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Abstract

This chapter intends to demonstrate that the Stockholm region is the key centre for knowledge development, innovations and intellectual creativity in Sweden. The region is an attractor for individuals with ambitions and talents in political, economic and cultural life. At the same time novel ideas and solutions diffuse from the Stockholm region to other regions of the country.

A major effort in the study is to describe occupations with regard to (i) the skills of a job and (ii) the tasks associated with a job. Moreover, the knowledge intensity of an urban region can be related to the absorption capacity of firms in the region, implying that firms can make use of all sorts of novelties in the world economy as stimuli for own imitations and innovations. Compared to other parts of Sweden, the Stockholm region has both a richer inflow of creative ideas and a larger absorptive capacity. This allows the Stockholm region to function as a source of innovation and business renewal for the rest of the country as novelties diffuse through the regional hierarchy.

Keywords: Sweden, Stockholm, Creativity, Knowledge, Innovation, Diversity
JEL classification codes: J24, O30, R11, R12

1. Creativity, Knowledge and Innovations in Urban Regions

In this chapter the Stockholm metropolitan region is presented as an example of how novelty-creation activities and occupations may unfold in an urban agglomeration. Why should we expect to find a stronger concentration of creative persons and creativity-driven firms in large urban regions than elsewhere? In response to the posed question, the chapter makes use of the Stockholm region to stress phenomena such as multiplicity of interaction opportunities among novelty creators, between innovators and potential users of the innovations. Using an analogy: a creative theatre life requires that actors, directors and audiences are in place. It also requires inflow from play-writers and stimuli from other theatre milieus. Section 1 presents a set of historical examples to support this view, and it starts by presenting the Stockholm region in this context.

1.1 The Stockholm region

A brief description of Sweden's economic geography the year 2005 may take the following form. There are three metropolitan regions, Stockholm, Göteborg and Malmö, where the population in the Stockholm region equals the sum in the two other regions. Close to half of the total population is located in the three metropolitan regions, and just below 40 percent have their homes in 17 medium-sized urban regions. The remaining geography consists of around 50 small urban regions, hosting a little bit more than 10 percent of the population.

Table 1 illustrates the development of the country's urban regions during the period 1950-2005. What we observe is a process of population concentration such that the three largest urban regions have grown much faster than the average for the country during more than half a century. The second observation that will be referred to in the sequel is that the Stockholm region comprises one quarter of the country's population.

Table 1: *Population size 2005 and growth between 1950 and 2005*

Regions and groups of regions	*Change 1950-2005 (%)*	*Size 2005*	*Population share 2005 (%)*
Stockholm	72.4	2 250 000	24.9
Göteborg	61.3	1 016 661	11.2
Malmö	43.6	1 005 712	11.1
17 medium-sized regions	17.7	3 532 431	39.0
Small regions	-12.4	1 242 638	13.8
Country as a whole	28.4	9 047 752	100.0

Remark: The regional boundaries have been kept invariant for the entire period.

In the presentation we will demonstrate that the Stockholm region for a very long period of time has remained the major centre for knowledge development, innovations and intellectual creativity in Sweden. It has maintained this position by hosting more of diversity and many-sidedness than other regions. Given this position, the region has been an attractor for individuals with ambitions and talents in political, economic and cultural

life. At the same time novel ideas and solutions have continued to diffuse from the Stockholm region to other regions of the country. To a large extent the region has functioned as a node collecting world-wide news for dissemination across the country. An illustrative example of this forerunner function is that in 1885 Stockholm had the largest number of telephones of all cities in the world (Hult, 1989)

The aim of this chapter is to provide the reader with a sequence of pictures of the Stockholm region, which together can describe its role as Sweden's major node for creative processes and innovation activities. This node is characterized by a labor supply with diversified cognitive skills which match the requirements of equally dispersed knowledge-handling tasks in different parts of the economy. Although knowledge-related activities are concentrated in the region, we find that a prominent share of the labor force consists of workers who are assigned to information-handling tasks. However, if knowledge and information activities are added together, they dominate the contemporary economy of the Stockholm region, with a share approaching 2/3.

We also want to show that Stockholm has a very long history as the major node for Swedish imports of ideas, technology and products (embodying new technical solutions) from the rest of the world. In addition, we claim that the Stockholm region has saddle-point properties, reflected by its gradual diffusion of novelties to the rest of the country's economy. The chapter ends with a discussion of "Stockholm's creative clusters" and the region's success in attracting talents to these clusters and other knowledge-handling activities.

1.2 **Social Milieus that Foster and Repress Creative Processes**

An act of creativity often implies that a new and surprising solution is found in the context of a certain problem or a complex of problems. To enrich this rather poor description of the meaning of creativity, we may recognize that a creative act also can have the form of redefining a given problem, such that it is replaced by a new and more solution-friendly formulation. Creativity is related to a playful propensity to reshape the structure of a system or problem cluster, and to recombine the elements of the system.

Andersson (1985) suggests that an analysis of creativity could be approached by considering the following aspects of the human brain: heuristic ability, ability to remember, to detect deep structure, to perceive and use ambiguity, multiplicity and variety, to appreciate paradoxes and surprises, to use disequilibria, and to use fundamental uncertainty. In Smith (1993) it is argued that a high level of creativity is a common phenomenon for young children, adding that constraints from the social environment of any person tends to reduce the person's creative capacity, which implies that most people loose part of their creativity as they leave childhood, grow older and start to experience responses from an environment which rewards established rather than innovative traits of problem solving. The message from Smith may be reformulated as a conjecture that we may identify social environments that are effective in suppressing creative thinking. If this is true,

it should also be possible to outline models of social conditions that foster and enable creative processes and novelty generating interaction among individuals.

The above conclusion suggests that creative activities are more frequent among certain groups of individuals, and that such creative groups, in turn, can be found in greater numbers in certain regional environments. The hypothesis put forward in this chapter is that creative milieus are characterized by communication externalities, where novel ideas generate additional ideas through interaction. As a consequence, creative milieus should be more prevalent in large and dense urban regions, to the extent that such regions host knowledge-intensive inhabitants with cognitive occupations, reflecting knowledge-handling activities. The outcome of favorable creativity conditions in a region may take different forms such as the creation of scientific and research-based knowledge, supply of artifacts and performances in the area of arts and entertainment, and innovations in the form of new production routines and novel products (goods and services).

It is clear that an identification of skills and tasks of an occupation may indicate a positive likelihood that creative processes will establish. However, there is indeed no one-to-one relation between type of occupation and degree of creativity. Consider R&D and observe that research involves checking and testing preliminary solutions and established knowledge, and the related activities are normally prescribed to be based on routines rather than creativity. Furthermore, a large share of artistic work and entertainment has a routine nature, where the appreciation may spring from recognition of patterns rather than from unexpected, surprise-loaded experiences. Thus, in all creative areas we can distinguish between initiators or innovators and followers or disciples.

Mellander (2009) argues that one needs to understand how the occupational structure in creative and knowledge-based industries differs from that in other industries (Florida, 2002; Andersson and Johansson, 1984). According to Mellander, this literature emphasizes social and economic diversity as a critical factor for the creativity of urban regions. In the analyses of Florida (2002), urban regions manage to develop as a consequence of lower barriers to entry and in-migration of creative and talented persons, and a supply of life-style activities that are attractive to people with creative skills.

