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Benny Borgman
Abstract

This thesis consists of three individual essays and an introductory chapter. The essays contribute to the current vein of empirical literature on economic geography and entrepreneurship. In two of the three essays the empirical analysis is preformed using panel data cross tabulated over years, regions and industries, whereas the third essay use data distributed over years and regions. The first essay implements a measure of geographic concentration and investigate the extent of concentration in Swedish industries and the relationship to economic growth specified as labour productivity. The second essay focuses on the composition of industry concentration. Using a similar measure as in the first essay the co-location of Swedish industries are investigated as well as the relationship to economic growth. The third essay explores the connection between entrepreneurship and regional growth – measured as employment growth – in Sweden and the U.S.
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1. Introduction

This thesis investigates the connection between geographic concentration, entrepreneurship and regional growth. It consists of two essays focusing on the magnitude and composition of geographical concentration of production and one essay focusing on entrepreneurship. All three essays are empirical and contribute to the current vein of literature on geographic concentration, entrepreneurship and growth.

The idea that more disaggregate geographic units than nations are interesting when investigating economic activity is far from new in economics. Some theoretical breakthroughs took place already in the 1950’s (Perroux, 1955; Myrdal, 1957), coupled with rudimentary empirical observations. However, the lack of measurements for geographic concentration, as well as shortage of regionally distributed data has particularly hindered empirical research. Instead research in this field has gained momentum in the last 20 years. One reason for this is that some obvious success stories of production agglomerations, so called clusters, became apparent. The most commonly referred is the Silicon Valley in the U.S., although many other examples can be found all over the world. Examples are telecommunications in Kista, Sweden and biotechnology in Sophia Antipolis, France.

A second reason to the resurgent interest in these issues is that the theoretical advances in economic geography – foremost the thought that interaction induces information

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1 Research along these lines goes back to Von Tünen (1826). Other important contributions have been made by Weber (1909), Christaller (1933) and Lösch (1940).
and knowledge flows between individuals and organisations – has highlighted the spatial
dimension of production as a catalyst for spillovers. In addition, the increased availability of
regional data and the fact that the 1990’s saw several new methodological approaches in
measuring geographic concentration, has facilitated analyses at regional level.

Despite these advances there is still considerable room for further research in
this area. For example, a large portion of the empirical investigations has been carried out
only using data from the U.S. and a few European countries. Moreover, when the link
between geographic concentration and economic growth has been investigated, almost all
studies have used some proxy for economic growth, such as employment growth. Similarly,
very few studies have investigated how the industry composition affects productivity. The
two essays in this thesis aim to fill some of these gaps since they extend the previous
empirical analyses by implementing data for Sweden, and, more importantly, investigate how
both the degree and composition of industry agglomerations influence economic growth using
labour productivity data.

Just like studies on the spatial allocation of economic activity, entrepreneurship
is far from a new research area albeit it has surged in the past two decades. The
entrepreneurial process was mentioned by Cantillon already 1755, and stood high on the
research agenda in the first part of the 1900’s due to the works of, for example, Schumpeter
(1911) and Knight (1921). Over the last 15 years attempts have been made to introduce the
entrepreneur into the endogenous growth theories. Empirical evidence also suggests that
growth is not confined to well-established large firms, but rather take place in small new
firms.\(^2\) This indicates an increased importance of entrepreneurs, starting up businesses and
transforming ideas into viable economic entities.

