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Human Capital, Talent and Regional Growth

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ABSTRACT

This paper is an introductory overview highlighting some of the current knowledge as regards three critical questions related to the emerging knowledge economy: i) Why does human capital and talent tend to agglomerate in large urban regions?, ii) How does this agglomeration affect the location of different types of economic activities?, and iii) How does this agglomeration affect regional growth? There are different underlying agglomerative forces creating spatially concentrated increasing returns to scale. Also, cities become centres of various amenities due to general increases in real incomes offering people spare time activities. One major reason for the agglomeration of production in urban regions and metropolitan areas today is the existence of various positive externalities, providing good settings for industries and firms with knowledge-intensive and knowledge-creation activities, specialised business service firms and headquarters of multinational firms. There are strong tentative empirical evidences that the agglomeration of human capital contributes to regional development and growth. However, there is uncertainty concerning the size of the human capital externalities.

Keywords: Human Capital Externalities, Talent, Knowledge Creation, Knowledge Spillover, Agglomeration, Urban Region, Regional Growth

JEL Classification: J24, R12, R23, D83, D62

1. Introduction

In recent decades, we have witnessed an increasing interest in phenomena associated with the emerging knowledge economy. However, the concept as such was launched in the late 1950's and early 1960's (Drucker, 1959; Machlup, 1962). The fundamental characteristics of the global knowledge economy of today are on the one hand a continuous increase in knowledge investments such as education and knowledge production, and on the other, a widening application of knowledge in the development, production, distribution and use of goods and services. In this context, knowledge can be defined to comprise the abilities, capabilities, methods, creativity and persistency in identifying and solving problems by collecting, selecting, interpreting and applying existing knowledge and information (cf. van Oort & Raspe, 2007).

The above observations imply a distinction between knowledge as “an object” and knowledge as talent, skills, know how, and understanding embodied in individuals. The concern of this book is primarily the latter aspect, including creativity as a dynamic and knowledge-enhancing capacity. It is individuals and teams of individuals who identify and solve problems and pursue activities that involve creation of new knowledge. It is also individuals, who are responsible for advancing formal and informal education, where teaching, tutoring, and other forms of exchange of ideas transfer knowledge to other individuals. Thus, it is only natural that skills and abilities of individuals to solve problems and transfer knowledge are a focal point in the knowledge economy. These skills and abilities are built up in investment processes, which involve formal and informal education as well as learning-by-doing, learning-by-using, and accumulation of experiences. Normally, we view the value of these skills and abilities of an individual as his or her human capital.

The increased interest in the knowledge economy has led to the development of new models of economic growth, frequently referred to as the theory of endogenous growth, in which the production of knowledge is endogenously determined, and in which the spillover of knowledge plays a critical role in the growth process (Romer, 1986; Lucas, 1988). The foundation for the role of knowledge was in principle introduced several decades earlier in Arrow (1962) and Solow (1956 & 1957) who both advocated the significance of learning mechanisms for increasing productivity. In the original versions of the endogenous growth theories, knowledge was assumed to move instantaneously and without friction between economic agents. However, it is obvious that the spread of knowledge is far from perfect and that knowledge transfer is a both time- and resource-consuming process (Karlsson & Johansson, 2006). This implies that different economic actors located at different points in geographical space have different knowledge access, even if they are in the same trade. Assuming that knowledge is essential in the growth process, this implies that different locations have different growth prospects given the differences in their knowledge accessibility. On top of this we can observe that the critical input in the knowledge economy – the human capital – is strongly concentrated in geographical space, much more so than most other types of economic resources and activities. With other words, we can conclude that human capital exhibits strong tendencies to agglomerate in certain locations.

In this discourse, it is interesting that economists for a long time have stressed that there exists a link between the agglomeration of human capital, sometimes named talent (Florida, 2002), and regional development and growth (Myrdal, 1957; Hirschman, 1958; Kaldor, 1970). The

contributions from these scholars observe that urban regions function as seedbeds of creativity and innovation and that human capital, in particular, is an important factor in stimulating economic growth (Park, Burgess & McKenzie, 1925; Jacobs, 1961; Thompson, 1965; Lucas, 1988).