1.3 Examples of Creative and Innovation-Rich Urban Regions

A functional urban region is characterized by being an arena for frequent interaction between persons and between organizations, making it a facilitator of face-to-face contacts. Following contemporary research, such a region should allow people to meet with travel distances shorter than 45 minutes (Johansson, Klaesson and Olsson, 2002). As a consequence, such regions were much smaller in historic time – like ancient Athens, Florence in the 16th or Edinburgh in the 18th century – than in the present-day Boston or Cambridge regions.

Creative urban regions are recognized for hosting individuals and groups of individuals creating and developing new ideas, solutions and knowledge, but also producers

carrying out innovations such as new routines and new products. This form of definition focuses on observed consequences of creativity, without shedding light on how the creation comes about – partly in line with Koestler's observation that great scientists reach their findings as if they were "sleepwalkers" (Koestler, 1959, 1964). Andersson (1985) argues that common features of creative regions are (i) supply of financial resources for novelty creation, (ii) deep original knowledge and competence, (iii) experience of tensions between needs and available resources, (iv) a regional milieu offering diversity, (v) opportunities for frequent interaction, and (vi) structural instability causing genuine uncertainty. In our exposition and examination of the Stockholm region, we emphasize competence, diversity and interaction opportunities.

The above characterization can be applied to the so-called Scottish Enlightenment during the second half of the 18th century. In the 1720s Edinburgh had reformed and developed its university on the faculty system. A similar change took place in Glasgow but with less remarkable consequences than in Edinburgh, where the milieu gave rise to an extraordinary intellectual and cultural flowering, later referred to as the Scottish Enlightenment. A characteristic of Edinburgh's Old Town in these days was its lack of segregation, due to the habit of housing both the very poor and wealthy in different floors of each multistoried building, while at the same time hosting a tavern where inhabitants of each house ate and drank in common.

Edinburgh's outbreak of intellectual inquiry took place in the dense milieu of the Old Town, fostering conversation and debate. This environment inspired scholars to explain phenomena by isolating a first principle. David Hume elaborated the concept of causality and suggested that causal relations are confined to ideas [in a model], while Adam Smith recognized the implications of division of labor, and William Robertson the degree to which environmental factors shaped economic history. Others like Joseph Black presented ideas about latent heat and James Hutton claimed that the Earth revealed an enormous antiquity (EB, 1991).

From another angle we may observe that Edinburgh was the university of the poet James Thomson, of James Boswell, the biographer of Dr. Johnson, of the novelist and poet Oliver Goldsmith, and of Benjamin Rush who is recognized as a signatory of the Declarations of Independence. From the 19th century one finds Sir Walter Scott, who developed the historic novel (EB, 1991) .

One background to the Scottish Enlightenment was a long history of theological debate, sharpening minds and ways of arguing. This background may also be a reason for the strong orientation towards European culture. David Hume, le bon David, got famous in his lifetime for his "History of England", while "A Treatise of Human Nature" has remained a point of reference into our time, just like Adam Smith's "Wealth of Nations" These are just some of the most well known pieces from the heyday of Scottish universities.

A related and even more magnificent story is presented in "Wittgenstein's Vienna" (Janik and Toulmin, 1973), which reports on an intellectual milieu, during the decades

around 1900, generating novelties in wide-spread fields such as music, journalism, architecture, theoretical physics and philosophy. In Vienna, where the Habsburg monarchy was suppressing new political ideas, interaction between creative persons was fostered by the café culture and inflows of ideas from the rest of Europe, just as the Scottish Enlightenment had strong links to the French society.

In the preceding two examples diversity prevails. We find the same story in England with Cambridge and the Bloomsbury group, centered around names like Russell, Keynes, Whitehead and many others. In more recent time, Cambridge is recognized as a resource concentration for both theoretical and applied research with impacts on the development of materials technology and biotechnology.

How do these examples relate to creativity in economic life? Do the developments in arts and sciences follow the same pattern as innovative activities by entrepreneurs and firms? It seems that we have to look for other regions when the introduction of new routines of production and new products (goods and services) are placed in focus. From a Swedish point of view we can observe how industrialists sent their sons (and other successors) to study technology in England during the 18th and to New England during the 19th century (Rydberg, 1989; Johansson, 1993). Starting in the end of the 19th century, the Boston region offered a fragmented picture with immigration that gave rise to ethnic diversity and intellectual multiplicity. The telephone was invented and transformed to an innovation in this realm, which also was the birthplace of the great market success of the Gillette Safety Razor. In the 20th century inventions and entrepreneurial efforts brought about a series of market novelties in the field of electrical engineering, radio technology and related fields, where we can recognize power tubes, thermostats and rectifier tubes (Warner, 1989).

The observations from the Boston region stress diversity, elements of social unrest, and the formation of a university milieu, with access to the concentrated demand on the east coast in the U.S. In a later wave, the Boston region also became a major location for digital ICT, although overshadowed by the development on the West Coast in Silicon Valley. The latter case has become an icon, and a narrative research documentation has emphasized knowledge competence, diversity and knowledge spillovers generated by labor mobility and venture capital networking (Huffman and Quigley, 2002; Saxenian, 1996). In its own way, the Stockholm region has in recent decades made imprints in the field of ICT innovations.

1.4 Occupations and Creative Processes

The subsequent analysis of occupations is based on two different classifications. The first classification is inspired by a recent contribution by Bacolod, Blum and Strange (2009), where occupations are recognized by the type of skills required: cognitive, management-administration, social and motor skills. The second classification is based on what types of operations (tasks) people in each occupation actually carry out (Andersson

and Johansson, 1984), leading to a division into knowledge, information, service and goods handling activities, where occupations are classified according to tasks.

Herzog and Schlottman (1989) made a clear distinction between the two different pictures that obtain when the basis is high-technology occupations and high-technology industries. The message, which was later stressed by Florida (2002), is that a classification of creative occupations has the capacity to reveal more aspects of the modern urban economy than a classification of creative industries. Inspired by this ambition, we also consider Andersson's classification of occupations into (i) knowledge-handling, (ii) information-handling, (iii) service-handling and (iv) goods-handling tasks.

As illustrated in Table 2 all knowledge-handling occupations are also classified as cognitive. However, information-handling task cover all four categories of skills, although most information-handling occupations are associated with management-administration skills. In a similar way we can see a strong correlation between service handling and social skills, as well as between goods handling and motor skills.

Table 2: *Cross classification of 94 occupations characterized by skills and tasks*

		Tasks			
		Knowledge handling	Information handling	Service handling	Goods handling
Skills	Cognitive	20	2		4
	Management- administration		18	3	
	Social		4	13	
	Motor		3	2	25
	Sum	20	27	18	29

Remark: Skills-classification inspired by Bacolod, Blum and Strange (2009), and task-classification according to Andersson (1985) and Andersson and Johansson (1984).

Table 2 informs us that management competence is primarily assigned to information-handling activities and not knowledge-handling. What is then the difference between knowledge and information? A first observation is that knowledge tends to be durable and information perishable. However, information can also be a carrier of knowledge messages. Using the terminology in the table, knowledge reveals itself in cognitive patterns that can be universally used in explaining phenomena and in designing instruments for controlling phenomena. Geometry provides an example of knowledge which may be appreciated as a set of consistent theorems. Geometry is also embedded in instruments to find the shortest route.

