



Centre of Excellence  
for Science and Innovation Studies

**CESIS** Electronic Working Paper Series

Paper No. 253

**Metropolitan Regions: Preconditions and Strategies for  
Growth and Development in the Global Economy**

**Johan Klaessona**  
**Börje Johanssonb**  
**Charlie Karlssonc**

August 2011

# **Metropolitan Regions: Preconditions and Strategies for Growth and Development in the Global Economy**

Johan Klaesson<sup>a)</sup>, Börje Johansson<sup>b)</sup> and Charlie Karlsson<sup>c)</sup>

a) Jönköping International Business School,

b) Jönköping International Business School and Royal Institute of Technology,

c) Jönköping International Business School, Blekinge Institute of Technology, Karlskrona and University West, Trollhättan

## **Abstract**

The importance of metropolitan regions as national growth and development engines, and in particular as driving forces in national as well as global innovation processes is well recognized. This paper highlights the role of metropolitan regions in different contexts in order to lay a foundation for future research on metropolitan regions and their development. Specifically, the paper dwells on the role of metropolitan regions as nodes in national and international networks and as nodes of knowledge generation and innovation. Further, market potential as a concept describing the economic concentration to and the opportunities of making contacts within and between metropolitan regions is introduced. Additionally, the internal dynamic of metropolitan regions and the role of fast and slow processes is described. Lastly this paper illustrates how the input and output market potentials represent factors that adjust slowly and that play the same role for metropolitan development as metropolitan infrastructure.

**JEL codes:** O18, O31, R11, R12

**Keywords:** Metropolitan regions, market potential, networks

## I. Introduction

Metropolitan growth has been dramatic in the industrialized countries since the Second World War. Today, metropolitan regions are increasingly recognized as the national growth and development engines in a globalizing world (Jacobs, 1984; Huggins, 1997), and in particular as the driving forces in national as well as global innovation processes (Shefer & Frenkel, 1998). In the industrialized countries, the metropolitan regions play a critical role not only as major generators of value added but also as major nodes for creativity, innovation and entrepreneurship as well as for communication and transportation. In line with Duranton and Puga (2005), one could claim that metropolitan regions are functionally specialized in the invention and creation of new products, i.e. innovation. Thus, since they are highly diversified and contain a broad range of different types of industries, local business services and firm sizes, they function as “incubator cities” (Chinitz, 1961) or “nursery cities” (Duranton & Puga, 2001), i.e. as superior ‘incubators’ for the development of innovations and for the development and growth of both new and small firms.

Traditionally, regional science research has shown that metropolitan regions provide agglomeration economies in the form of localization and urbanization economies to their economic actors. More recently, it has been stressed that they function as gateways to other regions, thus linking the economic actors in the region with economic actors in other regions nationally and abroad (Andersson & Andersson, 2000, Eds.). These two aspects are critical not least for the innovative potential of metropolitan regions (Revilla Diez, 2002). The innovative capacity of economic actors is not determined by their own R&D investments and capabilities only. It is also obvious that the context matters, which implies that a region’s innovative capacity is determined by region-specific location factors (Falck & Heblich, 2008; Glaeser & Kerr, 2009). The options for cooperation during innovation processes with regional partners, as well as with partners in other regions are important location factors that reduce risks and uncertainties and offer opportunities for collective learning within clusters (De Bresson & Amesse, 1991; Lakshmanan & Okumura, 1995; Malecki & Oinas, 1998; Ejeremo & Karlsson, 2006). The relevant partners include demanding customers, qualified suppliers, producer service companies, and competitors as well as research universities, and research institutes. Generally, innovation takes place in regions rich with knowledge-based location factors (Audretsch & Feldman, 1996) and metropolitan regions are rich with such factors.

Due to their size, metropolitan regions offer a great variety and diversity of partners for innovative economic agents with a potential to ensure synergies in innovation processes. It should in this connection be observed that metropolitan regions are characterized by a high degree of openness. They are the major nodes in national and international transport and communication networks and as such, they function, in particular, as import nodes for new ideas, new knowledge, and innovations (Jacobs, 1969 & 1984; Braudel, 1979). They also host the majority of the economic actors that in particular benefit from this openness, namely the multinational companies, domestic as well as foreign, which operate ownership, innovation, input, production, and delivery networks that include many countries and regions including other metropolitan regions and sometimes are of global proportions. Multinational companies increasingly tend to use several home bases in different metropolitan regions instead of being confined to one headquarter location in one specific metropolitan region in order to exploit resources across a wider geographical extent (Michie, 2003).