Park, Burgess & McKenzie (1925) were probably the first to stress the role of urban regions in concentrating and stimulating human creativity. Jacobs (1961) illustrated how urban regions function as open systems, which attract talented individuals from different backgrounds and spur their creative capacities. Lucas (1988) presented a formal theory showing how urban regions function as attractors for human capital, thereby forming an arena for the generation of new ideas and economic growth. It is in this connection important to observe that large urban regions also are the dominant communication and transport network nodes and as such the primary locations of emission and reception of knowledge and information. Because these regions contain concentrations of complex communication arrangements and transport terminals, information diffuses more easily from and to urban regions than it does within the hinterland of each urban region and otherwise peripheral areas (Florax & Folmer, 1992; Guillain & Huriot, 2001).

In recent years, the literature on urban and regional economics reveals a substantial increase in the interest of how agglomeration in general and knowledge spillovers in particular affect the regional growth process at the firm level, the sector level and the overall level. This interest has developed into inquiries of how agglomeration economies can explain differences between regions in terms of the knowledge intensity of firms and the knowledge spillovers between firms have been highlighted (Rosenthal & Strange, 2003; Capello & Nijkamp, 2004; Cheshire & Duranton, 2004). We can observe that human capital measured in terms of people with higher education¹ levels tend to agglomerate to a substantially higher degree than the population at large.² This naturally raises the following questions: Why do highly educated people, i.e. the carriers of human capital, tend to concentrate in large agglomerations? What are the agglomerative forces? How does this agglomeration of human capital impact different types of economic activities and in particular their location behaviour?

All these questions are formulated in the spirit of urban agglomerations as magnets, which attract persons who embody knowledge. They are assumed to select such locations, but why? How do the agglomeration of human capital and certain types of related economic activities affect regional growth and development? Other pertinent questions concern to what extent knowledge-intensive labour (i) becomes more productive in urban agglomerations, (ii) have greater opportunities to harvest the fruits from their knowledge investments in urban milieus, and (iii) do not crowd-out each other in the knowledge-rich regions.

These questions are examples of issues raised and discussed in this paper. The purpose of this paper is to discuss these questions at an overall level. The outline of this paper is as follows: In Section 2, we discuss and try to explain why human capital tends to agglomerate in large urban regions. How this affects the location of different types of economic activities is analyzed in Section 3. In Section 4, we discuss the effects that human capital agglomeration can have on regional growth and development. The conclusions are presented in Section 5.

¹ According to the human capital theory, education enhances an individual's skill level and thereby his or her human capital (Schultz, 1961; Becker, 1964). A work force with a higher skill level increases the production capacity of an economy.

² In the Nordic countries, for example, this evolution is combined with an increased share of knowledge intensive labor in medium-sized urban regions as well (e.g. NUTEK, 2006).

2. The Agglomeration of Human Capital and Talent

The tendency of human capital and talent to concentrate in cities and urban regions, i.e. to urbanize, has been known for centuries. In synthesizing the literature, the formation and growth of industrial as well as modern cities at a general level are explained by benefits or more precisely spatially bounded externalities arising from a variety of market and non-market forces. At the same time, many researchers in the USA have advocated models of a representative city, characterized by an “optimal size”. This phenomenon is often referred to as an inverted U-shaped (concave) curve, describing the relationship between the utility or real income per worker and the city’s population or employment (Mills, 1967; Henderson, 1974). When smaller cities grow, workers benefit in terms of rising real per capita incomes due to the localised agglomeration benefits from increasing scale.³

The identified market and non-market forces include division of labour, lower search costs for matching specialised labour and firms, market size, and non-traded intermediate inputs. Bigger and more dense local markets can, for example, support more varieties, and hence offer economies of diversity both in household consumption and in the use of local intermediate inputs (Krugman, 1991), where diversified inputs are assumed to improve innovation and efficiency among local producers (including exporters). Another important force is information spillovers, i.e. technological externalities from human capital, within industries and in input and output markets from economic agents in close proximity, which generate localised benefits for clustered firms when the spatial information decay is rapid (Henderson & Thisse, 2004; Rosenthal & Strange, 2004).