Knowledge is the result of creative efforts. Andersson (1997) suggests that knowledge can be understood as an ordered structure. Thus, we may consider thematic creativity which can give birth to new fundamental (structural) knowledge, as well as creativity in the form of variations on a given theme. If this idea is applied to innovations, one may safely conclude that most innovations in economic life has the nature of variations of an

established theme. This is illustrated in the following list of firms' innovation efforts: (i) Internal R&D efforts made inside the firm; (ii) Commissioned R&D taking place outside the firm; (iii) Acquirement of new equipment to be used by a firm; (iv) Search and collection of external knowledge; (v) Training of and investments in a firm's human resources; (vi) Efforts to commercialize innovations and promote their market penetration; (vii) Product development and product design; (viii) Collaborative innovation efforts together with external actors.

2. Education, Skills and Tasks in the Stockholm Region

Section 2 starts with an exposé of the knowledge intensity of the Stockholm-region economy, in comparison with the rest of Sweden. It continues to show that the cognitive-skills intensity is higher in the Stockholm region than elsewhere in the country. In addition, cognitive skills are shown to increase with the size of regions. The intention is to show that in contemporary knowledge economies many cognitive skills are associated with knowledge-handling tasks which require university education.

2.1 Education and the Growth of Knowledge Intensity

Education matters for the urban economy in the sense that knowledge-intensive workers (with at least 3 years of university studies) receive a wage premium which is claimed to be higher in large urban regions than in smaller regions. (Glaser and Mare, 2001; Rosenthal and Strange, 2008).

The knowledge intensity of the Swedish economy increased by more than 6 percentage unit between 1993 and 2007. The increase was faster in the metropolitan regions, which all grew by 10 percentage units. This reflects a bias of household migration, where labor with high education is attracted to the largest urban regions. For the Stockholm region we also observe that its knowledge intensity is double the average for the country.

Table 3: *Knowledge intensity in the entire economy. Percent of total employment*

Urban regions	***1993***	***2007***	***Change 93-07***
Stockholm	17.3	28.1	10.8
Göteborg	14.1	24.1	10.0
Malmö	13.0	23.4	10.4
Medium-sized regions	10.3	18.6	8.3
Country as a whole	8.6	14.7	6.1

Remark: Establishment statistics arranged for 72 FA-regions. Knowledge intensity refers to the share of employment with at least 3 years of university education. Statistics Sweden, Johansson et.al. (2010)

The knowledge intensity of an urban region can be related to the absorption capacity of firms in the region, implying that firms can make use of all sorts of novelties in the world economy as stimuli for own imitations and innovations (Cohen and Levithan

1990). Thus, knowledge intensity facilitates creative processes of a firm. In this context we can refer to Table 3, which shows that the share of knowledge-intensive labor is close to 60 percent among persons in cognitive skills occupations. This is more than double the knowledge intensity of occupations with management skills.

Table 4: *Knowledge intensity of different types of occupation skills in percent. Sweden 2007*

Knowledge intensity	*Cognitive skills*	*Management & administration skills*	*Social skills*	*Motor & other skills*	*Tot*
Low	41.5	72.0	85.3	96.1	77.9
High	58.5	28.0	14.7	3.9	22.1
Sum	100	100	100	100	100

Source: Occupation information from Statistics Sweden. High knowledge intensity obtains when more than 50 percent of the people in the occupation has 3 or more years of university education.

2.2 Occupations Classified by Skills and Tasks

Are persons in occupations requiring cognitive skills more creative than persons in other occupations? Are knowledge-handlers more creative than persons having other occupation tasks. As already recognized, cognitive skills and knowledge-handling tasks are oriented towards improving and enhancing the understanding the world and creating new knowledge. Thus, when occupations are classified as cognitive and knowledge-handling, then the message is that these occupations are oriented towards knowledge creation, and to manage this, the persons use their creative capacity as a resource. New knowledge is the result of technology development, formulation of new models and creation of algorithms, etc., and this includes inventions and innovations.

The empirical examination compares how total employment is subdivided into occupations in the Stockholm region and the rest of Sweden. For skills, we want to shed light on the following pattern:

- Cognitive skills and management-administration skills are overrepresented in large urban regions, and hence overrepresented in the Stockholm region.
- Motor and other skills are strongly underrepresented in the Stockholm region
- Social skills are equally frequent in Stockholm and the rest of Sweden, and tend to be spread in proportion to population size.

This pattern is illustrated in Table 5, which shows that the share of cognitive occupations is almost 30 percent larger in the Stockholm region than in the rest of the country, and management-administration skills are more than 35 percent larger in the Stockholm region. A structure like this may reflect that the Stockholm region attracts people with cognitive skills, and this attraction may in turn be caused by (i) amenities of the region

that are appreciated by persons with cognitive skills, and (ii) by higher wages in cognitive occupations located in the region. In the latter case it is often assumed that the pertinent occupations are more productive in large urban regions – when compared to a location in other urban regions (Glaeser, 2008).

Table 5: *Employment share of skills in Stockholm and the rest of Sweden 2007 (%)*

	Cognitive skills	*Managem. skills*	*Social skills*	*Motor & other skills*	*Total*
Stockholm	22.8	24.1	30.6	22.5	100.0
Rest of Sweden	17.7	17.6	30.9	33.8	100.0

Source: Statistics Sweden

In Table 6 we can see that a similar picture emerges when occupations are classified according to tasks. The Stockholm region has a higher share of both knowledge-handlers and information-handlers. At the same time the region's share is lower for service-handlers and goods-handlers. Taking Stockholm as an example of a large urban region, we may conjecture that there is a geographic division of labor, where large urban regions are specialized in knowledge and information activities and other regions have a higher share of occupations for handling of services and goods.

Table 6: *Employment share of tasks in Stockholm and the rest of Sweden 2007 (%)*

	Knowledge handling	*Information handling*	*Service handling*	*Goods handling*	*Total*
Stockholm	20.7	40.5	22.2	16.7	100.0
Rest of Sweden	16.5	33.6	27	22.9	100.0

Table 5 shows that cognitive skills as well as management-administration skills have both a larger share in the Stockholm region than the average for the country. In a similar way, Table 6 demonstrates that knowledge-handling and information-handling occupations dominate the labor market of the Stockholm region. We observe that the share of knowledge handlers with cognitive skills is size dependent. To test for this we can examine to what extent the agglomeration of each occupation type depends on urban size.

In the analysis we consider all urban regions in Sweden and try to show that the share of the four skill-type and the four task-type occupations are strongly dependent on the size of each region. In the regression equation the number of persons in an occupation of region *r*, E_r, is related to the population size, P_r, of the same region. This linear regression equation thus has the following form:

$$\ln E_r = \alpha + \beta \ln P_r + \varepsilon_r \quad (1)$$

The results from the regressions are presented in Table A.1 and A.2 in the Appendix. Our main interest is to show how the location of occupations depends on the size of each urban region. From the Appendix it is obvious that an urban region's occupation shares are strongly correlated with the size of each region. The size dependency is summarized in Table 7, which shows that a 10 percent increase of the total population of an urban region is associated with more than 11 percent increase in cognitive and management skills occupations as well as in knowledge-handling occupations, indicating that those occupations in a clear way are more frequent in large urban regions. As population size grows, the share of occupations associated with cognitive skills and knowledge handling increases in a disproportionate way.

Less than 10 percent increase as a response to growing urban size is recorded for occupations with motor skills as well as for service-handling and goods-handling occupations. The interpretation of this is that as a region grows, activities that intensively make use of these occupations gradually find their location in other smaller regions. Finally, we can observe that total employment grows faster than population size, implying a larger labor-market participation rate.