Empirical studies in various countries during the last 15 years of the spatial distribution of innovative activities have convincingly shown that metropolitan regions have a high innova-

tion potential (Anselin, Varga & Acs, 1997; Varga, 1998; Brouwer, Budil-Nadvornicova & Kleinknecht, 1999; Beise & Stahl, 1999; Andersson, Gråsjö & Karlsson, 2008). Metropolitan regions have been found to be the most important locations for innovations generating 96 per cent of all registered product innovations in the US (Audretsch & Feldman, 1999). The empirical results also indicate that diversity as suggested by Jacobs (1969) stimulates innovation. Sectoral specialization on a small number of industries generally seems to have a negative effect on the regional innovation output level.<sup>1</sup> Metropolitan regions are generally characterized by a more diverse economic structure than other regions, which tend to generate proportionally higher innovation outputs (Audretsch & Feldman, 1999). Thus, metropolitan regions tend to offer favourable conditions for innovative economic agents. Here, these economic agents normally find a diversified economic structure, a qualified labour force, qualified and competent co-operation partners in the form customers, suppliers, competitors, producer service firms, research institutes, research universities, etc. (Ewers & Wettman, 1980; Howells, 1983; Suarez-Villa & Fischer, 1995).

Given the importance of metropolitan regions not least for innovation and growth, it is critical to increase the understanding of

- how metropolitan regions function in terms of the simultaneous interactions between different metropolitan subsystems such as population, labour supply, housing, services, infrastructure, economy, workplaces, and metropolitan management, to provide a fertile seedbed for innovation,
- how the life cycles of metropolitan regions evolve over time,
- how metropolitan regions interact and compete with each other,
- how metropolitan regions interact with non-metropolitan regions,
- the factors determining differences among metropolitan regions in their capacity to nurture innovation and growth, and
- how metropolitan policies must be designed to secure the long-term vitality of metropolitan regions.

The purpose with this working paper is to discuss these issues and to lay a foundation for future research on these issues.

## **1.1 Metropolitan Regions as Nodes in National and International Networks**

Metropolitan regions may be perceived as large production and consumption systems based upon extensive information and knowledge processing. They are characterized by their agglomeration of economic activities and by their intra-regional transport infrastructure, facilitating very large movements of people, inputs and products within their interaction borders. One fundamental characteristic of a metropolitan region is the large integrated labour market with a much more intensive commuting as well as job search and search for labour within the region than between regions (Johansson, 1997). The border of the integrated labour market region is a good approximation of the borders of a metropolitan region.<sup>2</sup>

---

<sup>1</sup> However, there are a few studies indicating that specialization fosters innovation (Acs, FitzRoy & Smith, 2002).

<sup>2</sup> Fujita (1989) identifies an urban region by deriving increasing commuting costs from increasing distance to the city centre, which hosts the majority of all workplaces.

In all industrialized countries, the metropolitan regions are responsible for a major share of the economic activities. They are the major nodes in each country's inter-regional transport, communication and interaction networks and together they make up the major nodes in the same international networks. The role that metropolitan regions play in these networks has changed over time. When they started to develop, they were normally locations for large-scale industrial production. Today they are normally centres for decision-making in business and government, negotiations, knowledge creation and other activities dependent upon face-to-face interaction but also for consumption and tourism.

Metropolitan regions have developed out of smaller towns and cities that for extended periods have grown more rapidly than other towns and cities. However, their long term development not only include stages of fast growth but also stages of maturity, and in some cases stages of obsolescence and also decline (Jacobs, 1961). Over time, they have often developed specialized roles in the national and international systems (Noyelle & Stanback, 1984) but at the same time, they exhibit a degree of diversity not found in non-metropolitan regions. With technological and structural changes in the world economy, the specialization of metropolitan regions may become obsolescent (Jacobs, 1969) and rigidities develop due to that the specialization may delay the rejuvenation of their economies for extended periods. Some metropolitan regions may never be able to regain their previous position in the national and international systems since they lack locational attraction for expanding sectors in the international economy.

Urban regions develop at different speeds and in different directions in processes, which are interrelated with demographic processes. Migration and intra-urban relocation of households are not only reactions to the economic development of nations and urban regions but have their own dynamics due to different population cycles. Some of these phenomena are not only to a certain universal but also parallel among different industrialized nations and thus common to many urban and metropolitan regions, which may differ in many other aspects.

Urban and metropolitan regions are in many respects related. The development from a non-metropolitan to a metropolitan region is characterized by the expansion of population and economic activities and the construction of physical elements such as housing, industrial sites, office buildings, infrastructure and transportation facilities. Many attributes of these physical elements are shared by different metropolitan regions. The growth and expansion process of metropolitan regions has certain general effects, which are common for all metropolitan regions, such as more and more space becoming occupied by buildings, facilities, and other durable infrastructures and an increased density of economic activities in central locations.

Over time, different rigidities are built into the metropolitan structure and the location of new economic activities becomes more demanding in terms of investments and relocation of more mature activities. Every metropolitan region develops from a young to an old structure, which may be very durable. However, the vitality may be preserved if enough resources are invested in renewal processes.