Duranton & Puga (2004) make a distinction between matching, sharing and learning mechanisms. The matching mechanisms work in such a way that the larger the number of employers and workers in a regional labour market, the higher are the chances for a good match between the needs of the employers and the skills of the workers, which increases regional labour productivity. Sharing mechanisms imply that spatial proximity between producers and customers allows both to reduce their spatial transaction costs, which induces lower prices, increased demand, higher output, and higher wages. Learning mechanisms, finally, imply that the larger the number of people brought together in an urban region, the higher the potential for learning, which implies that knowledge production as well as knowledge diffusion becomes more efficient. In this case, one may wish to add that there is more to learn in knowledge-rich regions – and even more in large knowledge-rich places. Nevertheless, the general conclusion from this discussion is that clustering of firms and people may arise due to a number of different underlying forces generating spatially concentrated increasing returns to scale (Marshall, 1890; Duranton & Puga, 2004). With the general rise in real incomes, cities have also become centres of arts, entertainment, and other amenities. Brueckner, Thisse & Zenou (1999) show how the concentration of human capital increases with the supply of regional amenities. A more general understanding of the urbanisation process also demands that issues such as the development of infrastructures and institutions are brought into the picture (North, 1981).

³ The inverted U-shaped (concave) form implies that at some point the marginal benefits of increasing city size are overtaken by rising marginal costs for commuting and other diseconomies. The idea with a concave size curve is at best a “tentative simplification” and discussions of the pertinent diseconomies are beyond the purpose of this introductory chapter.

To understand the underlying urbanisation processes it is necessary to start from a microeconomic framework, which contains centrifugal as well as centripetal forces. There are numerous models of urbanization in the literature on regional and urban economics. The original two-sector models were set up to explain urbanization in general and not specifically the agglomeration of human capital. In the original models people move from a rural sector to a general urban sector as an effect of exogenous factors, such as (unexplained) technology shifts (Lewis, 1954). These two-sector models focus on questions such as, the existence of urban bias, the effects of public policies on urban-rural development, and the efficient allocation of population between the rural and the urban sector at a given point in time. What is typical for these models is that they are static and that urbanisation is driven by exogenous technological factors that favour either the urban sector or the terms-of-trade of the urban sector. Extending the microeconomic issues in this type of models would include questions such as: (i) does urban productivity rise because in-migrants are more productive, or (ii) do migrants and already established workers become more productive because a growing urban region gets augmented agglomeration economies, or (iii) because of the interaction effects of both individual effects?

In recent decades, another type of two-sector model – the core-periphery model – has been used to explain urbanisation (Krugman, 1991; Puga, 1999). These models usually specify two interacting regions. The core question in these two-sector models is the following: what conditions will retain two agglomerations, and what conditions will channel urbanisation towards one of the regions? When the latter happens, an important and disproportional share of economic activities become concentrated in one of the regions. These models assume that there exists one sector characterised by monopolistic competition. The normal starting point is two identical regions, which initially are affected by some external factor, such as an exogenous (historical) location decision, which makes one of the regions' the largest or a technological improvement, which reduces transport costs in one relative to the other. This external factor induces the development of an expanding core and a declining hinterland due to the existence of increasing returns. These models have a limited focus, since they target the analysis on what happens to the core-periphery relationship, when, for example, transport costs fall. This implies that even if these models are spatial models, their power to highlight agglomeration and urbanisation in general and the agglomeration of human capital in particular remains unexploited. To provide a better understanding of agglomeration and urbanisation in a more comprehensive way, the models must be capable of depicting the city formation process more generally. In this sense, there is a need for formulations with several urban regions, whose number and size are determined endogenously in a dynamic process. Fujita, Krugman and Vennables (1999) struggle with this issue, and Fujita and Thisse (2002) suggest alternative ways to elaborate such ideas.

Within the framework of an exogenous growth model, it is possible to illustrate how increases in national population are accommodated through increases in the number of cities in the national system of cities (Henderson & Ioannides, 1981). Efficient city size will also grow due to exogenous technological changes, which increase agglomeration economies or reduce the commuting costs in urban areas. These basic ideas were developed by Black and Henderson (1999) in an endogenous growth model, where there are two types of cities, each using different technologies and having different human capital intensities. In their model, members of growing dynastic families are allocated between the two types of cities. Human capital is the only capital in the model and there is no formal market for human capital. However, there exists an intra-family capital market with family members in low capital-intensity cities lending to those in high capital-intensity cities. People in cities with a high

human capital-intensity earn a (positive or negative) premium relative to those in the other type of city but their nominal wages must be high enough to pay back the human capital they have borrowed in order to earn the returns of their higher required levels of human capital.