Table 7: *Occupation increase caused by a 10 percent increase in the population size of urban regions.*

Type of occupation by skill	*Occupation increase in percent*	*Type of occupation by task*	*Occupation increase in percent*
Cognitive	11.8	Knowledge	11.9
Management	11.0	Information	10.9
Social	10.1	Service	9.5
Motor	9.7	Goods	9.9
All occupations	10.3	All occupations	10.3

2.3 Specialization of Urban Regions with regard to Occupation Skills

The results in Table 7 may be complemented by an analysis of how each region's specialization in different occupations co-varies with urban size. For this exercise, specialization is measured by the specialization quotient for each occupation. The quotient, y_{rj}, of occupation *j* in region *r* is calculated as follows:

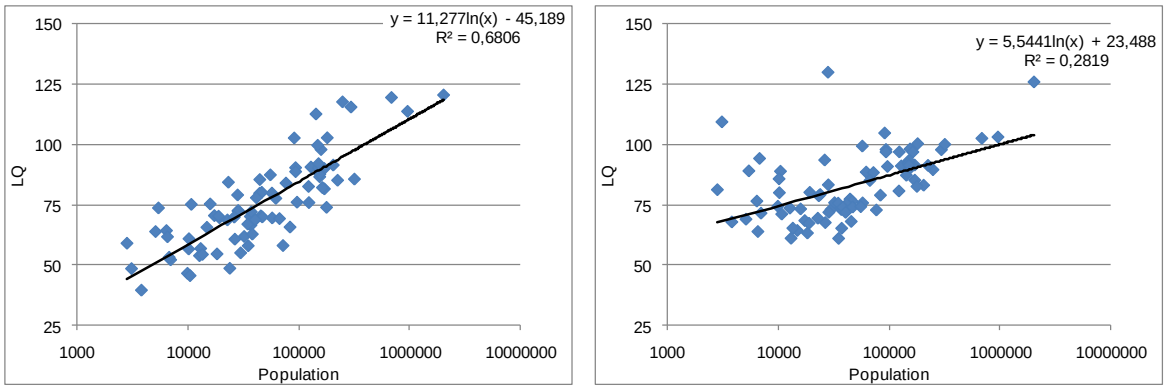
$$y_{rj} = 100 \cdot [Y_{rj} / Y_r] / [Y_j / Y] \quad (2)$$

where Y_{rj} denotes the number of persons with occupation *j* in region *r*, Y_r denotes the total labor force in region *r*, Y_j the total labor force with occupation *j* in the country, and *Y* denotes the country's total labor force. When y_{rj} is greater than 100 region *r* is specia-

lized with regard to occupation *j*. The specialization value can be regressed as a function of urban size by means of the following specification:

$$y_{rj} = \alpha + \beta \ln P_r + \varepsilon_r \qquad (3)$$

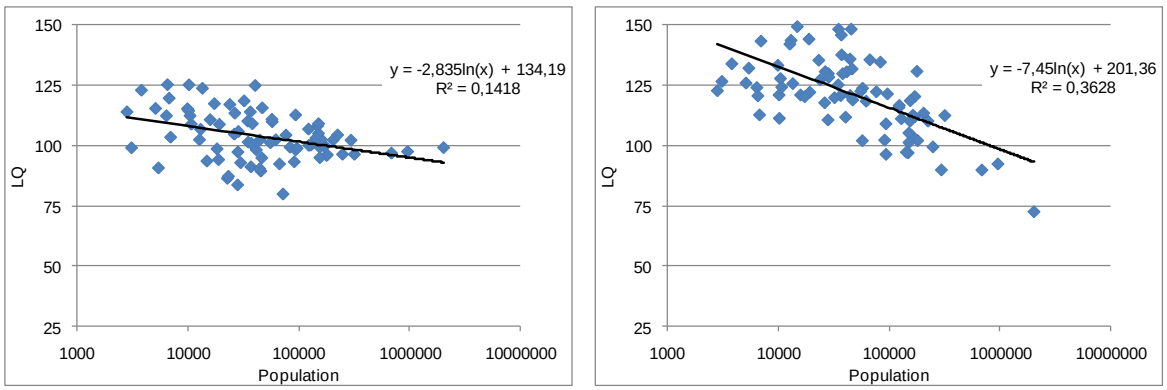
where P_r refers to the size of urban region *r*. From the diagrams in Figure 1 we can see that a region's specialization on cognitive occupations increases as the population increases. The same applies for management-administration occupations, but in this case the specialization increases at a slower pace.



Cognitive *Management & administration*

Figure 1: *The specialization quotient as a function of urban-region size for cognitive and management occupations.*

Turning to Figure 2, it is obvious that the specialization on motor-skills occupations declines with the size of an urban region. The same applies to a very modest degree for social skills, which rather seem to approach the level 100 as urban regions become large enough, and this observation is consistent with our earlier observation that social skills tend to be size neutral.



Social skills *Motor & other skills*

Figure 2: *The specialization quotient as a function of urban-region size for social skills and motor skills occupations.*

Large urban regions are characterized by being able to afford a richer spectrum of specialized firms as wells a broader composition of specialized labor supply. In particular, a diverse supply from many differentiated firms can take place because of the larger number of diversified customers in especially metropolitan regions like Stockholm. When a firm is small its possibilities to develop intra-firm division of labor are limited. As a consequence it has to purchase cognitive skills as services from other firms, and such opportunities are more plentiful in metropolitan regions. Table 8 illustrates that small establishments have a low share of persons with cognitive skills. The share is increasing as the size of an establishment increases, whereas management skills are fairly invariant to variations in size. Moreover, for establishment with more than 100 employees, the share of occupations with motor skills drastically decline.

Table 8: *Establishment size & occupation type in percent of total firm employment. Sweden 2007*

Employees	*Cognitive skills*	*Management & administration skills*	*Social skills*	*Motor & other skills*
1-4	13.0	23.7	21.9	41.4
5-9	9.3	20.8	26.1	43.8
10-19	10.8	20.5	24.1	44.6
20-49	13.8	19.9	23.3	43.0
50-99	15.9	20.3	23.0	40.8
100+	22.2	18.2	34.6	25.0
Sum	18.9	19.2	30.8	31.1

Source: Statistics Sweden

3. Knowledge, R&D and Innovations in the Stockholm Region

Innovations are generated by creative processes. There is a clear consensus in the innovation literature that the innovativeness of firms is positively affected by the individual firm's absorptive capacity as well as the corresponding capacity of the region where the firm dwells. There is very little information about the creative capacity of innovative firms – as measured by the composition of occupations. Because of this Section 3 will focus on knowledge intensity.

3.1 Innovation inputs and Outputs

The typical creative process in economic life is R&D activities, which by definition are designed to bring about new products and new routines of a firm. To emphasize that the verdict of a firm's creativity is made in the market place, the following exposition uses the term *innovation activities*, instead of R&D activities. This relates to the distinction between inventions and innovations, where the latter comprise those inventions and other novelties that are economically viable by generating revenues and profits in markets.

Figure 3 describes basic categories of inputs to innovation activities and basic outputs from the same activities. The inputs include a firm's (i) interaction with other actors, (ii) import flows, (iii) inflow of labor from other firms, (iv) knowledge-intensive labor, (v) accumulated knowledge, (vi) R&D routines and heuristics, and (vii) innovation activities as measured by spending. As a first step we compare the Stockholm region with the rest of the country in terms of innovation inputs.

The second part of the figure considers the output from innovation activities. In this case we discuss the introduction of new products and new export products and opening of new markets by firms in the Stockholm region.