## **1.2 Market Potential and Metropolitan Regions**

The concept of market potential can be used as a means to describe the economic concentration to and the opportunities of making contacts within and between metropolitan regions (Lakshmanan & Hansen, 1965). There are strong reasons for making a precise distinction

between the internal and the external market potentials of metropolitan regions. The geographic delineation of a metropolitan region is in a fundamental way related to the identification of its internal market potentials. The internal market potentials are measures of the existing opportunities in various markets inside the borders of a metropolitan region.

Goods and services vary with respect to the contact- and/or interaction-intensity associated with their input and/or output transactions (von Thünen, 1826; Lösch, 1943; Hirsch, 1967). Little or no direct contact between buyer and seller is necessary for goods and services with standardized and routine transaction procedures. Moreover, when a pair of suppliers and customers repeats the delivery of a certain good or service, the interaction between these two actors can normally be routinised, and hence the contact intensity decreases and the transaction costs decline. On the other hand, many goods and services are traded under complex and contact-intensive conditions, which often involve transaction phenomena such as inspection, negotiations and contract discussions, technical and legal consultation, and documentation of agreements. Such goods and services may themselves be complex and have a rich set of attributes. However, the basic thing is that, from a transaction point of view, they are not standardized, and the interaction procedures are not routine. A special example of a contact-intensive transaction is the case when a good or a service is customized and designed according to specifications made by the customer during an often time-consuming process of supplier-customer interaction.

Interaction costs are normally much lower for transactions within a metropolitan region than between regions. This implies that contact-intensive goods and services have distance-sensitive transaction costs and that these geographic transaction costs rise sharply when transactions are made between regions (Johansson & Karlsson, 2001). Of course, goods and services can also be distance-sensitive with respect to input transactions. As a result, the interaction-frequency associated with distance-sensitive goods and services supplied in a given metropolitan region can be assumed to decrease with increasing time distance from the centre of the region (Holmberg, Johansson & Strömquist, 2003).<sup>3</sup>

For each type of good or service in any region, it is possible to divide the total market potential into the internal (intra-regional) and the external (inter-regional) market potential. Companies who want to supply distance-sensitive goods or services must find a sufficiently large demand for their sales within their location region. Since internal economies of scale normally prevail, the internal market potential must exceed a certain threshold if companies producing distance-sensitive goods and services shall be able to make a profit. This implies that “economic density” matters (Ciccone & Hall, 1996; Karlsson & Pettersson, 2005), which gives metropolitan regions special advantages when it comes to supplying distance-intensive goods and services.

The size of the internal market potential in a metropolitan region is among other things a function of the capacity and quality of its interaction infrastructure. Such infrastructure has the role of offering high density combined with low transaction costs, i.e. a high intraregional accessibility (Johansson, 1996). A high intraregional accessibility implies that suppliers of distance-sensitive goods and services can reach a large number of potential customers and that producers can be reached by many suppliers offering distance-sensitive inputs as well as by many households supplying specialized labor inputs.

---

<sup>3</sup> It is a general result from spatial interaction theory that the interaction intensity is a decreasing function of the time distance between origin and destination (Sen & Smith, 1995).

A rich infrastructure for interaction is a special characteristic of metropolitan regions. This infrastructure, which reduces interaction costs, primarily consists of the entire built environment with its various networks for transportation and communication and its many different arenas for meetings, negotiations, education, and so on (Batten, Kobayashi & Andersson, 1989; Kobayashi, 1995). However, it also includes the links connecting the metropolitan region with other regions and the associated external market potential. The intra- and inter-regional infrastructure has two fundamental roles (Lakshmanan, 1989): i) it influences the consumption, production and innovation possibilities of regions, and ii) it is intrinsically a collective good in the sense that it is common to all economic agents in a region, households as well as companies. Thus, the infrastructure will in a basic way influence the internal and external market potential of a metropolitan region by i) extending its spatial interaction links, and ii) determining the intra- and interregional accessibility of the region. Infrastructure is durable and continues to deliver services over long periods, and in this way, it influences a metropolitan region's economic and environmental sustainability.

The intra-regional infrastructure makes it possible to combine a high economic density with low interaction costs for all markets. High density and low geographic transaction costs in metropolitan regions imply 'thick' markets with large demand, many customers and suppliers and frequent transactions. Moreover, investments in interaction infrastructure may also enlarge the markets of metropolitan regions in a complementary way by including additional surrounding geographic domains. In this case, extensions and/or improvements of transport infrastructure integrate new geographical areas with the metropolitan region by reducing the travel time distances to these areas. This form of enlargement also implies that the internal market potential of the metropolitan region grows.

### **1.3 Metropolitan Regions as Nodes of Knowledge Generation and Innovation**

Metropolitan regions function as birthplaces for new technologies and innovations in the form of new products and/or new production methods. This implies that they attract economic agents specialized in innovation based upon specific external economies of scale, which arise at the regional level (Marshall, 1920). There are two major groups of external economies: pecuniary externalities and knowledge externalities (Krugman, 1991; Ellison & Glaeser, 1997). Pecuniary externalities emanate from natural regional advantages such as natural and/or man-made resource endowments, advantageous location and/or comparatively low labor and other input costs (Ellison & Glaeser, 1999).