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\(^2\) Growth, in the context of this thesis, always aims at referring to economic growth i.e. increasing economic
means often measured by changes in value added. When such data is not available economic growth is often
proxied by measures such as growth in employment (see for example Hart and Harvey 1995; Fölster, 2000; and
Acs and Armington, 2004).
Entrepreneurship has always had a regional dimension since most individuals start firms in the area where they live. However, lately the regional aspect has been further strengthened since researchers have found a connection between knowledge spillovers and entrepreneurship. When knowledge is not exploited in incumbent firms it may spill over to entrepreneurial individuals who will use the knowledge by starting up a new business. Thus, even if two regions have the same amount of knowledge flows one might grow faster if it has more entrepreneurial individuals. Numerous empirical studies have investigated the extent of entrepreneurship and its relation to economic growth. However, not all of these have had a regional dimension, Since there is no single optimal measurement of entrepreneurial activity there is still need for empirical research examining how different measures of entrepreneurship affect the relationship to economic growth, and why the extent and mechanisms of entrepreneurship may differ in different countries and regions. The essay on entrepreneurship in this thesis contributes to the current empirical literature by providing new information on Sweden, and implementing the same model for both Sweden and the U.S. allowing for comparability.

Hence, the purpose of this thesis is to empirically investigate the connection between geographic concentrated production, entrepreneurship and regional growth. Special attention is paid to analyzing the extent of industry diversity of concentrated production structures in Swedish industries. In the entrepreneurship essay a comparison of the entrepreneurial role in two economies embarking from different traditions and institutional frameworks will be undertaken.

The remaining part of this chapter is structured as follows. First the theoretical foundations linking geographic concentration to economic growth will be laid out in section 2, followed by some empirical evidence. In section 3 the corresponding foundations and evidence will be presented for entrepreneurship. Definitions and some measurement issues
connected with the two concepts will then be described in section 4. Finally, in section 5 the essays and their main conclusions will be summarized.

2. Geography matters

2.1 Theoretical foundation

The fact that geography matters for economic growth was noted by, for example, Perroux (1955), who explained that growth was not evenly distributed over nations but rather that the progress of a nation was often driven by a few regional “growth poles”. Hirschman (1958) also stressed that there were forces tending to agglomerate production in certain areas, and once such an agglomeration has occurred it rarely regresses. In fact, as pointed out by Myrdal (1957), these regional differences in production density as a rule increase rather than decrease over time. Krugman (1991) developed a model with transportation costs, which shows that firms locate either near its input market or its customers, and scale economies makes the firms stay where they first locate. These insights build on an even older tradition, not modelled as stringent, starting with Weber (1909).³


The connection between densely located production and economic growth has been emphasized as the new knowledge spill-over growth theories emerged. Traditional neo-classic growth models relied on Solow’s (1956) contributions where growth was determined by additions to an economy’s stock of capital and (effective) labour. However, these factors can not alone account for the diverging growth rates of countries and regions over time, also emphasized by Solow (1957) who claimed that most of growth is explained by the “technical residual”. As the endogenous growth models was developed (Romer, 1986; Lucas, 1988) the
attention turned to knowledge. Since knowledge has a non-excludable nature (Arrow, 1962), growth can be continually increasing as knowledge is spreading.\footnote{Knowledge is in itself a complicated concept. There are, for example, differences between explicit knowledge that can easy be shared between individuals through books, lectures etc., and tacit knowledge (Polanyi, 1985) that is often bounded in individuals, institutions or regions and hard to communicate to those lacking the knowledge. Other distinctions are made between human capital and knowledge (the former refers to knowledge that is readily used, whereas the latter also include a broader view of the whole stock of all available knowledge and information). Popper (1972) also makes a differentiation between objective and subjective knowledge. Objective knowledge is such that is documented but not necessarily used, whereas subjective knowledge is that knowledge that is actually used and that influence the decisions of economic actors. For a survey of knowledge concepts in relation to knowledge spillovers, see Döring and Schnellenbach (2006).}

The importance of geographics and the regional dimension was underlined by Glaeser et al. (1992), claiming that geographical proximity foster knowledge spillovers.\footnote{See Audretsch and Feldman (2004) for a summery.} Von Hippel (1994) described how a significant part of the knowledge spillovers are geographically bounded and transferred through individual meetings. Particularly tacit knowledge (Polanyi, 1958) is transmitted through frequent social interaction between individuals, which arise when they live and work close to each other. This, together with the absence of decreasing returns to scale of knowledge accumulation promotes agglomerations and knowledge spillovers as the prime sources of diverging growth rates across regions (Fujita and Thisse, 2002).

