for knowledge-based growth models that have until now kept the diffusion of knowledge exogenous are rather important (see Braunerhjelm, 2008a for a discussion). Gaining a better understanding of the processes surrounding the entrepreneurial event could contribute to the efforts of understanding and properly formulating the micro-foundations of endogenous growth theory. We hold many pieces of the puzzle, yet we still lack a complete picture of the underlying processes.

4. How does this thesis contribute to the literature?

It is in this framework that the current thesis contributes by scrutinizing the event of an entrepreneurial birth in several novel ways. The availability of complete and perfect information of the entire private market of an open western economy (Sweden) over a series of years allows an in-depth and systematic analysis of unprecedented scope,

leading to new insights. The ability to compare manufacturing industries with services is key given the on-going transformation of most developed western economies from industrial to service-oriented. Most importantly the essays presented in this volume focus on identifying and explaining the conditions that lead to the birth of high-potential entrepreneurs.

It is becoming a stylized fact that not all entrepreneurial instances have a positive societal effect. Instead it is a small number of high-quality entrepreneurial ventures that create the most new-job openings, introduce the most radical innovations and cause the largest productivity increases in the local industry (see Fritsch and Schroeter, 2009, Acs and Mueller, 2008 and references therein). The problem of measuring entrepreneurship has plagued the field from its infancy and a long list of proxies has been used over the years. These include self-employment rates, business ownership rates, new-firm start-ups, or other forms of industry demographics. Identifying high-potential entrepreneurs through such means is virtually impossible. The present thesis takes advantage of a unique individual level micro-dataset in order to identify the founders of all *de novo* start-ups in the Swedish economy over a series of years, track their former employment, their industry-specific experience and their access to related knowledge capital, among other things. This approach allows among other things to net out from the analysis necessity-based entrepreneurs that choose self-employment simply as an alternative to unemployment. Essays I and II consider individuals that choose to leave their positions and spin-off starting their own firms, entailing a focus on opportunity-based entrepreneurship¹. Essay III has a similar focus but refines the analysis further by also addressing differences between spin-offs in general and spin-outs (firms

¹ The insignificant relation between these occurrences and regional unemployment rates (see Essay II) enhances the belief that it is indeed opportunity based entrepreneurship that is captured.

in the same industry as the incumbent firm)². The fourth Essay compares the location choice of skilled entrepreneurs (graduates from institutions of higher education) to that of entrepreneurs in general and evaluates the role of the place of studies.

In three out of the four papers the analysis considers the choice of the individual. This allows for a proper treatment of the counterfactual, which is so often absent in many studies on entrepreneurship, the control group of individuals sharing similar characteristics with the entrepreneurs that choose paths other than that of firm-ownership.

A more detailed discussion on the contribution of each paper can be found in the brief summaries in Section 7 while Section 9 recaps the major findings in an integrated manner.

5. Data

Although several different data sources have been utilized and merged in the process of completing the essays presented in this volume at the heart of the analysis lies a database compiled by Statistics Sweden (SCB) and referred to as FAD which is the acronym of “Firms and establishments dynamics” (Företagens och arbetsstälernas dynamik). FAD contains linked information on all firms, establishments and working individuals in Sweden starting from year 1985³. The unique identification code of each working individual allows tracking the

² Considerable confusion surrounds the terms “spin-off” and “spin-out” in the literature since they are frequently used interchangeably but also to mean a list of different types of entry. In this volume the following convention is used: Spin-offs are all firms started by ex-employees of surviving incumbents irrespective of the industry they choose to enter. Spin-outs are those spin-offs that enter the same industry as the parent firm.

³ The database is continuously updated as new data is made available but the information contained therein is richer for the most recent years (1997 onwards). The data used in this volume covers the period up to 2005.

employment history of the entire working population in Sweden with great precision. To my knowledge and at the present time, comparable data are available only in the rest of the Nordic countries. The use of the data is limited to authorized users, restricted by confidentiality agreements and most of the work has been carried out through remote desktop connection on the SCB servers housed in Örebro, Sweden.