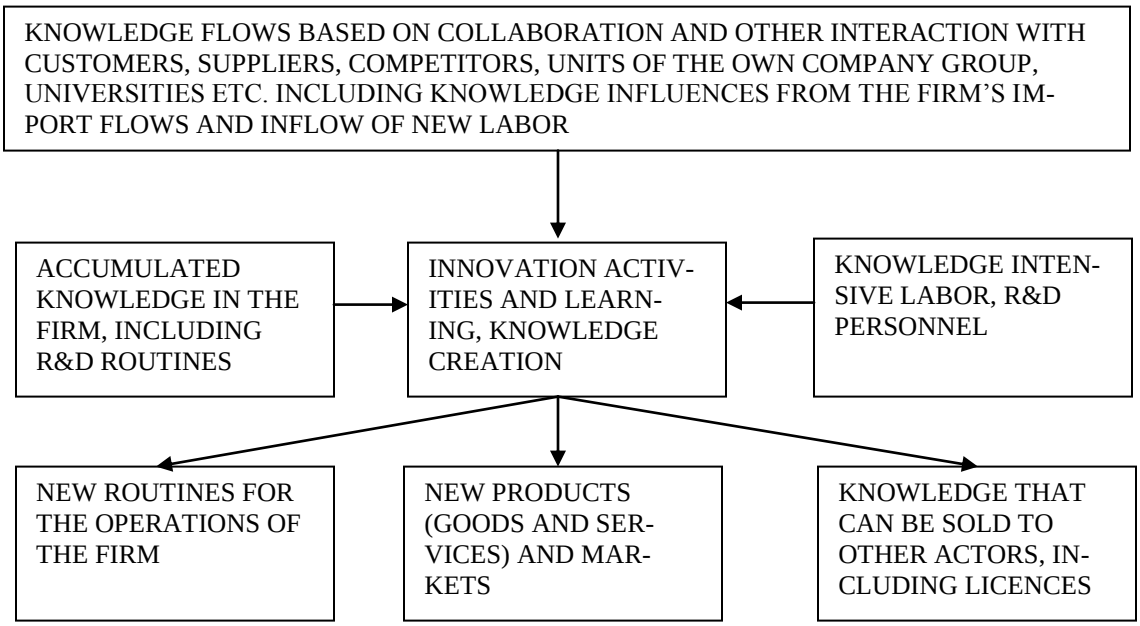


Figure 3: *Categories of innovation inputs and outputs*

3.2 Knowledge Intensity and Innovation Efforts by Firms in the Stockholm Region

Section 2 informs in Table 3 that the knowledge intensity has grown fast in Sweden during the period 1993-2007, with a very high expansion in the Stockholm region. In Table 9 the same development is described for two sub sectors of the economy – manufacturing and advanced services.

Table 9: *Knowledge intensity in manufacturing and advanced services*

Urban regions	*Manufacturing 1993*	*Manufacturing 2007*	*Advanced services 1993*	*Advanced services 2007*
Stockholm	13.8	25.2	26.6	38.2
Göteborg	9.4	19.9	25.1	36.9
Malmö	7.1	14.8	21.5	37.1
Medium-sized	3.7	8.9	14.4	24.0
Country	2.7	6.5	10.5	18.1

Remark: Knowledge intensity of the labor force is the share of labor with at least3 years of university education. Source: Johansson et.al. (2010). Advanced services = SIC 65-74 and Manufacturing = SIC 15-36.

Table 9 shows that the knowledge intensity in the Advanced-services sector has grown fast in all three metropolitan regions and reached a very high level, which is about 100 percent above the country average. Of course, this illustrates that knowledge intensity and creativity is clearly associated with service production. However, the values for the manufacturing industries show that their knowledge intensity is four times as large in

the Stockholm region as it is in the country as a whole. The message from that observation is that Stockholm's manufacturing sector has a markedly different orientation and activity composition than what applies to the non-metropolitan regions. The knowledge intensity of the Stockholm manufacturing firms reflects their orientation to innovation efforts and knowledge creation ambitions. However, we cannot substantiate that with firm-level data on occupation structure and its covariance with innovation efforts.

Table 10: *Innovation efforts in manufacturing and service sectors 2007*

Regions	*R&D Man years, %*	*R&D spending, %*
Stockholm	*33.4*	*33.3*
3 metropolitan counties[1]	76.0	78.0
The rest of the country	24.0	22.0
Total	100.0	100.0

Source: Statistics Sweden and Johansson et.al. (2010).

The population size of the Stockholm region is about a quarter of the country's population. This may be compared with the region's share of the country's innovation efforts, which shows that the region has a much stronger orientation towards innovation than the country average. Another observation is that ¾ of all innovation efforts in the country are associated with the three metropolitan counties.

3.2 The origin of Ideas and Import Diversity

In a widely cited contribution Jacobs (1984) outlines the mechanism behind the creativity and renewal of economic life in urban regions. Contrary to Marshall (1920), who stresses the importance of industry-specific localization economies of industry clusters, Jacobs suggests that creativity in economic life is stimulated by the diversity of large urban regions – metropolitan regions. Such regions offer their firms cross fertilization of ideas that grow out of industrial diversity with clusters of clusters and rich opportunities for novel combinations of seemingly unrelated fields.

In this context Jacobs points at a special feature of metropolitan regions: their interaction with the rest of the world economy by means of communication, export and import flows. In particular, metropolitan regions have a much richer composition of import flows than other regions, and such flows comprise products (goods and services) that add to the diversity that the region itself can produce. However, the important aspect is that the imports of metropolitan regions contain novelties from the world economy, and these novelties can stimulate existing and potential firms of the region to initiate their own product renewal and help the firms to detect new business opportunities. This picture can refer to Amsterdam in the 17th century or London in the 19th century. It also applies to the contemporary Stockholm region.

[1] The county of Stockholm is approximately equal to the Stockholm region, whereas the counties of Göteborg and Malmö are somewhat larger than the respective region.

How can we verify that import of ideas, services and goods enriches the diversity of a region's economy so that it can function as an inspiration resource for creative processes? One approach could be to just study how different urban regions grow in response to its import diversity. Here we will make use of a more direct Swedish study of how the arrival of innovation ideas to innovating firms affect the frequency with which they develop new export products and new links to foreign destination markets. Following Andersson and Johansson (2008, 2009), we can conclude that the frequency of innovation ideas increases as a consequence of the conditions enumerated below:

(i) The firm's experiences of previous product and market innovations and export activities.
(ii) Knowledge flows to the firm through import activities of the firm and its neighboring firms.
(iii) Output diversity and scale of the firm.
(iv) Knowledge intensity of the firm, reflecting absorption capacity
(v) Knowledge flows from the world to a firm belonging to a multinational company group via the internal network of the company group.
(vi) The accumulated knowledge among firms in the region about export opportunities.

With reference to the described conditions for export-product innovations, Table 11 presents export intensity in the Stockholm region and other Swedish regions. In the table we distinguish between exports that are carried out by trading companies (wholesale, agencies etc) and by manufacturing firms. Trading firms are specialized to manage thin flows to a multitude of destinations. When flows are thicker they are exported by the manufacturing firms themselves. As shown in Table 11, more than 50 percent of the exports by trading firms in Sweden are managed by firms in the Stockholm region. In contrast, direct exports managed by the producers themselves are just around ¼ of total exports, which is proportional to Stockholm's population share.