Hence, there are two prominent reasons why geographic concentration of production can be related to economic growth. The first is that concentration allows firms to utilize scale economies and exploit input/output linkages to reduce transport costs – so called pecuniary externalities. The second is that concentration fosters knowledge spillovers – so called non-pecuniary externalities. However, knowledge spillovers are not only affected by the concentration of production, but also the composition of this concentration. Marshall-Arrow-Romer (MAR) externalities build on the view that focus should lie on the concentration of one specific industry, and that spillovers exist predominantly at the intra-industry level. However, Jacobs (1969) showed that dynamics benefits from agglomerations...
based on interrelated industries, rather than one dominant industry. Such spillovers, operating at the inter-industry level, are therefore often referred to as Jacobian externalities. The importance of such externalities has been emphasized by, for example, Glaeser et al. (1992), Feldman and Audretsch (1999) and Acs and Varga (2002).

In addition to the positive aspects of concentrated production, some negative aspects has also received attention, especially congestion effects such as increasing competition for labour and other local and less mobile inputs driving prices upward and profits downwards and shrinking margins for investment and innovation (Maggioni 2002, Ottaviano and Thisse, 2004).

2.2 Empirical evidence

Krugman (1991) measured the inequality of industry employment over regions through locational Gini-coefficients and found significant concentration of U.S. industries. Ellison and Glaeser (1994) found similar evidence when they applied U.S. data on their own index measuring industry concentration. Their measure was later applied to European data covering France (Maurel and Sedillot, 1999), Sweden (Braunerhjelm and Johansson, 2003), and Belgium (Bertinelli and Decrop, 2005). Industry concentration was obvious in all studies, although the extent of concentration varied somewhat.

Many studies have found support for the statement that knowledge spillovers are local (Almeida and Kogut, 1997; Anselin, Acs and Varga, 1997; Keller, 2000; Orlando, 2000; Autant-Bernard, 2001; Jaffe and Trajtenberg, 2002) and have even measured the decline over distances (Adams and Jaffe, 2002; Feldman, 2002; Karlsson et al, 2006a). Quoting Audretsch and Feldman (2004, p. 2723) “the empirical evidence suggests that location and proximity clearly matter in exploiting knowledge spillovers”.

See also Baldwin and Martin (2004).
Empirical evidence for the link between geographic concentration and economic growth was shown in a pioneering study by Ciccone and Hall (1996). They used employment density as measure for concentration and found that a doubling of this measure induce a labour productivity increase of 6 percent. Ciccone (2002) later preformed a similar study on European data, also confirming a positive relationship. However, these are two of very few such studies carried out on a regional level with productivity data.7

3. The entrepreneur as a catalyst for growth

3.1 Theoretical foundation

The economic importance of the entrepreneur has been recognized for a long time. Knight (1921) saw the entrepreneur as someone who could be profitable by acting successfully in the face of uncertainty. Schumpeter (1911) defined the entrepreneur as an individual who drives the economy forward by introducing new products, new production methods, and new ways of organizing production. Besides the obvious growth aspects of a new firm conducting successful business, entrepreneurship can also induce higher growth rates by increasing competition within the existing markets (Aghion and Howitt, 1997; Fritsch and Mueller, 2004).

The role of the entrepreneur in relation to knowledge spillovers has received much attention in recent years. Acs and Audretsch (1988, 1990) found that although large enterprises undertake most of the R&D work the innovation intensity is greater in small firms. Audretsch (1995) then focused on the individual R&D worker and argued that an expected increase in the pay-off of exploiting individual specific knowledge within a new firm, determines whether the R&D worker becomes an entrepreneur. This way the entrepreneur