Knowledge externalities, on the other hand, need not be related to natural regional advantages but to a milieu that attracts highly skilled people, whose knowledge and experiences, knowledge exchange and knowledge creation contribute to the increase of the regional knowledge stock. Even if we assume that this knowledge is non-rival, this does not imply that the knowledge is freely accessible to everyone. In particular, new knowledge is not only highly specialized but also "sticky" (von Hippel, 1994), i.e. highly complex, contextual and uncertain. This implies that persons who intend to evaluate and apply it must have both relevant training and opportunities for frequent face-to-face interaction to interpret it fully. In this way, metropolitan regions have clear advantages since they offer both a large and varied supply of skilled people and a well-developed intra-regional transportation infrastructure together with a large variety of different meeting places suitable for intense face-to-face communication. Metropolitan regions offer comparative advantages in the production of new knowledge (Hender-

son, 2005), and the costs of innovation tend to be lower in such regions (Feldman, 1994). Thus, the formative, innovative stages of product development are more likely to be located in regions with diverse economies and corresponding spillovers, both of which is conducive to the creation of new products (Duranton & Puga, 2001). Empirical evidences also clearly indicate that newly developed knowledge codified in the form of patents stimulate the development of further knowledge within the same region (Jaffe, Trajtenberg & Henderson, 1993). This implies that there is a distance-decay in the diffusion of knowledge, since the critical knowledge tends to be tacit, i.e. embodied in people and thus at least in the short-run stuck to the region of origin (Audretsch & Feldman, 1996).

Innovations, which are yet un-standardized goods and services, tend to be brought into the market via the entry of new companies (Aghion, et al., 2009). The driving force behind innovation and thus entry originates often outside the set of incumbent companies, i.e. from companies and/or basic research laboratories in technology-related industries (Winter, 1984). As the knowledge generated in private as well as public R&D laboratories is likely to spill out, metropolitan regions offer an atmosphere consisting of a variety of intellectual externalities waiting to be absorbed by entrepreneurs. This view is consistent with the idea of inter-industry spillovers resulting from the diversity in metropolitan regions, as advanced by Jacobs (1969). Metropolitan regions also offer a large enough internal market potential to make the launching of new and distance-sensitive goods and services profitable. The intra-regional proximity help to keep the transaction costs of this type of supply at a low enough level.

Entrepreneurs in metropolitan regions are likely to have lived in the region all their life or at least for many years (Keeble & Walker, 1994; Saxenian, 1999; Greene, Mole & Storey, 2008). This implies that these entrepreneurs have had time to create dense social networks based upon experience and frequent social interactions in the region that provide access to information and knowledge but also facilitate the process of resource generation (Stuart and Sorensen, 2005; Michelacci & Silva, 2007). Thus, entrepreneurship should be looked upon as a regional phenomenon (Feldman, 2001; Stam, 2007) stimulated by the entrepreneurial opportunities, which emerge from the regional economic milieu. In metropolitan regions, it is in particular various diverse knowledge externalities, which stimulate various kinds of innovation-driven entrepreneurship.

Knowledge-intensive and high-tech industries tend to locate in new spatial patterns with a preference for larger metropolitan regions with a rich and varied supply of higher education, research, and cultural and other amenities. This preference puts stress on smaller metropolitan regions, which have to develop diligent ways of adjusting to technological and structural changes in the world economy and shifts in the international division of labour. If they fail to adjust and reshape their profile in accordance with changes in the world economy, they will descend to less favourable positions in the international competition between metropolitan regions. Thus, for these regions the renewal of the internal structure and revitalization of their international contact patterns is critical.

## **1.4 Metropolitan Internal Dynamics and Management**

Over time, a metropolitan region must adjust its internal structure in response to external technological, economic and demographic changes to preserve its vitality and competitiveness. The changes include short-term economic fluctuations as well as slowly changing conditions as regards the metropolitan region's interaction and exchange with other regional



economies nationally and internationally. One slow internal process, which functions as an almost exogenous driving force is the time-dependent change in the age composition of the region's population.

The internal processes of metropolitan change include complex dynamics of spatial relocation of firms and households, the entry, growth and exit of firms, goods and services, household formation, which are influenced by prevailing incongruencies between the supply of and the demand for capacities in the transportation, facility, housing, and service systems. To influence these processes and to support metropolitan development there exist a number of instruments for the management of metropolitan regions including land use planning, regulation and taxation, investments in infrastructure, operation of public facilities and services, migration and labour market policies, housing market control, and policies aiming at stimulating innovation and entrepreneurship.