Table 11: *Export shares of trading and manufacturing firms 2004*

Urban regions	*Share of total export value. Trading firms*	*Share of total export value. Manufacturing firms*
Stockholm	51	26
Göteborg	14	18
Malmö	8	4
Sum of medium-sized	18	34
Sum of small regions	9	18
Total	100	100

Remark: Manufacturing = SNI 15-36, Trading firms = SNI 50-52. Source: Statistics Sweden and Johansson et.al. (2010)

For trading companies, we observe a strong concentration of their export value in the Stockholm region, matched by an even stronger concentration of their import value in the same region. As shown in Table 12, the import share of the Stockholm region's trad-

ing firms is close to 60 percent. We may also verify that the import flows via trading firms is extremely diversified. When we distinguish import events by an 8-digit product code combined with an identification of the country origin of each import flow, the number of import events of trading firms reach the value 140 000 (Johansson, et.al., 2010). This can be compared with the same type of diversity measure for the Göteborg region with 65 000 and the Malmö region with just above 40 000.

Table 12: *Import shares of trading and manufacturing firms 2004*

Urban regions	*Share of import value. Trading firms*	*Share of import value. Manufacturing firms*
Stockholm	57	21
Göteborg	13	20
Malmö	8	5
Sum of medium-sized	16	34
Sum of small regions	6	20
Total	100	100

Remark: Manufacturing = SNI 15-36, Trading firms = SNI 50-52. Source: Statistics Sweden and Johansson et.al. (2010)

3.3 Knowledge Flows Through Labor Mobility

A firm collects information about markets and technology through many channels as discussed in the previous text. Some of the knowledge flows are paid for in knowledge transactions in the form of purchases from knowledge providers, including payments for patents. Still, an important part of knowledge flows seem to be pure knowledge spillovers. How do these spillovers take place? And why are these spillovers larger in metropolitan regions?

In large urban regions the labor market is denser than elsewhere, making the supply of labor more varied, with many specialized competences. Such thick labor markets can substantially increase the congruence between a heterogeneous supply and an equally differentiated demand for specialized labor from firms. In this way, persons with specialized qualifications can more accurately be assigned to jobs which require those qualifications, causing improved productivity.

Labor market mobility is important also from a dynamic development point of view. When individuals shift employment from one firm to another, then the individual carries with him/her experiences and knowledge to the new firm. This evidently is an important mechanism for knowledge spillovers. The following observations illustrate how labor mobility affects knowledge flows in the Stockholm region (Andersson and Thulin, 2008; Johansson et. al., 2010):

- In a large and dense region like Stockholm, labor mobility has a higher frequency than in other Swedish regions. The larger knowledge intensity in the Stockholm

region also implies that its labor mobility affects knowledge flows especially much.

- Econometric analyses show that labor productivity is higher in regions with larger labor-mobility intensity.
- The growth of labor productivity is faster in urban regions with large labor-mobility intensity.
- The labor mobility is higher than average for employees working in industries classified as advanced services.[2] In this context we observe that the Stockholm region has both a high share of advanced services and an intense labor mobility.
- The labor mobility is higher for knowledge-intensive labor, which favors the Stockholm region with its high knowledge intensity.

4. The Creative Clusters of the Stockholm Region

Section 4 examines four clusters with high specialization in the Stockholm region and presents observations about their growth pattern. In the Swedish discussion, the pertinent industries have been labeled creative or innovative clusters.

4.1 Cluster Formation in the Stockholm region

The preceding sections provide an exposé of the structural development of the Stockholm region. A major feature of the evolution has been a rapid expansion of the knowledge intensity and hence a growing share of knowledge handlers with cognitive skills. Knowledge intensity has increased in all sectors but the intensity is far from evenly spread across sectors, and this may also imply that creative processes are more prevalent in some sectors than in others.

One way to organize available data is to consider those sectors and sub sectors for which the Stockholm region has a high specialization quotient (ratio) as specified in formula (2). Our hypothesis is that knowledge intensity and creativity in the region is primarily concentrated in industries with a high specialization quotient. As shown in Johansson et.al. (2010), such an approach is supported by the fact that the Stockholm's specialization pattern differs significantly from the pattern that can be found in the other two metropolitan regions, Göteborg and Malmö.

In the sequel we suggest that a cluster is identified as co-located firms in a group of associated industries with (i) a high specialization ratio, (ii) location in the region of suppliers that deliver to the firms in the cluster, (iii) location in the region of customers of the firms in the cluster, and (iv) tangible and intangible infrastructure endowments in the region (Figure 4). The cluster formation is strengthened when suppliers deliver distance-sensitive inputs to the cluster firms, and when the latter deliver distance-sensitive products (services) to their customers in the region. The observation is that distance depen-

[2] Advanced services comprise SIC 65-74.

dency stimulates the co-location of cluster firms and the cluster's environment of firms (Johansson and Forslund, 2008).

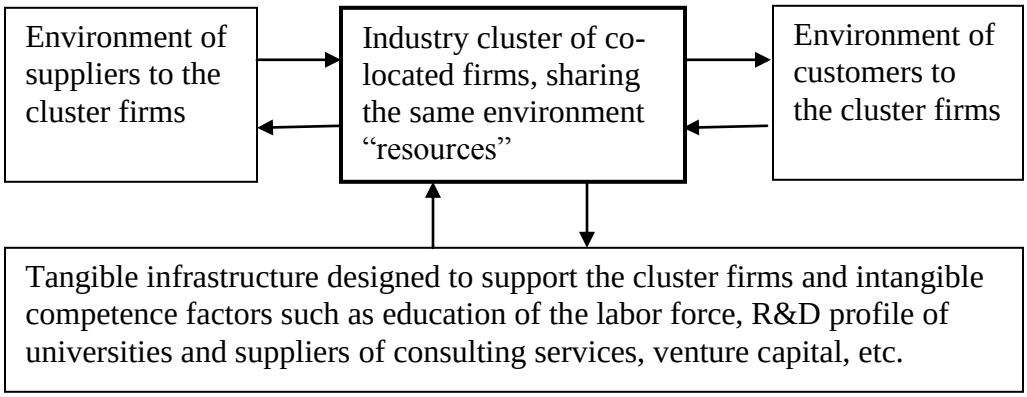


Figure 4: *An industry cluster and its environment of suppliers, customers and endowments*

In a study from the 1990s Johansson and Strömquist (1998) identify 5 major clusters in the Stockholm region. From these, we have selected 4 clusters that satisfy the label "creative clusters". In these clusters we find occupations requiring cognitive skills of persons working as knowledge and information handlers. The clusters are presented in Table 13, and they comprise (i) knowledge, information and market services to firms, (ii) financial services, (iii) media commodities and services, and (iv) ICT commodities and services. Specialization is recorded when the ratio is above 100, and hence the ratio 204 for financial services in 2008 means that these activities are overrepresented by 104 percent in the Stockholm region.

Table 13: *Four creative cluster of the Stockholm region*

	Specialization 1993 (%)	*Specialization 2008 (%)*
Services to firms: legal incl. patents, accounting, market analysis, organization, advertisement, design, fairs & conferences (25 SIC codes)	157	138
Financial services: banking, securities, insurances, etc. (16 SIC codes)	188	204
Media: printing, electronic mediation, video and films (21 SIC codes)	148	165
ICT products and services: production of and trade with office equipment, software and ICT services (23 SIC codes)	200	173
Remaining sectors of the economy	92	89

Source: Statistics Sweden

Table 13 shows that the four clusters together increase their specialization between 1993 and 2008, since the remaining sectors of the economy reduce their joint ratio from

92 to 89. In this period financial services and media increase their specialization, whereas the ratio is reduced for ICT commodities and services, and for services to firms.