7 Cities have been studied quite extensively (Blacks and Henderson, 1999; Acs, 2002; Baldwin and Martin, 2004). Similarly, other specifications of growth have been used (Rosenthal and Strange, 2004).
acts as a mechanism for knowledge spillovers, which explain the discrepancy between R&D investments and innovative output found by Acs and Audretsch. In this setting the choice of becoming an entrepreneur is a function of the difference between perceived profits for the R&D worker to use her/his knowledge in the existing firm versus starting a new venture. According to Audretsch and Feldman (2004) the perceived profits of starting a new venture is greater in agglomerated regions, since the potential entrepreneur has greater access to tacit knowledge in such locations. Acs et al (2004) goes on to formalize an endogenous growth model where they define the entrepreneur as “a missing link” between knowledge spillovers and economic growth, arguing that its not sufficient to have knowledge spillovers if there is no one to successfully commercialise the knowledge.

3.1 Empirical evidence

Using turbulence – that is, the entry and exit of firms – as a measure of entrepreneurship Caves (1998) finds that the relationship with productivity growth is significant in the long run, but not in the short run. Bosma and Nieuwenhuijsen (2000) claim that turbulence has had a positive impact on total factor productivity in the Dutch service sector between 1988 – 1996, but not in the manufacturing sector, whereas Callejon and Segarra (2000) show that such a link can be found in the Spanish manufacturing sector. Reynolds (1999) demonstrate a positive association between the two variables using U.S. data for the years 1980 – 1992, while Audretsch and Fritsch (1996) find a negative relationship for Germany in the 1980’s. In a later study (Audretsch and Fritsch, 2002) they show the opposite pattern for Germany in the 1990’s. Consequently the results from using turbulence as a measure of entrepreneurship and trying to explain growth are mixed.

measures of new and small firms Hart and Harvey (1995) finds a positive association to employment growth in the U.K. In fact, when the size distribution of firms is used as a proxy for entrepreneurship, the results are somewhat more unanimous. For example, Fölster (2000) finds a positive connection between self-employment and regional employment rates in Sweden between 1976 and 1995. Baldwin and Picot (1995) use Canadian data to show that smaller firms have carried a more than proportional share of employment growth in the manufacturing sector during the 70’s and 80’s. There are also results pointing in the opposite direction. For example, Blanchflower (2000) finds no connection between self-employment and economic growth for a set of OECD countries.

A final set of studies has used changes in the size distribution of firms to demonstrate the link between entrepreneurship and growth. Carree and Thurik (1998) find that as the share of small firms increase in European manufacturing industries output growth increases in the ensuing four years. Robbins et al (2000) show that productivity growth was higher between 1986 and 1995 in the U.S. regions with a larger share of small businesses.

To sum up the empirical evidence it is clear that more research needs to be undertaken before any consensus between the effects of different measurements for entrepreneurship and their relation to economic growth can be concluded.

4. Definitions and measurements

4.1 Geographic concepts

The concept of one or more industries concentrating their location in geographic space is often referred to as an agglomeration, or an industry cluster. It is such formations that are the focus of theories concerning pecuniary and non-pecuniary externalities in the works of Krugman (1991), Ellison and Glaeser (1994, 1997), Glaeser et al (1992), etc. However, there
are also other concepts defining the production structure, such as regions industrial specialization, referring to the size of an industry share in the regional economy as compared to the corresponding share at an aggregate (for example, national) level. This concept has not been linked with knowledge spillovers and studies have not found a robust positive connection with regional growth. Yet another concept is business density, that is, the number of establishments in proportion to a region's area, or population. This definition is not optimal for explaining externalities since it does not account for industry structure, nor does it relate to the situation in other regions.

While specialization and business density are straightforward to measure, agglomeration is more complicated. One attempt at creating such a measure was done by Krugman (1991), who developed a locational Ginicoefficient, measuring to which extent the workforce within an industry is unevenly distributed over space. Still, this coefficient has some shortcomings since, for example, it identifies an industry that has production in few regions as concentrated even if those regions are far apart and each region only hosts a minimal workforce.