Viewed in a long-term perspective, the instruments for metropolitan management may have the objective to affect the attractiveness and development potential of the metropolitan region. In this context, the metropolitan policies may try to influence the location of i) public and private R&D activities and institutions of higher education, ii) infrastructure and communication networks, iii) labour with different education, skill and competence profiles, and iv) manufacturing and service firms.

A major part of the metropolitan management takes the form of adjustments and responses to signals of malfunctioning and tensions in the various metropolitan sub systems. However, such signals may be misleading seen from a longer time perspective, if the dynamics of the actual system are only vaguely understood. Figure 1 highlights a case in which both the demand and the supply of capacity develops in a smooth way. In spite of this, the tension signals do fluctuate. The "capacity" in the figure may refer to any metropolitan system, such as the labour market, the land market, the market for office space, the housing market or the market for metropolitan transport.

Although the two developments paths in Figure 1 follow each other closely, the sign of the capacity tension fluctuates. Quick responses to this type of signals risk aggravating the short-term mismatching, and causing new oscillations in the supply and demand paths, and thereby produce confusing signals of tension. Actually, the possible overshooting in the response pattern may be obtained through both i) planning and public interventions, and ii) market reactions. In many cases, the market and public metropolitan management may stimulate each other to an "over-reactive" behavior. When the speed of change is fast in a certain dimension, the imbalances in some metropolitan systems may be substantial. In highly attractive metropolitan regions, local inflation in the housing market and related service sectors and congestion in the transportation networks are typical indicators of disequilibria.

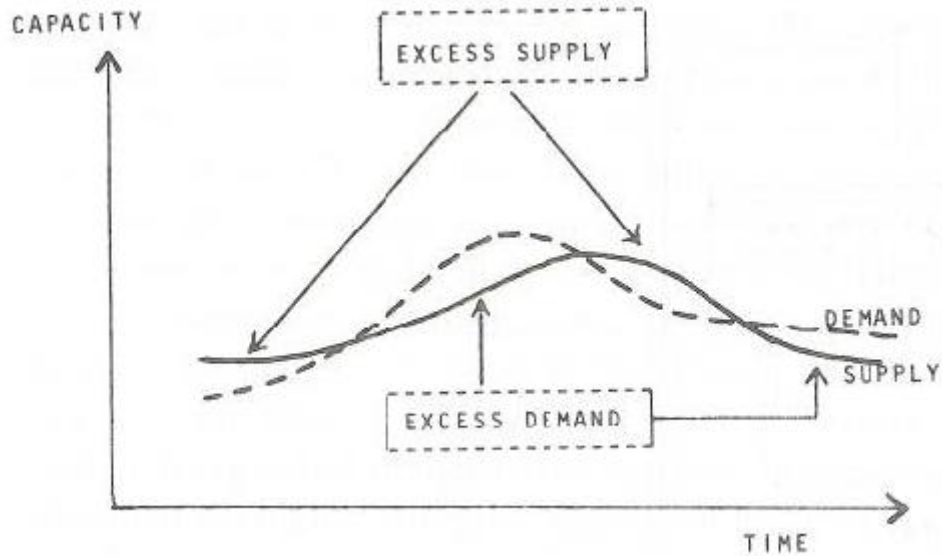


Figure 1. Tension signals  
Source: Johansson (1985, 117)

Metropolitan management and market behaviour associated with the change processes of the type described above concern to large extent extremely durable structures. Construction and location of infrastructure, housing areas, service and manufacturing sites, and commercial centres usually affect the life of metropolitan regions many decades into the future. Many metropolitan structures were determined many decades and even centuries ago. In particular, the process of capital formation determines the anatomy of the complete metropolitan region.

## 1.5 Speed of Adjustment – Fast and Slow Processes

A common element of the change processes in most metropolitan regions is the inertia in the inter-process adjustment mechanisms. As housing is constructed in peripheral rings to accommodate an increasing population, the pressure on the land in the downtown business district may accelerate. A relocation of households and workplaces between different zones in a metropolitan region may bring about multi-faceted tensions in the sense that both the land market and the transport system are affected. The tensions and their signals of manifestation give rise to adjustments on different time scales. Capital stock inertia and differentials in household and sector mobility may thereby give different zones traits, which are typical for their vintage of construction.

Figure 2 is an attempt to provide a schematic illustration of generic types of adjustment processes in metropolitan regions. The interaction between the production system and the given infrastructure comprises adjustments, which are close to be instantaneous, given the capacity constraints that prevail at each point in time and space. Changes in the capacity constraints and relocations must be filtered through time-consuming decision and investment processes. Thus, investment and relocation decisions are delayed in relation to the observed tension signals of under- or over-utilization of existing capacities (in the form of congestion, queuing, local inflation, etc.).