6. Methodology

The availability of complete individual level data is certainly a luxury. The advantages of using a database as large as FAD⁴ do come at a cost, the most serious of which is the time required to manage and analyze the data despite modern advances in computational power. Moreover, taking full advantage of the wealth of information contained in individual level micro-datasets requires the departure from the realm of OLS. The need to and apply state-of-the-art micro-econometric techniques made the whole process engaging and challenging. Discrete choice analysis (McFadden, 1973, 1984) is the main tool used to tackle this problem. Survival analysis, a commonly used method in medical sciences but not so much in economics, was used in order to properly assess the effect of a set of conditioning variables on the survival of entrepreneurial start-ups. Finally, a negative binomial estimator (in essence a Poisson estimator that also allows for a gamma distributed error term), completes the arsenal deployed in this research. Presenting more technical points is beyond the scope of this introduction but Cameron and Trivedi (2005) and Wooldridge (2002) are excellent manuscripts on micro-econometrics for the reader interested in more details than the ones provided in each essay.

⁴ Each annual cross-section contains information on roughly 2.5 million individuals working in the private sector of the Swedish economy

7. Summary of essays

Essay I: “Spin-offs : Firm, regional and industry determinants”, with Pontus Braunerhjelm.

Spin-offs have been shown to be critically important for cluster growth and dynamics, to perform considerably better than other start-ups, and to generate more radical innovations (Klepper, 1996, 2002; Romanelli and Feldman, 2006; Lerner 2009). Notwithstanding these insights and the potential societal value of spin-offs, our knowledge concerning the underlying factors that trigger spin-offs is surprisingly scarce. Previous research contributions in this area lack a coherent theoretical framework, while empirical studies apply a plethora of different methods and data at different levels of aggregation (Reynolds et al., 1994; Gompers et al., 2005; Klepper and Sleeper, 2005).

The starting point of this essay is the work by Low and MacMillan (1988), who stressed that entrepreneurship is the outcome of actions of individuals that are influenced by a combination of factors, particularly the organizational and regional context in which they operate. Hence, entrepreneurship analysis should combine multiple levels of data (Gartner, 1985; Aldrich and Zimmer, 1986).⁵ This insight was however neglected until recently when an empirically oriented research vein has emerged that implements data at different levels of aggregation.⁶ A particularly relevant contribution in that perspective to the issue pursued in this paper is the study by Hyytinen and Maliranta (2008). Combining individual-level information based on nation-wide census

⁵ More than a decade later Davidsson and Wiklund (2001) assessed whether Low and MacMillan’s (1988) call for micro/aggregate mix approaches has been heeded and found rather disappointing results, where difficulties in gathering appropriate data has hindered such an analysis.

⁶ See Braunerhjelm (2010) for a survey.

data to identify entrepreneurs and using individual and firm level characteristics, they show that in the case of the Finnish economy, small firms with low R&D intensity seem to spawn entrepreneurs more frequently than their larger R&D intensive counterparts.

This essay makes use of a comprehensive micro-dataset that completely describes the Swedish economy by linking all individuals to their place of work. Our purpose is to extend the model of Hyttinen and Maliranta (2008) by including regional data. More precisely, we intend to focus on the effects of a region's size, its knowledge endowments and the degree of regional industry specialization/diversity on an individual's decision to spin off a new venture from an existing incumbent. The authors draw on an extensive literature that addresses different but related relationships between individual characteristics, the attributes of the local regional economic milieu and entrepreneurship. Still, these analyses do not combine data associated with all three dimensions of entrepreneurship. As pointed out by Shane and Venkataraman (2000), the creation of new enterprises is the outcome of the (individual's) discovery, evaluation, and exploitation of entrepreneurial opportunities, Acs et al. (2004, 2009) present a theoretical model – which also gains empirical support – where individual ability and the regional knowledge endowment is shown to be important in propelling entrepreneurial activity.

Thus, as far as knowledge is concerned, there seems to be consensus regarding its positive role in promoting entrepreneurship. The ambiguity is considerably larger when it comes to the effect of regional industrial specialization versus regional diversity on entrepreneurial activity (Klepper, 2002; Rosenthal and Strange, 2003). Empirical analyses support both of these hypotheses albeit the evidence give slightly more

weight to specialized regions in explaining entrepreneurship while the opposite seems to prevail for innovative activities (Glaeser et al. 1992; Feldman and Audretsch, 1999; Henderson and Thisse, 2004; van Oort and Atzema, 2004; van der Panne and van Beers, 2006; Desrochers and Sautet, 2008; Beaudry and Schiffauerova, 2009).