Assuming conditions allowing for steady state growth, people accumulate human capital continuously. The regional stock of human capital within cities generates a knowledge externality, which is translated into improved production efficiency and thus the efficient city sizes grow continuously. The urban knowledge externalities are the source of national economic growth. Hence, urban and national growth processes are interdependent parallel processes. In the Black & Henderson model, both types of cities grow at the same rate in terms of their size and if the national population growth is high enough, both types of cities grow in number at the same rate.

What more can be said about the agglomeration of human capital and talent? In terms of modelling, there exist endogenous urban growth models with human capital agglomeration. In the model presented by Henderson & Wang (2005), there is a migration from rural to urban sectors driven by increased human capital and per capita income. The urban sector consists of many cities, which grow in size with human capital accumulation and in number as the national population increases and people move from the rural to the urban sector. The demand for food products produced in the rural sector is assumed to be income inelastic. This implies that as real incomes increase the relative demand for food products will decline at the same time as the productivity in the food sector increases. Thus, labour will be pushed out of the rural sector, and induced to move to the urban sector as the relative demand for urban products increases over time. However, to get a deeper understanding of the agglomeration of human capital there are a number of further questions that need to be considered:

- What induces people to invest in human capital?
- What is the composition of the labour demand in the rural and the urban sector and how does it change over time?
- What factors induce educated, knowledge-intensive labour to move from the rural to the urban sector?
- Why do certain activities prefer to locate in cities and urban regions?
- How does the composition of urban activities change over time?
- Which role do infrastructures and institutions play in the urbanisation process?
- Is there an inter-urban equilibrium which is consistent with a change process involving both expanding and declining urban regions?

3. Human Capital Agglomeration and the Location of Economic Activities

To more fully understand why human capital has such a high tendency to agglomerate in cities and urban regions one needs to fully explore urban regions as places for both production and consumption. It seems obvious, starting with the production aspect, that certain industries and activities in the economy at each point in time prefer an urban location, and thus can be

classified as urban industries and activities. Certain industries such as universities have largely been urban for centuries with a few noted exceptions at least in the U.S. of universities located in more rural and isolated places. Other industries, such as many of the manufacturing industries that developed in the city centres during the industrial revolution, have with few exceptions left the city centres to locate either in the outskirts of the city region or in more peripheral places, including totally non-urban locations. Recent decades, have witnessed how, for example, knowledge-intensive business services agglomerated historically in urban centres and, in particular, the core of large urban regions.

One major reason for the agglomeration of production in urban regions and metropolitan areas today is the existence of various positive externalities, such as

- The potential to realise internal economies of scale in a larger and denser market
- The existence of a larger labour market with a more diverse and specialised labour force
- The existence of a larger supply of specialised input services
- The existence of well developed intra- and inter-regional infrastructures, which allow for frequent local face-to-face interaction with customers and suppliers in the region as well as planned face-to-face interaction with customers and suppliers in other regions.

Industries and firms with knowledge-intensive and knowledge-creation activities that demand accessibility to a labour force with deep and varied knowledge and specialisation as well as labour equipped with special talents will be attracted by the labour market in large and dense urban regions. The underlying reason is that the competitiveness of firms in these industries is critically dependent upon their creativity (Andersson, 1985; Fujita & Thisse, 1996). The level of creativity is a function of personal communication within groups of people sharing common interests and goals (Lucas, 1988). However, distance is a barrier to the spread of information and knowledge (Hägerstrand, 1965). Thus, efficient communication within such groups is dependent upon the options for face-to-face interaction (Saxenian, 1994), since the knowledge to be exchanged often is complex, uncertain and developing. The incentives to develop interactive communication come from the need to avoid the risk of misunderstanding when the knowledge involved is complex (Gaspar & Glaeser, 1998). Here frequent encounters are critical for an efficient diffusion and good understanding of information and knowledge (Leonard & Strauss, 1997). A prerequisite for efficient communication is that the individuals involved understand things in the same way and thus share the same culture (Arrow, 1974; Cohen & Levinthal, 1990). Proximity between economic agents favours the establishment of a common language and thus facilitates the understanding of the information and the knowledge exchanged (Guillain & Huriot, 2001). Proximity is a vehicle for calibrating the processes of encoding and decoding complex messages.