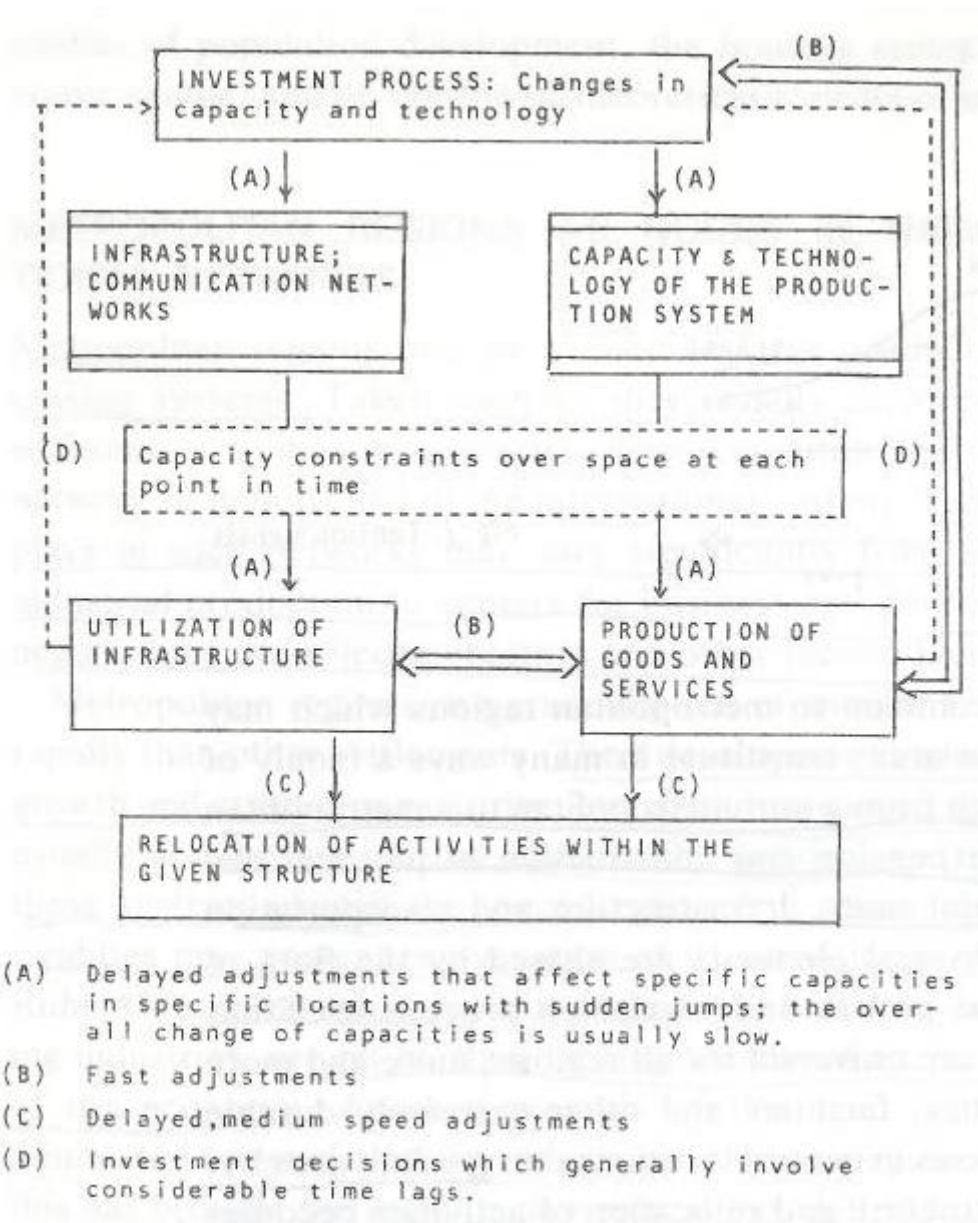


Figure 2. Variations in speed of adjustment

Source: Johansson (1985)

Investment processes bring about new capacities at a slower pace than the B-type interactions (capacity use). The resource consumption in the investment activities contains fast adjustments. The capacity change in individual locations within metropolitan regions occur with sudden jumps, but the overall change of capacities in the production, housing and transportation systems is a much slower process than the adjustments of B-type. Investments in the built structure in a metropolitan region, for example, seldom reach more than a few percent of the value of existing structures. Spatial relocation of households and production units of various kinds represents a medium-speed type of adjustments.

The classification in Figure 2 can be used to shed light on the possibilities to explain, model and forecast metropolitan dynamics. If a model is applied to analyze the fast adjustments, the slower processes will appear disguised in the form of parameters in the model. Similarly, a

model of the slow adjustments will contain parameters, which are affected explicitly or implicitly by the fast adjustment mechanisms. In both cases, the parameters are not actually constants but may instead change slowly over time. Nonlinear models will in this case generate sudden shifts, i.e. catastrophes, based upon bifurcations or singularities in the model behavior for certain parameter values (Varaiya & Wiseman, 1984).