One aspect that sets this paper apart from past studies on the effects of regional attributes on entrepreneurial spawning is that it does not utilize aggregate data on business start-up rates but instead considers the decision of the individual implementing highly detailed micro-level data. This approach allows controlling for characteristics of both the founder of the new firm and the incumbent firm when examining spin-offs while simultaneously considering the regional context. Moreover, and following Hyytinen and Maliranta (2008), our approach implies that the decision to become an entrepreneur can be contrasted with the counterfactual. Prior studies that use start-up rates as the unit of observation fail to take into consideration people of similar backgrounds and characteristics that choose to stay in their current job, or switch to a different employer, rather than become entrepreneurs. In addition, we examine start-ups across all industries of the economy rather than a selected number of industries.

Besides extending the model of Hyytinen and Maliranta (2008) the authors also improve their approach by using a more straightforward measure of entrepreneurship. In the case of the Finnish study entrepreneurs are identified indirectly by their participation in an insurance scheme for self-employed individuals. In the current study, firm ownership as opposed to employment can be directly observed in the Swedish data. The information available includes the exact type and

location at the individual level, which allows for a multi-level analysis. The two datasets are comparable in most other respects.

There are obvious links between this study and the occupational choice literature, but there are also considerable differences. Whereas that vein of the literature addresses a more general question, the current analysis is mainly preoccupied with the impact of regional and firm-level determinants on spin-offs. Expected pay-offs from running a firm is extremely hard to measure, particularly for spin-offs where anticipated profits may stem more from firm-specific characteristics rather than the average profit level for a certain industry and region. Productivity is implemented as a variable that captures expected future pay-off, given that comparable data on profits are extremely difficult to find.⁷ Higher productivity can be expected to indicate enhanced probabilities of future wage increases, which would dampen the individual incentives to set up a firm, and vice versa for low productivity firms.

The results suggest that the size of the region and local entrepreneurial culture (the relative number of SMEs) have a positive effect on the propensity of the individual to set up a new venture. Separating between related local industrial diversity and diversity in general, it is shown that the former type of diversity exerts a positive impact on spin-offs while no such effect could be detected for diversity in general. The contrast is stark with respect to unrelated diversity, which is shown to have a statistically negative impact on spin-offs. Also industrial specialization is shown to have a positive impact on spin-offs, however only in high-tech manufacturing and in knowledge intensive business service (KIBS) sectors. These results suggests that for less specialized and less

⁷ For instance, detailed information about the firm's age, capital-intensity, depreciation policy and vintage of capital stock, etc., is required if meaningful comparisons should be undertaken.

knowledge intensive products the size of the market is critical for entrepreneurial activities while it may be more important to carve out a specialized niche in knowledge intensive production.

Furthermore, corroborating the Finnish results, smaller firms are more likely to spawn entrepreneurs. In general, individuals predominantly tend to leave less productive firms to become self-employed, with the exception of high-tech industries and more knowledge intensive firms where productivity of the incumbent plays no significant role. The interpretation suggested is that in low-productive firms employees make an active choice to become entrepreneurs based on perceived future pay-offs. In the knowledge intensive and high-tech industries, other factors dominate the decision to set up a new venture. Finally, in contrast to the Finnish study, the current measure of the incumbents' innovativeness (knowledge intensity of the firms' employees) is found to have a positive effect on the likelihood of individuals spinning-off.

Essay II: "Agglomeration externalities and opportunity-based entrepreneurship"

The emergence of the endogenous growth theory (Grossman and Helpman, 1991; Krugman, 1991; Romer, 1990, 1986; Lucas, 1988;) has directed considerable attention to the importance of knowledge for economic growth. The creation and diffusion of knowledge lies at the heart of economics of innovation and growth. In this setting the entrepreneur has come to be recognized as an important figure that exploits a region's aggregate knowledge capital but also contributes to its growth. The link between entrepreneurship and knowledge spillovers is well documented (Acs et al., 2009; Acs and Sanders, 2008; Audretsch and Lehmann, 2005) and so is the fact that the latter are geographically

bounded (Audretsch and Feldman, 1996; Henderson et al., 1995; Jaffe et al., 1993). The question whether it is specialized within-industry (MAR externalities) or diverse between-industry (Jacobs externalities) spillovers that contribute the most in the creation of entrepreneurial opportunities remains unsettled (Beaudry and Schiffauerova, 2009).

This essay empirical study adds to this literature by exploring the effect of MAR and Jacobs externalities on regional entrepreneurship. This work differs from similar past efforts in several important ways. First, the analysis considers the entire private economy as opposed to other studies that focus on single industries such as the ICT, computers and biotech (Van Oort and Atzema, 2004; Van Oort and Stam, 2006; Baptista and Swann, 1999; Swann and Prevezer, 1996). Second, the analysis considers employee start-ups, entailing a focus on opportunity rather than necessity based entrepreneurship. The former is argued to be more relevant in assessing the effects of agglomeration externalities. Third, the analysis considers the recent literature on related and unrelated variety (Frenken, Van Oort and Verburg, 2007), in assessing Jacobs externalities.