Ellison and Glaser’s (1994) proposed measure rectified this weakness. Their proposed concentration index takes on a value of zero, representing no concentration, when the location decision of a firm’s factory is completely independent of the location of other firms within the same industry. This index takes into account the number of plants in an industry as well as their size and report concentration irrespective if it is stems from firms’ desire to be near natural resources, customer, suppliers, or their wish to exploit knowledge spillovers. This index was later extended to also include the concentration of inter-related industries (Ellison and Glaeser, 1997) measuring to which extent there is inter-industry correlation between the location decisions of plants.

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Almeida (2001) and Paci and Usai (2002) show a negative connection between specialization and regional growth, whereas Forni and Paba (2002) find the opposite result.
4.2 Entrepreneurial concepts

Entrepreneurship is not easily defined. Carree and Thurik (2003) emphasize three roles of the entrepreneur based on the works of Schumpeter, Kirzner and Knight.\(^9\) The Schumpeterian entrepreneur is first and foremost an innovator, whereas the Kirznerian entrepreneur is a perceiver of profit opportunities, and the Knightian entrepreneur takes on risks and its associated uncertainty. Also Kihlstrom and Laffont (1979) focus on risk and conclude that entrepreneurs are less risk averse than other individuals. Baumol (1993) emphasise the idea of the entrepreneur as a catalyst transforming “inventions and ideas into economically viable entities”. Koppl and Minniti (2003) explain entrepreneurial behaviour in the context of Kirzner’s work by stressing that what defines an entrepreneur is the “alertness” to new opportunities, and the will to take action in the face of an opportunity. They thus conclude that “In Kirzner’s theory, what the entrepreneur is like determines necessarily what the entrepreneur does” (Koppl and Minniti, 2003, p. 87). As mentioned in Karlsson et al (2006b) some researchers proposed yet more detailed definitions of entrepreneurs than presented above. They note that Glancey and McQuaid (2000) has five definitions of entrepreneurship, while Wennekers and Thurik (1999) has a list of thirteen definitions.

Considering the diversity of definitions there is no wonder that difficulties arise in measuring entrepreneurial activity. In the previous section the connection between growth and a variety of the most common proxies for entrepreneurship was presented. Here follows a brief theoretical scrutiny of those measurements.

The entry and exit of firms, i.e. turbulence, is a measure of entrepreneurship that has a clear connection with Schumpeter’s (1911) concept of creative destruction. However, this measure cannot control for the innovative power of the start-ups, neither does it take into account...
account the age structure of exits. One region can have much turbulence simply because the start-ups are not based on opportunity recognition and are thus forced to exit the market quickly. Measuring only start-up rates is obviously connected to entrepreneurs entering the market. However, this only describes one side of creative destruction. Audretsch (1995) also notes that start-up rates are generally only measured over a single time period whereas a firm’s innovative capacity and effect on the market is probably more dynamic.

As mentioned in section 3, self-employment as well as the size distribution of firms has been used to measure entrepreneurship. According to Carree and Thurik (2003, p. 458) “In case a region has a larger share of small firms when compared to another region this could indicate a higher level of entrepreneurial activity. […] In developed economies the rate of self-employment will be related to the extent of entrepreneurial activity. New firms usually start with a phase of self-employment”. Despite this link between the size of firms and entrepreneurial activity, this measure is not optimal. One reason for this is that it is often impossible to know how large share of all self-employment are start-ups. Many of the self-employed and small firms might thus be small simply because they do not have the potential to grow and not because they are new. To conclude, it is clear that there exist a variety of definitions measurements of entrepreneurship, each with its own benefits and weaknesses. Although not explicitly the focus of this thesis continued empirical and theoretical research is thus vital to gain further insights in this area.