The size of the communication groups is critical, since people have different skills. To solve complex problems and to create new knowledge, the groups must be large enough to contain the necessary complementary skills and experiences. Knowledge creation and problem solving are critical for competitiveness in the modern knowledge economy, which implies that the most important activity of economic agents to achieve this is information and knowledge exchange. Due to their rich and specialised supply of arenas for such exchange processes, large and dense urban regions offer the best conditions for arranging such

communication activities – ranging from congress meetings to bars – it is natural that such information-intensive activities agglomerate in large urban regions (Fujita & Ogawa, 1982).⁴ Florida (1995) characterizes such regions as ‘learning regions’, although the label ‘creative regions’ seems more to the point. In Florida’s interpretation firms benefit from concentrating their activities in such regions, because such locations allow them to minimize transport (contact) costs for a given level of learning, and to maximize their learning with a given budget for interaction costs. Firms striving to augment their creative capabilities have strong incentives to locate in these learning regions.

Consider now that new problems to be solved are emerging. Under such conditions, there is a need to change the composition of the creative groups. Large urban (metropolitan) regions are proper places for such re-arrangements. This implies that large and dense urban regions give rise to substantial static and dynamic scale and scope effects, because in such regions it is possible to have many creative groups as well as to change the composition of each group over time. It must also be acknowledged that ideas and knowledge have public goods characteristics, which implies that the communication processes will generate localised spillover effects. This implies that the creative processes in large urban regions themselves can induce strong agglomeration tendencies (Fujita & Thisse, 1996).

Large urban regions and, in particular, metropolitan regions are centres of innovation, headquarters and the locus of advanced business services. Large urban regions are normally highly diversified⁵, making it possible for new firms but also for development units in established firms to experiment with different technologies until they learn what technology best satisfies their goals (Duranton & Puga, 2000). When firms have adopted a standard technology, production will be decentralised to smaller, more specialized urban regions. According to this model, large diversified urban regions function as centres for R&D and innovation and as incubators for new high-tech products. The market penetration and routine development of these products follow the product cycle model in the sense that once a product has become standardised and its production process has become routine, the location of its production will move to smaller cities or be off-shored to countries with lower land and labour costs.

Duranton & Puga (2005) present a model of functional specialization in large urban regions. For the organisation of production and final sale, the large multinational firms need specialised business services, which Duranton & Puga summarize as “headquarter functions”. Due to the improvements in transportation and communication technologies, these headquarter functions can be localised in large urban regions, often far away from many of the production facilities located in smaller cities all around the world. Such a location makes it possible for the headquarters to locally buy inputs from specialised business service firms in areas such as R&D, marketing, financing, law, exporting, logistics, etc. The co-location of headquarter functions in large urban regions generate agglomeration benefits due to the shopping behaviour of these headquarters. Together they create the foundations for a wide variety and diversity of specialised intermediate business service firms from which the headquarters can buy locally when they want to outsource various services.

⁴ Actually, Beckmann (1976) suggested the need for interaction among individuals as an explanation for the existence of cities.

⁵ Baumont, Beguin & Huriot (1998) maintain that cities and urban regions can be defined basically in the concepts of agglomeration and diversity.

As the urban demand for educated and experienced individuals expands, wages for such kinds of employees will increase, and more and more of these individuals are attracted to these regions. A large market is attractive for individuals who are rich in human capital, because it provides better-expected job matches and thus a higher wage (Kim, 1990), but probably also a more interesting job. It also offers lower risks for unemployment in case of idiosyncratic employment shocks. Large urban regions generally offer more “liquid” labour markets to people with specialist skills. In order to attract human-capital rich employees, knowledge-intensive firms may be forced to offer jobs in large urban regions with liquid labour markets. To attract these employees to other regions they would normally need to pay substantially higher wages.

Urban regions are also the location of institutions of higher education, which implies that they also attract households that give priority to education possibilities for their children. In addition, the location of one or several universities in an urban region means that the conditions for communication externalities are greater in these locations.