The analysis employs a unique individual-level dataset that allows identifying the average count of opportunity-based entrepreneurs across Sweden's 81 functional regions for the period 1999-2005. Negative binomial estimators of indices of agglomeration externalities are calculated controlling for the most common determinants of regional entrepreneurship (population density, pool of potential entrepreneurs, local entrepreneurial climate, knowledge intensity of industry/region, unemployment rate, opportunity cost).

The results suggest that while MAR externalities positively affect entrepreneurship across all sectors, Jacobs externalities (related variety) positively affect entrepreneurship in *high-tech manufacturing* and *knowledge intensive business services* alone. No effect of Jacobs externalities on *low-tech manufacturing* or *other services* was detected. Unrelated variety is also found to have no significant effect.

Essay III: “R&D strategies and Entrepreneurial Spawning”, with Martin Andersson and Hans Lööf

A stylized fact that appears in various branches of economic thought is that new firms are an engine of technological change, employment and growth (Baumol, 1990; North, 1994; Acs, 2006). But the impact and survival differ considerably across new entrants. Start-ups by ex-employees of incumbent firms are found to be a distinctive class of new firms. Bhide (1994) reports, on examining survey-data, that 71 % of all founders of fast-growing companies replicated or modified an idea encountered through previous employment. Several studies confirm that employee start-ups play an important role in the evolution of industries, and that the knowledge they inherit from incumbents is important for their quality (US automobile industry, Klepper, 2002; laser industry, Klepper and Sleeper, 2005; semiconductors, Malone, 1985; disk drive industry, Agarwal et al., 2004).

The superior performance of employee start-ups naturally stimulates questions about the type of firms that are more likely to spawn new entrepreneurs. One of the central questions in entrepreneurship research indeed concerns the characteristics of incumbents that influence the quantity and quality of employee start-ups. Yet, the empirical evidence on such characteristics is limited. For instance, in a recent survey of the

literature, Klepper (2001) concludes that evidence on employee start-ups is rare and that existing studies often reach different conclusions.

The purpose of this essay is to shed more light on the relationship between attributes of incumbent firms and their entrepreneurial spawning. The focus is on how the R&D strategies of incumbents influence the quantity as well as the quality of *de novo* employee start-ups. Quantity refers to the frequency of entrepreneurial spawns and quality to survival rates. Employee start-ups with higher likelihood of survival are assumed to be of higher quality. The paper investigates the effect of three different R&D strategies that describe the frequency of R&D investments over time: (i) no R&D, (ii) temporary R&D and (iii) persistent R&D.

There are several motivations for the focus on R&D strategies. It is widely maintained that start-ups are stimulated by the stock of accumulated knowledge of incumbent firms (Acs et al., 2009). When employees leave to start a new firm, they walk out with tacit knowledge and know-how on routines, resources, customers, etc., connected to the incumbent. In this way, employee start-ups inherit knowledge from incumbent firms. Such knowledge inheritance is expected to have a positive influence on both the quantity and quality of entrepreneurial spawns (Klepper, 2001; Klepper and Sleeper, 2005). Firms with different types of R&D strategies may readily be assumed to develop different levels of experience, skills and knowledge. Because of this, they may be associated with distinct potentials to generate high quality employee start-ups, where firms with persistent R&D could be regarded as ‘hotbeds’ for entrepreneurial spawns.

An opposite perspective suggests that innovative firms that invest persistently in R&D are less likely to spawn entrepreneurs. Agarwal et al. (2004) maintain that successful firms are more capable at capitalizing on new ideas and knowledge developed in the firm which should reduce start-up activity by their employees. Studying the disk drive industry in the US, they find support for this prediction. Moreover, Lööf and Johansson (2010), find significant differences in Swedish firms' performance related to their long-run R&D-strategy. Firms that undertake R&D persistently have higher sales, productivity and profitability per employee. From this perspective, employees of such well-performing firms that pay high wages and offer stable employment may perceive the opportunity cost of starting an own firm as high, which would lower the probability of employee start-ups.

Although the nature of association between knowledge inheritance and employee entrepreneurship are topics of active research, the lack of systematic evidence and agreements is striking. This study contributes to this literature by presenting an empirical analysis of the relationship between R&D strategies and the spawning of entrepreneurs, using a novel comprehensive dataset on incumbent firms and start-up activities of their employees.