The problem of the relationship between fast and slow processes in metropolitan development may also be studied from a slightly different perspective. If the system illustrated in Figure 2 develops in such a manner that new capacities are created at the same speed as the demand for new capacities, there will be no imbalances or tensions. Such change processes develop along trajectories, which may be looked upon as equilibrium paths. In a sense, such a path represents a balanced rate of change for the system as a whole. However, a system following such a steady path may suddenly be influenced by strong exogenous changes, e.g. a fall in the demand for certain export products of the metropolitan region or a shift in migration or fertility rates. Such exogenous changes will bring about a faster speed of change in some parts of the system.

A third type of change is the catastrophes mentioned above. In this case, it is usually possible to pick out a specific subset from a large dynamic process in such a way that the smaller system describes the mechanisms that give rise to catastrophic shifts in the speed of change (Casti, 1985). Figure 3 illustrates a case in which shifts occur repetitively (cyclically), possibly with a long duration for the slow phases. The figure may for example describe the relation between land values and activity density in a given zone in a metropolitan region. The centre point of the figure represents an unstable equilibrium of the change process. The system illustrated will develop in cycles around the equilibrium point with longer periods of slow change broken by short periods of fast change. A particular example is provided in Johansson (1993), where  $x_1$  denotes the amount of infrastructure in an urban zone, while  $x_2$  represents the size of economic activities in the zone. The relaxation oscillations that obtain imply that the infrastructure in zones has to be renewed in intervals, and the activity level will follow a wave-like development, where a period of expansion will generate high activity with density and congestion phenomena, which is then succeeded by a period of decline and deterioration of the infrastructure or built environment. The model intends to depict the interaction between planners or developers and firms that are attracted to the zone in expansion phases and that leave the zone in decline phases.

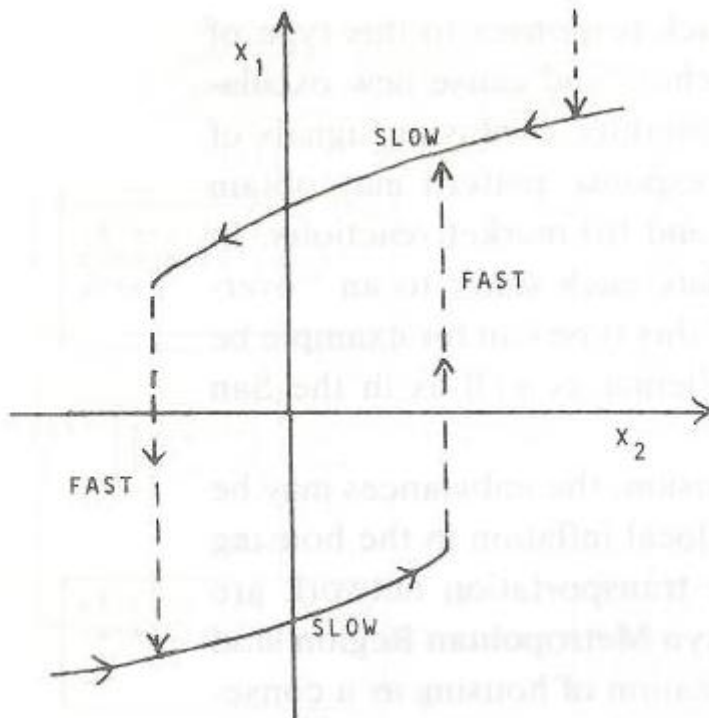


Figure 3. Oscillations of fast and slow time scales  
Source: Johansson (1985)

## 1.6 Market Potential and the Development of Metropolitan Regions

The input and output market potentials of metropolitan regions represent factors that adjust on a slow time scale, which implies that the growth (and decline) of metropolitan regions is a gradual process. This in turn implies that these market potentials, as well as their specific components, play the same role as metropolitan infrastructure. The input and output market potentials of a metropolitan region provide arenas for processes that adjust on a fast or medium-speed time scale. The input market potential determines the conditions of economic life in urban regions by comprising the supply of capital, labour (with different education, experiences and skills), and built environment of the metropolitan region, which are all factors emphasized in resource-based models of regional economic development.