4.2 Specialization in the Stockholm Region and Diffusion to other Regions

Following Karlsson and Johansson (2006), we can observe a global transformation of large urban regions from predominantly industrial economies to knowledge economies, changing the composition of industries, the location of production, the occupational structure, the education level, the variety of goods and services and the R&D intensity. In this process, outsourcing of producer services plays a major role, allowing producers of both goods and services to decompose their production into sub-processes, which can be outsourced to new and separated suppliers of producer services. As shown in Table 14, firm services has continued to grow both in the Stockholm region and the country as a whole. This happens across all sizes of urban regions (Johansson, et.al., 2010). In a similar way the majority of industries in the ICT cluster also diffuse across the rest of the country (Johansson, 2006; Johansson and Paulsson, 2009). There are some but much weaker signs of spatial diffusion of financial services. The final observation in Table 14 is on the other hand quite strong:

> Industries in the media cluster do not display any general diffusion from the Stockholm region to other urban regions.

Table 14: *Growth Rates in the Stockholm Region and in Sweden. (%)*

	Stockholm		***Sweden***	
Year	*1993-2000*	*2000-2008*	*1993-2000*	*2000-2008*
Firm services	84.55	20.00	67.1	37.3
Financial	12.53	14.17	1.1	7.22
Media	0.39	11.44	-4.04	-4.94
ICT	17.8	78.11	37.3	56.85
The rest	9.77	9.72	4.27	8.03

Source: Statistics Sweden

The growth of creative clusters as illustrated in Table 13 can be said to reshape the entire economy towards a stronger concentration of activities in the Stockholm region, and other large urban regions. From Table 1 we also know that the three metropolitan regions grow much faster than other urban regions in the country. Does this mean that there is a conflict between the metropolitan and the other regions in the process of economic renewal? The question is essential because industries in the four clusters represent a growing segment of the contemporary economy in Sweden and other OECD countries.
In the Stockholm region, total employment in the four clusters amounts to 24 percent of the entire employment. The same figure for Sweden as a whole is 14 percent.

To answer the above question we can refer to several studies, where Forslund (1997) refers to the 1980s, RTK (2003) to the 1990s, and Johansson and Klaesson (2010)

refers to the period 1999-2006. All these studies confirm the picture provided in Table 15, where the message is that industries with high specialization in the Stockholm region can be expected to diffuse to other urban regions in the country. High specialization in Stockholm thus predicts that the industry is very likely to grow in a large number of other regions. The opposite holds true for industries with a low specialization in the Stockholm region. This indicates that structural change is initiated in the Stockholm region, while other urban regions follow the same path although with a clear delay.

Table 15: *Diffusion regularity for industries with high and low specialization in the Stockholm region*

INDUSTRIES WITH	*EXPANSION IN THE REST OF SWEDEN*	*CONTRACTION IN THE REST OF SWEDEN*
High specialization in the Stockholm region	The pertinent industries (including the Stockholm clusters) increase their employment in most other regions.	
Low specialization in the Stockholm region		Majority of pertinent industries reduce their employment in most other regions

Source: Forslund (1998), RTK (2003), and Johansson et.al. (2010)

Other smaller clusters in the Stockholm region, which follow the dynamic pattern in Table 15, comprise (i) Marketing, advertisement and conference activities, (ii) Travel services and some transport services, and (iii) Pharmaceuticals and medical equipment industries. With few exceptions the industries with high specialization in the Stockholm region employ a large share of persons with cognitive skills and university education in occupations characterized by knowledge-handling tasks.

5. Attracting Households Embodying Talents and Knowledge Resources

5.1 What Attracts Household to the Stockholm Region?

For a 35 years period, between 1970 and 2005, more than half of Sweden's population increase can be attributed to growth of the Stockholm region. Such an expansion requires that both the number of jobs and the supply of labor grow. There are strong empirical evidence that this growth process satisfies a pattern where jobs follow people (Johansson and Klaesson, 2007). This finding associates with theoretical arguments in agglomeration economics, that large urban regions attract firms and job creation by offering labor supply, diversity of input opportunities and large local demand for distance sensitive output, especially supply of service varieties.

Urban regions primarily grow as a result of having larger in-migration than out-migration flows. A positive net migration is often taken as a sign of a region's attractiveness. The choice of moving from one region to another is associated with a series of cost components such as costs of transporting household members and equipment, finding new housing, finding a new job, breaking up old and establishing new social networks, etc.

Do the migration flows bring about a gradual concentration of creative occupations in the largest urban regions? Available data do not allow for such an analysis. As a substitute, our interest is directed towards migration flows that make the knowledge intensity grow in the largest urban regions. In view of this, there are two major categories of movements: (i) to carry out university studies and (ii) to find a job after finished university studies. For the latter type of flow, the literature recognizes the following two separate motives:

- The working life or job motive, with focus on the career opportunities and the expected wage premium associated with changing location.
- The consumption motive which includes the diversity of consumption alternatives, public goods and other amenities in the new location.

Comparing the Stockholm region with a typical medium-sized region in Sweden, we can conclude that the diversity of job opportunities is more than 7 times as high in the Stockholm region (Johansson, et.al., 2010). The diversity advantage is especially pronounced with regard to knowledge-handling jobs that require cognitive skills.

5.2 Attractiveness, Wage Premium and Amenities of the Stockholm Region

Attractiveness of a region reveals itself in in-migration and generates high demand for land and housing, and this generates scarcity and increasing dwelling rent levels. As a consequence, household income need to be higher than elsewhere in such a region, which should be reflected in higher wages. In turn, the latter requires that attractive urban regions have higher productivity. In view of this, one may contemplate an adjustment process as described in Figure 5 (Glaeser, 2008). Attractiveness as perceived by households and agglomeration advantages as perceived by firms bring about increasing wages and land values with higher rents for dwellings and premises. For Stockholm, this is reflected by housing prices that are about double the average for the country, and 3-4 times as high as in medium-sized and smaller regions. The rent level in Stockholm for CBD floor space in retailing is normally 5-6 times as large as the CBD rent level in medium-sized urban regions (Johansson, et.al., 2010).

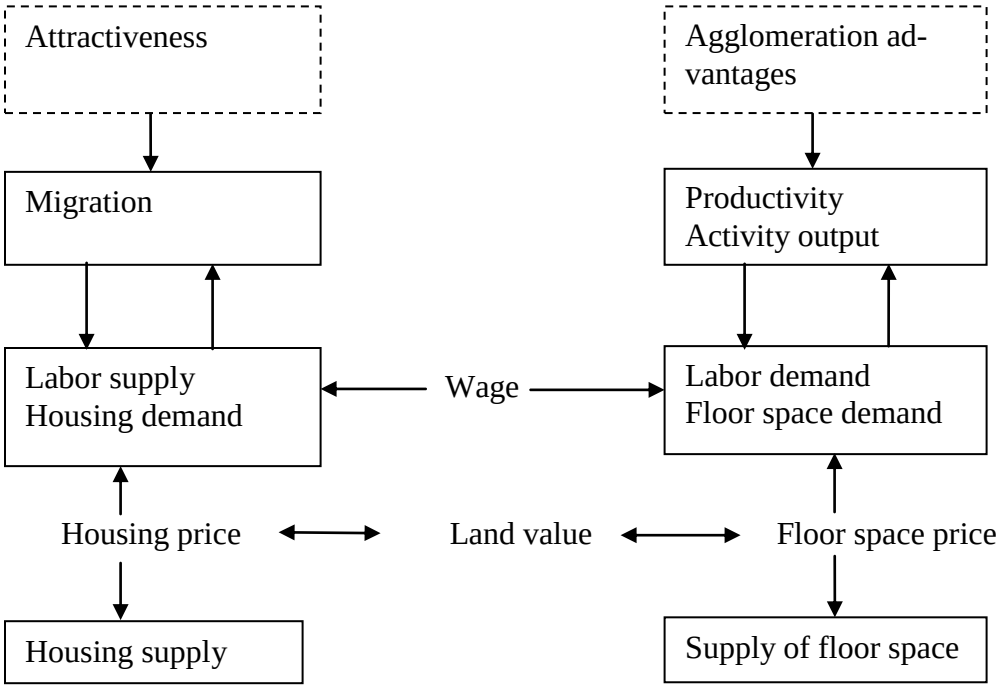


Figure 5: *Location of households and firms and equilibrium adjustment of housing and floor space prices*