4. Human Capital Agglomeration and Regional Growth and Development

The early development economists in the post-war period emphasized that the spatial agglomeration of human capital generated benefits over and above the private returns reaped directly by the individuals themselves. Today these social benefits are usually considered the result of either market-mediated or extra-market mediated⁶ human-capital externalities (Moretti, 2004a). Contributions by Arrow (1962), Romer (1986) and Lucas (1988) which stress that human capital externalities arising from uncompensated learning processes between individuals are an important source of economic growth, underpinning the importance of arguments, which refer to technological non-market externalities. However, pecuniary market externalities related to human capital, for example, may arise if firms choose their investments in physical capital in anticipation of the expected average human capital of their future employees (Acemoglu, 1996). It is in this context important to distinguish between (i) static externalities, which imply that increases in human capital has a one-time effect on output (Lucas, 1988), and (ii) dynamic externalities, which imply that increases in human capital make the economy grow faster, either due to a larger number of innovations (Romer, 1990) or more efficient imitation of technologies developed by others (Nelson & Phelps, 1966). If we are able to demonstrate that there exist human capital externalities, this has indeed strong policy implications (Aghion & Howitt, 1998).

Obviously, there are strong theoretical arguments but also tentative empirical evidences that the agglomeration of human capital contributes to regional development and growth. Empirical studies, for example, have found that an urban region’s supply of educated people plays an important role in generating urban growth in metropolitan areas in terms of population, employment and incomes (Glaeser, Scheinkman & Shleifer, 1995). Glaeser (1994) showed that the association between human capital and growth seems to get stronger

⁶ Extra-market externalities from human capital accumulation include reductions in crime rates, better informed voting decisions, improved health-related behavior, etc. (Davies, 2002).

over time. Black & Henderson (1999) found in a panel context for the US that cities with higher shares of college graduates grow faster in each decade during the period 1940-1990.⁷

Rauch (1993) found empirically that the geographic concentration of human capital significantly increases productivity and wages. He approached his research problem by augmenting the standard wage regression of the Mincer type (Mincer, 1974; Card, 1999) with data on the properties of the cities where individuals are located. In his empirical modelling, he related the wage w of individual i in city c to basic characteristics of the individual, such as education and experience, X_{ic} , to the average level of schooling in city c , S_c , and to other characteristics of city c , Z_c using the equation

$$\log w_{ic} = \alpha X_{ic} + \beta S_c + \gamma Z_c + \varepsilon_{ic}$$

where ε_{ic} accounts for all unobserved factors influencing individual wages across cities. By estimating the above equation using data for US cities in 1980, he found β to be significantly positive indicating the existence of human capital externalities at the city level in the US. Rauch's approach has certain drawbacks: (i) it does not account for unobserved city characteristics, which are time-invariant, while still affecting both schooling and wages, and (ii) it assumes city-level schooling to be exogenous.

Rosenthal & Strange (2004) report in their literature survey that there seems to be a consensus that a doubling of the size of cities is associated with a productivity increase in the range of three to eight percent. Other studies have shown that if the employment density is doubled, wages and productivity increase by about six percent in the US (Ciccone & Hall, 1996), by about five percent in European countries (Ciccone, 2002), and by four percent in the UK (Anastassova, 2006). Karlsson & Pettersson (2008) show in panel study of urban centres in Sweden that a 10 percent increase of local accessibility to population, i.e. labour, increases gross regional product per square kilometre by more than five percent. Furthermore, the share of the labour force with three or more years of university education also has a significant positive effect on regional product. For Germany, Möller & Haas (2003a & b) found that a doubling of the employment density tended to raise individual wages by about 2.5 percent and that these benefits increased with the skill level. However, this is not a measure of human capital externalities, since it also includes the effects of other influences. Suedekum (2006) analyzes human capital externalities in a study of the effect of regional human capital shares on regional employment growth. He finds that regional human capital accessibility has a positive impact on subsequent employment of low-skilled workers indicating a complementary relationship between skilled and unskilled workers. Moretti (2004b) reports, that he found the largest wage increases for college students between 1980 and 1990 in the US cities where the share of college graduates had increased most. In another study using plant level data, he found that the output of plants in high-tech city industries did rise with the levels of schooling in other high-tech industries in the same city (Moretti, 2004c), which is consistent with the existence of human capital externalities. However, there is an alternative explanation. It could be that skill-based technological progress is translated into productivity and wage increases of college graduates in high-tech industries. With such a scenario, cities specialising in industries having rapid productivity growth would experience faster growth and attract more college graduates from other regions. The period 1980-90 was characterised

⁷ The association between human capital and urban growth also holds for much longer periods as shown by Simon & Nardinelli (1996) using data on Britain.

by increased wage premiums for college graduates, which Katz & Murphy (1992) explain by skilled-based technological progress, which supports the alternative hypothesis.