The analysis makes use of unique Swedish matched employer-employee data material comprising firms included in the Community Innovation Survey (CIS4), which covers both manufacturing and services sectors. The authors observe about 350,000 individuals in about 2,200 incumbents and about 3,000 start-ups. They identify, over a sequence of years, employees that stay in the old firm, switch to another firm, exit from the labour market, or transcend into entrepreneurship. Applying a multinomial logit model, the empirical analysis first estimates the

influence of the R&D strategy on the probability of such a transition, while controlling for ample characteristics of the individuals and of the parent firm as well as regional milieu characteristics. Next survival analysis is used to assess how the R&D strategy of the parent influences the survival of employee start-ups. The R&D strategy information is obtained from the CIS4 survey.

This work is concordant to recent papers by Klepper and Sleeper (2005) and Agarwal et al. (2004). Though the present analysis is similar to these studies in terms of questions asked, it distinguishes itself from previous literature in several respects, and the nature of our data allow us to address some of the limitations that Agarwal et al. (2004) associate to their study.

First, to the best of the authors' knowledge, this paper represents the first attempt to use data from the increasingly popular Community Innovation Survey (CIS) as the point of departure and study relationship between the surveyed firms and new firms whose founders have pre-entry experience from the incumbent CIS-firms.

Second, this study is not restricted to a specific industry. Spawning and survival are observed for firms in both manufacturing sectors (NACE 15-36) and the services sector normally labelled Knowledge Intensive Business Services (KIBS) comprising NACE (72-74). The data is split into two different groups and the results are compared in an integrated empirical framework. This allows us to contrast KIBS and manufacturing sectors.

Third, the analysis is not limited to any specific type of employee start-up. The study employees start-ups in both the same sector (2-digit

NACE) as the parent firm, labelled spin-outs following Agarwal et al (2004), and in other sectors. Hence, employee start-ups may or may not take place in the same sector as the incumbent. Following previous literature, a test of survival differences between spin-outs and other types of employee start-ups is carried out.

Fourth, in addition to the R&D strategy variables, ample attributes of the incumbent firms are controlled for (e.g. size, sector affiliation, performance history). Furthermore, the characteristics of the regional milieu in which the incumbent firm and the employee start-up is located are also controlled for. There are several arguments in the literature why location characteristics may impact the decision to start a new firm as well as the firm's survival (see e.g. Feldman, 1999).

Furthermore, existing literature on the links between incumbents and new businesses based on microeconomic methodology typically uses the firm as the unit of analysis (for instance Agarwal et al., 2004 and Klepper and Slepper, 2005). In contrast, the authors of this essay observe the incumbent firm, the start-up firm and all unique individuals employed in the incumbents and their choice of staying at their current employment, switching to another firm, starting a new business or exiting from the labour market. This allows controlling for characteristics of the employees (such as age, education, wage, gender, tenure), which may influence the start-up decision as well as opportunity costs of starting a firm (eg. wage), as well as for firm characteristics.

The main findings can be summarized as follows: regarding the quantity of entrepreneurial spawning evidence is presented that firms with persistent R&D in both manufacturing and KIBS sectors are less likely to spawn entrepreneurs. These results hold across different model

specifications, and corroborate the findings of Agarwal et al. (2004), who report that firms with high levels of both technological and market knowledge produce fewer spin outs, since they are better equipped to capitalize on new ideas and knowledge developed in the firm.

As regards the quality of employee start-ups, no significant difference in the survival rate can be found between entrepreneurs spawned from firms with different R&D strategies among incumbents in manufacturing sectors. However, for the survival of employee start-ups from KIBS firms, previous employment within an incumbent that persistently invested in R&D is positively associated with survival. In addition, if the entrepreneurial spawning takes place within the same KIBS-industry, it is more likely that the new firm (a spin-out) will survive, indicating the importance of related knowledge. Finally, our analysis shows that spin-outs related to innovative firms have a stronger survival capacity than spinouts from non-innovative firms.