Calculating an average wage index for all Swedish urban regions in 2006, we can conclude that the wage index of the Stockholm region was 22 percent higher than the average for the country and 34 percent higher than the average for medium-sized regions. Partly this reflects that the average education level has remained higher for the Stockholm region. However, we can also disregard the education effect and instead calculate the average wage premium associated with a job in the Stockholm region for different occupation groups, as presented in Table 16. The premium is highest for management-administration skills and has about the same positive level for social and cognitive skills. For motor skills there is barely any premium. The wage level for occupations with motor skills is approximately the same in the Stockholm region and the rest of Sweden. A similar result for motor-skills occupations is reported for the U.S. in Bacolod, Blum and Strange (2009).

Table 16: *Average monthly wage (SEK) 2008*

	Cognitive skills	*Management & administration skills*	*Social skills*	*Motor & other skills*
Stockholm region	34 047	37 081	25 716	22 518
Rest of Sweden	29 526	29 100	21 916	22 085
Stockholm/Rest of Sweden, %	115	127	117	102

Source: Statistics Sweden

Why is the wage premium lower for occupations with cognitive skills than for occupations that require management and administration skills? A primary reason can be that a large share of knowledge handlers with cognitive skills is employed by the public sector, where wages on average are lower than in the private sector. This may be complemented by the conjecture that knowledge handlers appreciate the location amenities of a large urban region, and that knowledge handlers may experience a creativity externality such that localized knowledge handlers are a major attraction factor for knowledge handlers – all in jobs requiring cognitive skills.

The overall attractiveness of the Stockholm region has been summarized in the following way (Johansson, et.al. 2010):

- Large accessibility to a wide range of job opportunities with many potential employers, in particular in occupations requiring cognitive skills.
- An infrastructure that increases households' accessibility to private and public services, and that makes public goods accessible.
- A diverse and tradition-rich supply of cultural services.
- An infrastructure that provides a rich variation of waterfront contact both for housing and workplaces.
- A great variation of housing and recreation milieus.

6. Concluding remarks

This chapter illustrates the importance of the Stockholm region for the Swedish economy. For a long period of time the Stockholm region has been the major centre for knowledge development, innovations and intellectual creativity in Sweden. It has maintained this position by hosting more of diversity and many-sidedness than other regions. Given this position, the region has been an attractor for individuals with ambitions and talents in political, economic and cultural life. At the same time novel ideas and solutions have continued to diffuse from the Stockholm region to other regions of the country.

The knowledge intensity of the Swedish economy has increased during the period studied. The increase was faster in the metropolitan regions, and in particular the Stockholm region. This development has been related to the well-established hypothesis that the knowledge intensity of an urban region reflects the absorption capacity of firms in the region, implying that firms can make use of all sorts of novelties in the world economy as stimuli for own imitations and innovations (Cohen and Levinthal, 1990).

It is shown that cognitive and management skills occupations dominate the labor market of the Stockholm region, and that jobs with these skills correlate strongly with knowledge and information-handling task. Descriptive statistics are used to illustrate the associated wage-level advantage of the Stockholm region. In this context, the presentation also stresses that Stockholm's manufacturing sector has a markedly higher share of knowledge-intensive labor than any other region of the country, reflecting a concentration on innovation activities of the Stockholm manufacturing firms.

A major distinguishing feature of the Stockholm region is its interface with international import flows into the region. These flows are disproportionally large in terms of value as well as diversity. The important aspect is that the import flows contain novelties from the world economy. These novelties can stimulate existing and potential firms in the region to initiate the introduction of own new products, and they can help the firms to detect new business opportunities. Based on these observations, the presentation suggests that the Stockholm region functions as a source of innovation and business renewal for the rest of the country as novelties diffuse through the regional hierarchy.

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Appendix

Tables A.1 and A.2 present the results from estimating the regression equation

$$\ln E_r = \alpha + \beta \ln P_r + \varepsilon_r$$

where the dependent variable E measures the number of persons in each urban region with different occupation skills (Table A.1) and with different occupation tasks (Table A.2)

Table A.1: *Urban size and employment in different skill categories*

Dep.Var.	*Tot emp*	*Cognitive*	*Management*	*Social*	*Motor*
Const (α)	-1.25	-4.80	-3.81	-2.11	-1.51
t-value	(-16.1)	(-31.5)	(-22.8)	(-26.3)	(-11.3)
Pop (β)	**1.03**	**1.18**	**1.10**	**1.01**	**0.97**
t-value	(144.0)	(83.6)	(70.9)	(135.6)	(78.0)
R^2	0.996	0.989	0.985	0.996	0.987
No. Obs.	81	81	81	81	81

The estimated parameters are highly significant for both skills and tasks. One interesting observation is that employment increases faster than population. A second observation is that cognitive skills as well as knowledge-handling occupations display a clearly higher threshold, as reflected by large α -values.

Table A.2: *Urban size and employment in different task categories*

Dep.Var.	*Tot emp*	*Knowledge*	*Information*	*Service*	*Goods*
Const	-1.25	-4.95	-2.95	-1.6	-2.14
t-value	(-16.08)	(-31.39)	(-21.08)	(-15.89)	(-15.62)
Pop	**1.03**	**1.19**	**1.09**	**0.95**	**0.99**
t-value	(143.97)	(81.21)	(83.83)	(102)	(77.63)
R^2	0.996	0.988	0.989	0.992	0.987
No. Obs.	81	81	81	81	81

Table A3: *Definition of cognitive and knowledge handling occupations*

Knowledge handling	Occupation
1	Physicists, chemists and related professionals
1	Mathematicians and statisticians
1	Computing professionals
1	Architects, engineers and related professionals
1	Life science professionals
1	Health professionals (except nursing)
1	Nursing and midwifery professionals
1	College, university and higher education teaching professionals
1	Secondary education teaching professionals
1	Primary education teaching professionals
1	Special education teaching professionals
1	Other teaching professionals
1	Legal professionals
0	Archivists, librarians and related information professionals
1	Social science and linguistics professionals (except social work professionals)
1	Writers and creative or performing artists
1	Psychologists, social work and related professionals
1	Physical and engineering science technicians
0	Computer associate professionals
1	Optical and electronic equipment operators
1	Life science technicians
1	Artistic, entertainment and sports associate professionals
0	Potters, glass-makers and related trades workers
0	Handicraft workers in wood, textile, leather and related materials
0	Craft printing and related trades workers
0	Wood treaters, cabinet-makers and related trades workers