It has been questioned to what extent the urban wage and productivity premium can be ascribed to human capital externalities. Glaeser & Mare (2001) argue, for example, that a large part of the urban wage premium is due to spatial sorting of workers with respect to observable and unobservable characteristics. Still, they find that human capital externalities increase wages in urban regions by about 12 percent. For French cities, human capital externalities are estimated to increase wages in urban regions by about three percent (Combes, Duranton & Gobillon, 2007).

One reason for the current uncertainty concerning the size of the human capital externalities are the critical identification problems involved (Angrist & Kreuger, 2001). Omitted variables in the econometric specification may imply that human capital externalities are not properly identified. If, for example, shifts in the supply of and demand for different skills in urban regions, i.e., structural change, are not acknowledged in the analysis, this could lead to substantially biased estimates. Ciccone and Peri (2006) show, using a Mincerian wage equation that a positive effect of average schooling may not be due to human capital externalities. Instead, they suggest an alternative approach, which starts from the fact that the wage differential between workers with low and high education mirrors differences in marginal social products between the two types of workers when human capital externalities are absent. According to their results, there is no significant evidence of human capital externalities at the level of US states and cities.

It is also interesting to note that the use of instrumental variables in some cases, as in the study by Acemoglu & Angrist (1999), have reduced social returns from education to below one percent, which is substantially lower than in earlier studies. They assume that US states rather than cities are the relevant aggregates when estimating the equation used by Rauch (1993). They show that at the state-level changes in compulsory schooling and child-labour laws can be used as instruments for changes in average schooling at the state level. According to their study, there is no evidence of significant evidence between 1960 and 1980 of significant schooling externalities.

However, Heuermann (2008), using instrumental variables in a study in Germany, finds human capital externalities to be an important wage determining factor. According to his estimations, the regional share of highly qualified workers increases wages by 1.8 percent for highly qualified workers and by 0.6 percent for other workers. He claims that human capital externalities are underestimated by about 50 percent in simple regressions for workers at all qualification levels. He interprets his results to indicate that knowledge externalities emerging through communication and learning processes are of greater importance for highly qualified workers, while other workers are influenced primarily by pecuniary externalities coming from investment decisions by firms affected by the overall regional human capital endowments.

5. Conclusions

This introductory overview has highlighted some of the current knowledge as regards three critical questions related to the emerging knowledge economy: i) Why does human capital and talent tend to agglomerate in large urban regions?, ii) How does this agglomeration affect the location of different types of economic activities?, and iii) How does this agglomeration affect regional growth?

There are different underlying agglomerative forces creating spatially concentrated increasing returns to scale. Also, cities become centres of various amenities due to general increases in real incomes offering people spare time activities.

One major reason for the agglomeration of production in urban regions and metropolitan areas today is the existence of various positive externalities, providing good settings for industries and firms with knowledge-intensive and knowledge-creation activities, specialised business service firms and headquarters of multinational firms. Also, the location of one or several universities in an urban region means that the conditions for communication externalities are greater in these locations. Furthermore, large diversified urban regions function as centres for R&D and innovation and as incubators for new high-tech products (Duranton & Puga, 2000). When firms have adopted a standard technology, production will be decentralised to smaller cities or be off-shored to countries with lower land and labour costs.

As the urban demand for educated and experienced individuals expands, wages for such kinds of employees will increase, and more and more of these individuals are attracted to these regions. Large urban regions generally offer more “liquid” labour markets to people with specialist skills.

There are strong tentative empirical evidences that the agglomeration of human capital contributes to regional development and growth. However, there is uncertainty concerning the size of the human capital externalities. One reason being the risk of misspecification in the econometric model that could lead to biased estimates (Angrist & Kreuger, 2001). Heuermann (2008) suggests that knowledge externalities emerging through communication and learning processes are of greater importance for highly qualified workers, while other workers are influenced primarily by pecuniary externalities coming from investment decisions by firms affected by the overall regional human capital endowments.

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