Essay IV: “Attractors of talent – Universities, regions, and alumni entrepreneurs”, with Anders Brostöm

The importance of universities for regional economic development has been analysed from several different economic perspectives (Andersson et al., 1990; Felsenstein, 1995; Phelps, 1998; Chesire & Malecki, 2004). These studies typically find that regional economic growth is linked to the presence of institutions of tertiary education. A common caveat is that this effect is mediated by different regional characteristics such as the density of population and business activity (Varga, 1998; Goldstein & Drucker, 2006) and the region’s industrial structure (Braunerhjelm, 2008b). However, the mechanisms through which universities affect

regional growth and the specific reasons for the heterogeneous impact of universities across regions have not yet been pinned down. The literature on the regional role of universities is dominated by studies which aggregate over sectors, firm sizes or scientific disciplines and which are therefore not able to disentangle completely the different roles that a university may have in its local economic environment (Audretsch et al., 2006).

Universities have been ascribed several different functions in the regional economy. Most straightforward, it has been noted that universities attract national and international funds into a region. Through the direct purchases of the university, and through the purchases of students and faculty, the institution creates local jobs and revenues (Florax, 1992). Furthermore, universities are perceived as important actors in at least certain types of regional economies in their capacity as research and teaching organisations. While the economic impact remains very difficult to estimate with any accuracy, universities are associated with productivity gains and innovation in existing firms, with effects on new firm-formation and industry location choices and therefore with long-term regional growth (Goldstein & Renault, 2004).

In attempts to disentangle the role of higher education institutions for regional growth, entrepreneurship has been suggested to play an important role. This connection has attracted considerable policy interest (Feldman, 2001), based on expectations that universities should take on the task “to create a support structure for firm formation and regional growth” (Etzkowitz & Klofsten, 2005). However, almost all studies of the university-entrepreneurship linkage focus on the case of academic entrepreneurship, i.e. on academic researchers’ engagement in

start-up ventures (Lindholm-Dahlstrand, 1997; for a review, see Rothermael et al., 2007). There is only very limited disaggregated evidence on the impact of higher education institutions on regional entrepreneurship in the wider sense of alumni entrepreneurship. A notable exception is Bania et al. (1993), who find a positive association between university R&D and firm formation in the electrical and electronic equipments industry, but not for the instruments manufacturing industry. Mainly, however, non-faculty entrepreneurship activities have only been examined insofar as it has taken a path over university-owned science parks and incubators (Hisrich & Smilor, 1988; for a review, see Link & Scott, 2007). This paper addresses the relatively unexplored phenomenon of alumni entrepreneurship, which may explain more of the measured impact of universities on a region than what has hitherto been acknowledged.

In particular, the authors investigate how universities may affect regional entrepreneurship through the localisation decisions of entrepreneurial alumni. The assumption that there may be such a connection is based on entrepreneurship theory, in which entrepreneurial activity is considered to be a truly regional phenomenon (Sternberg & Wennekers, 2007). On the one hand, (necessity-based) entrepreneurship may be a response to the desire of the individual to live in a certain region, and a failure to find a suitable job in existing firms. On the other, (opportunity-based) entrepreneurship may arise as a consequence of the recognition of opportunities in markets with which the nascent entrepreneur is familiar. For both types of entrepreneurship, the location choice is likely to be conditioned by personal networks. Familiarity with a region and its different markets as well as personal contacts is particularly valuable in the establishment-phase of a new venture (Stam,

2007). Therefore, this paper tests the hypothesis that higher education institutions may bolster entrepreneurship in a region simply by pulling talented people to the region, where they may then choose to remain – possibly in a role as an entrepreneur. Furthermore the role of alumni entrepreneurship in regional economic development is analysed, considering the relationship between alumni entrepreneurship and the theoretical concept of agglomeration economies. Two questions are asked, related to urbanisation and localisation economies, respectively. Does a university affect regional entrepreneurship the most in urban or non-urban regions? Does alumni entrepreneurship strengthen industrial clustering effects, or does it provide a means for diversification of the regional economy?

This analysis is one of the first studies to explore differences in entrepreneurship across regions utilising individual-level data, following the path pioneered by Evans & Leighton (1989). This approach allows dealing with the problem of the counterfactual in a satisfactory way. Establishing a suitable counterfactual and quantifying the effects is a typical problem for all kinds of impact studies, which is particularly difficult to solve in studies of the impact of universities (Siegfried et al., 2007).

The assumptions are tested empirically using a comprehensive individual-level dataset from Sweden. The results of the analysis support the hypothesis that entrepreneurs will exhibit an increased propensity to start their firm in their place of studies. This tendency appears to be stronger in more peripheral areas of Sweden than in the three major urban centres. The analysis also indicates that the pull effect of universities substitutes rather than complements that of localization

externalities. Together, these findings suggest that universities, through the mechanisms of alumni entrepreneurship, play a particularly interesting role for the renewal of non-urban regional economies.