5. Outline of the study and summary of main findings

This thesis is comprised of four chapters, including this introductory chapter. In chapter 2, titled “Geographical Concentration, Entrepreneurship and Regional Growth: Evidence from
Regional Data in Sweden, 1975–99\textsuperscript{10}, the extent of geographical concentration present in Swedish industries, and its impact on labour productivity, is investigated. This chapter is co-authored with Pontus Braunerhjelm. Geographical concentration is measured by locational Gini-coefficients and Ellison and Glaser’s concentration index (EG-index). The analysis use cross-tabulated data over regions and industries in three-year intervals between 1975 and 1999, collected by Statistics Sweden (SCB). We find that Swedish industries are generally more concentrated as compared to the U.S. (Ellison and Glaeser, 1994) and France (Maurel and Sedillot, 1999), which corroborates the results of Braunerhjelm and Johansson (2003). We also find higher concentration in the manufacturing industries than in services, whereas there is no evidence for the hypothesis that the most knowledge intensive industries are the most concentrated.

The econometric analysis examines the effect of the level and change in geographical concentration on labour productivity, implementing standard OLS-techniques, while controlling for heteroscedasticity. To satisfy the zero conditional mean assumption the regressions include, besides a measure of geographical concentration, also a vector of control variables containing measures of regional specialisation, average size of firms, level of education, regional population and entrepreneurship. We find a positive correlation between geographical concentration and labour productivity, irrespective of whether level data or changes over time are used. It is also shown that if an industry’s concentration increases by the population mean, the regression results predict a simultaneous growth in labour productivity in the range 2 – 6 percent. The effect is most prominent in knowledge intensive manufacturing industries, network industries and industries that are heavily dependent on raw materials. Also the variables entrepreneurship and regional population are positively

\textsuperscript{10} This essay was published in Regional Studies, 2004, 38, 929-948.
correlated with labour productivity, whereas scale economies are important for manufacturing industries but not for services.

Chapter 3, "Agglomeration, Diversity and Regional Growth. The effects of poly-industrial versus mono-industrial agglomerations"\(^1\), is also co-authored with Pontus Braunerhjelm. The purpose of this chapter is to investigate the relationship between co-agglomeration of interrelated industries and labour productivity utilizing the same database as the previous chapter. However, the analysis is restricted to the 1990’s and the manufacturing industries. To calculate the extent of industry co-agglomeration we adopt the methodology developed by Ellison and Glaeser (1997), which provides a modified version of the EG-index applied in chapter 2 to account for industry co-location. A first problem that must be addressed is how to choose the appropriate industries in order to calculate the co-agglomeration index. Considering that even if industries belong to the same classification, each region in some respect host a unique set of industries that are co-located and interact in various ways, this is not a trivial task. Since it would be impossible to take into account such region-specific characteristics over an entire nation, the index is based on those industries at the three digit ISIC level that belong to the same two digit level. The analysis shows a clear sign of co-agglomeration among Swedish manufacturing industries, although the degree varies considerably over industries.

The econometric analysis is based on a fixed effects approach controlling for industry specific heterogeneity. Besides estimating the correlation between co-agglomeration and labour productivity, different industry-specific concentration indexes are also included in the regressions, as well a vector of control variables similar to that in previous chapter. The evidence suggests that co-agglomeration augments the positive effect of industry specific concentration on labour productivity, as well as on labour productivity growth.

\(^{11}\) This essay is at the moment of writing under review for Journal of Regional Science and Urban Economics.
The purpose of chapter 4, “The impact of entrepreneurship on local growth: a comparison of the U.S. and Sweden”, is to investigate the effect of entrepreneurship on regional employment growth in the U.S. and Sweden. The U.S. data is collected by the U.S. Census Bureau, covering the years 1990 to 1999 and is spatially divided into labour market areas. Swedish data stems from the same database as in previous chapters. The analysis focuses on the 1990’s and uses a standard OLS approach that takes heteroscedasticity into account. To satisfy the zero conditional mean assumption the regressions include, besides a measure of entrepreneurship, a vector of control variables related to regional employment growth. The analysis shows a significant and robust positive relationship between entrepreneurship and regional growth in the U.S. In Sweden a positive relationship is also found, although not of significant proportions during 1993 – 1996. Moreover, in the U.S. the education level and scale economies also have a significant positive connection with regional growth, whereas business density is found to be important for both countries. In Sweden no positive effect could be found for education.
References