8. Connecting the pieces

In this section I have no choice but to switch to the first person and assume a less formal prose. Essays I to III were written in the order presented in this volume. In a sense the motivations for the first paper, presented above, also planted the seed for the other two while the fourth Essay was the product of combining my interest in entrepreneurship with Anders Broström's interest in the role of institutes of higher education in promoting innovation and growth. Therefore, although the summary of the fourth Essay above may be considered on its own the way the research questions as well as the results of the other three papers are related needs to be further elaborated.

One of my first points of departure, in my career as a researcher, was a report by Nås et al. (2003) on high-tech spin-offs in the Nordic countries. In that report the research team demonstrated how it is possible to use the extremely detailed census data available in the Nordic countries to identify and also track high-tech spin-offs. I was fortunate enough to have access to the equivalent Swedish data and the possibilities seemed indeed unlimited. The figure of the Schumpeterian entrepreneur had from an early stage in my studies in economics attracted my attention and I was extremely keen on tracking him down, identifying him among the myriads of individuals in the Swedish labour market and unlocking his mysteries.

Becoming familiar and working with the massive database was no easy task but it soon became apparent that the biggest challenge in my research would be to sort through the incredible polyphony of studies and approaches addressing (or claiming to address) some aspect of entrepreneurship and identify the manner in which I could add to this ever-growing body of literature. On that matter I was lucky enough to receive help and guidance from Professor Pontus Braunerhjelm who has extensive knowledge on the subject. The first Essay, titled “*Spin-offs : Firm, regional and industry determinants*”, was the product of my collaboration with him. I will not repeat here the motivations of the paper but it is worth stressing that to our knowledge this study is unique in combining three different levels of data (individual, firm, region). This study *partly* corroborates the findings of past firm- and regional- level studies (the world *partly* lies behind the motivation for Essay III) but also contributes the findings previously discussed concerning the local entrepreneurial culture and the effects of specialization and diversity.

The issue of industrial specialization and diversity and within (MAR) versus between (Jacobs) industry spillovers is of important concern in Essay I and the main topic in Essay II and some clarifications are in order. Being aware of the theory on knowledge spillovers and the two opposing theses concerning which type matters the most for creating new knowledge I believed that turning to the relevant literature and finding what constitutes an appropriate measure of the two externalities would be relatively straightforward. However, I was faced with a plethora of studies using a multitude of measures (usually without any motivation why a particular measure was preferred over other alternatives) seeking to explain several different phenomena

(employment growth and counts of patents being among the most frequently used).

Not surprisingly, there is no consensus among the regression-based empirical studies exploring the controversy; what is a bit surprising though is the relative limited attention those studies paid to entrepreneurship. In the end the decision was made to apply the most commonly used measure of MAR externalities, a location quotient measure, and an entropy measure to control for related (within industry) and unrelated (between industry) diversity. This decomposition led to the interesting result that while related variety (Jacobs externalities) will always positively affect the propensity of the individual to leave her job to start her own firm, unrelated variety will have a negative effect.

Given the novelty of the approach used in the first essay there was no way of knowing if these results would hold if the usual practice of regressing a region's level of entrepreneurship on a set of indices describing the local industrial organization was applied instead. I took up this task in Essay II, which is subsequently the only paper in this volume that does not include an analysis at the level of the individual agent. According to the results of the second essay MAR externalities seem to positively affect entrepreneurship across all industry sectors however Jacobs externalities (related variety) will only do so in the case of high-tech manufacturing and knowledge intensive business services. Unrelated variety seems to play no significant role. It is obvious that these results only partly agree with the ones from the first essay.

In a recent review article on the Marshall-Jacobs debate Beaudry and Schiffauerova (2009) suggest that the controversy persists because of the heterogeneity of methodologies applied in addressing the issue. The

results presented in this volume provide strong support to this thesis⁸. Despite the sensitivity of the results to the methodology used one finding is particularly robust and that is the importance of related variety for entrepreneurship (particularly so in high-tech manufacturing and knowledge intensive business services), compared to an insignificant or negative effect from unrelated variety. This discovery invites further scrutiny in future research. Where does the dividing line between related and unrelated variety actually lie? In this volume variety within the same 2-digit NACE code was considered related while variety outside that industry code was considered unrelated. A more careful approach addressing the degree of homogeneity among different industry sectors at varying levels of aggregation could be very informative in assessing the relevance of knowledge spillovers.

Going back to the word *partly* stressed earlier in this section the findings in the first Essay suggest that an incumbent's innovativeness (measured by the labor intensity of its employees) has a positive effect on its propensity to spawn entrepreneurs while a similar Finnish study (Hyytinen and Maliranta, 2008) using an R&D-dummy (equal to one if the ratio of R&D expenditures to turnover exceeded 3.5%, zero otherwise) finds the exact opposite. A similar controversy exists among the firm-level studies referred to above. In order to address this "enigma" the decision was made to merge the microdata describing the Swedish economy with data from the Community Innovation Survey 4 and use a more precise measure of innovativeness (specifically a firm's frequency of R&D investments over time) to explore whether persistent innovators, temporary innovators and non-innovators differ in their propensity to spawn entrepreneurs and/or in the quality of spawned start-ups.

⁸ In the third essay where local industrial diversity is only included as a control variable the common approach of using a Hirshman-Herfindahl index is applied instead but that is found to have no significant effect.

9. The lessons learned

Summarizing the conclusions of all four papers the following lessons can be learned. The size of the region and the local entrepreneurial culture (the relative number of SMEs) have a positive effect on the propensity of the individual to set up a new venture. The latter point is particularly telling. Recent studies have similarly stressed the significance of small firms for regional growth and entrepreneurship (Glaeser and Kerr, 2009; Rosenthal and Strange, 2009) but the fact that the relative number of SMEs in a region positively affects the births of spin-offs even when controlling for the size of the incumbents constitutes a novel finding that further supports the importance of SMEs for economic growth, enforcing the belief that this might indeed be a causal relation rather than a simple correlation.

Turning to the question concerning which type of knowledge spill-overs seem to matter most in the supply of entrepreneurial opportunities it is important to note that the results are sensitive to the method used to address the issue. Within industry spill-overs appear to positively affect the supply of opportunities but this finding is sensitive to model specification and sample choice. What constitutes however a robust result is that decomposing industrial variety in related (within the same 2-digit NACE branch entropy) and unrelated (between 2-digit NACE branches entropy), the former is found to have a consistently positive effect and the latter a negative or insignificant effect, especially in the case of high-tech manufacturing and knowledge intensive business services. Coupled with the indication of positive gains from specialization this finding suggests that the optimal entrepreneurial-enhancing regional policy is to promote the development of a diverse set of businesses within the sectors a region already exhibits a relative specialization.

Diversity is good as long as it does not take the form of start-ups in industries under-represented in a region.

Moreover, the finding that small firms are more likely to produce spin-offs than their larger and better performing counterparts emerges as a sort of stylized fact. Firms that persistently invest in R&D are more likely to internalize the gains from potential discoveries than allow their employees to independently pursue such opportunities. Does that mean that the majority of spin-offs do not in fact possess the knowledge inheritance needed for survival? Thankfully, no. Considering the survival rates of a sample of ex-employee entrants we find that market-specific knowledge is as important as technological knowledge. Start-ups in the same industry as the parent company (spin-outs) are significantly more likely to survive even if the incumbent was not carrying out any R&D. Start-ups originating in firms engaging in persistent R&D projects enjoy a similarly superior survival rate. These results concern knowledge intensive business services (KIBS) but not manufacturing. This difference is particularly interesting given the transformation of most western economies to service-based economies. It is also worth noting that roughly 50% of the start-ups by ex-KIBS employees enter the same industry as the parent firm. The equivalent percentage for manufacturing sectors is just 5%. Scrutinizing further the group of spin-outs we find that even within this better-performing group of entrants firms spawned by incumbents carrying out persistent investments in R&D exhibit higher survival rates. These findings suggest that a policy designed to foster such high-quality entrepreneurship should comprise incumbent firms. These are important sources of new high-quality entrepreneurs, and the results point in the direction that an environment conducive for investments in R&D in established firms has a higher

potential for generating such high-quality entrepreneurs in the form of spin-offs from incumbents.

Finally, the research presented herein has considered the role of universities in the location decision of its entrepreneurial alumni. The evidence suggests that university graduates entering self-employment are more likely to start their firms in the regions where they studied. This pull effect seems to be strong enough to substitute for both localization and urbanization economies highlighting the importance of universities as attractors of talent. This study supports the fundamental notion that local embeddedness is a central factor for the location choices of entrepreneurs, but offers a complementary view on the potential of migration-based policies. Regional governments may find that by ensuring the attractiveness of the region to mobile students, the foundations for a boost to local entrepreneurship may in effect have been laid.

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