Metropolitan regions in high-income countries are characterized by their concentration of knowledge-intensive labour force, which raises questions about the factors attracting such labour to metropolitan regions. Many empirical studies support the assumption that households whose members have a university education and other specific skill attributes, such as entrepreneurial skills, are attracted to migrate to and stay in regions that offer an attractive regional household milieu (Glaeser, Kolko & Saiz, 2001; Clark, et al., 2002; Florida, 2002). The regional household milieu consists of, on the one hand, natural amenities including climate conditions in the region, and, on the other hand, the household infrastructure in the region (Cheshire and Magrini, 2009). The regional household infrastructure comprises the region's housing market potential and the accessibility it offers household in different locations to other market potentials in the form of different kinds of i) household services, ii) amenities, iii) institutions of higher education, and iv) job opportunities in different workplace areas. Regions with an attractive household milieu offer their inhabitants a large and varied household market potential

The perspective presented here implies that a metropolitan region's household milieu is a partly independent attractor (repellent) of household location and regional labour supply. However, it also implies that regional labour markets adjust by means of a process where companies follow the location of the labour supply, rather than the opposite (Quigley, 1990; Maclellan, 1990). This form of causation is associated with the "knowledge society" in which the growing economic sectors have a high demand for knowledge-intensive labour, primarily with a university education. Under these conditions, knowledge-intensive households chose their residential location in regions with an attractive household milieu. As a result, companies with a large demand for knowledge-intensive labour have to adjust their location accordingly. Thus, the supply of knowledge-intensive labour is one of the factors driving the growth of metropolitan regions.

The overall market potential of a metropolitan region, i.e. its size and density, is an infrastructure phenomenon in itself. It changes in a process of very slow adjustments and offers collective market opportunities that benefit both households and companies. In growing metropolitan regions, the location of households and firms form a self-reinforcing dynamic process, i.e. a cumulative causation process with positive feedbacks (Myrdal (1957)). These positive feedbacks are in general constrained, on the one hand, by the development of the demand in the metropolitan region and in its external markets, and, on the other hand, by the existing capacities in the form of built environment, the accessibility offered by the transport system, production capacities, and labour supply. For the expansion of certain activities, these constraints may not be binding, whereas the expansion of other activities requires adjustments of durable capacities. The market potential can be assumed to adjust on a faster time scale than the durable capacities. In a longer time perspective, regional capacities and the regional economic and household milieu will adjust through a system of coupled feedbacks.

Over time, the (slow) formation of regional infrastructure affects the household and company location processes by gradually building up the basic conditions for the household milieu and the economic milieu of companies. Naturally, the economic milieu is partly determined by the household and company location processes. However, it is natural to assume that the household milieu and the economic milieu, respectively, as a whole changes at a much slower pace than the location of households and companies. Hence, in a limited time perspective it is possible to treat the milieu characteristics as approximately invariant. The regional change process described here has the form of interdependent dynamics such that companies and households mutually adjust to each other.

## **1.7 Conclusions**

In the industrialized countries, the metropolitan regions play a critical role not only as major generators of value added but also as major nodes for creativity, innovation and entrepreneurship as well as for communication and transportation. Given the importance of metropolitan regions not least for innovation and growth, it is critical to increase the understanding of

- how metropolitan regions function in terms of the simultaneous interactions between different metropolitan subsystems such as population, labour supply, housing, services, infrastructure, economy, workplaces, and metropolitan management, to provide a fertile seedbed for innovation,
- how the life cycles of metropolitan regions evolve over time,
- how metropolitan regions interact and compete with each other,
- how metropolitan regions interact with non-metropolitan regions,

- the factors determining differences among metropolitan regions in their capacity to nurture innovation and growth, and
- how metropolitan policies must be designed to secure the long-term vitality of metropolitan regions.

In this paper, we have highlighted i) the role of metropolitan regions as nodes in national and international networks, ii) how the concept of market potential can be used as a means to describe the economic concentration to and the opportunities of making contacts within and between metropolitan regions, iii) the role of metropolitan regions as nodes of knowledge generation and innovation, iv) the internal dynamics of metropolitan regions and the role of fast and slow process and v) how the input and output market potentials play the same role for metropolitan development as metropolitan infrastructure, as slowly changing factors. The overall ambition has been to build a solid foundation for future research on metropolitan regions and their development.

## References

- Acs, Z.J., F.R. FitzRoy & I. Smith (2002), High Technology Employment and R&D in Cities: Heterogeneity vs Specialization, *The Annals of Regional Science* 36, 373-386
- Aghion, P., et al., (2009), The Effects of Entry on Incumbent Innovation and Productivity, *The Review of Economics and Statistics* 91, 20-?
- Andersson, M., U. Gråsjö & C. Karlsson (2008), University and Industry R&D Accessibility and Regional Economic Growth, *The Italian Journal of Regional Science* 7, 97-117
- Andersson, Å.E. & D.E. Andersson (2000) (Eds.), *Gateways to the Global Economy*, Edward Elgar, Cheltenham
- Anselin, L. A. Varga & Z. Acs (1997), Local Geographic Spillovers between University Research and High Technology Innovations, *Journal of Urban Economics* 42, 422-448
- Audretsch, D.P. & M.P. Feldman (1996), Innovative Clusters and the Industry Life-Cycle, *The Review of Industrial Organization* 11, 253-273
- Audretsch, D.B. & M.P. Feldman (1999), Innovation in Cities: Science-Based Diversity, Specialization and Localized Competition, *European Economic Review* 43, 409-429
- Batten, D.F., K. Kobayashi & Å.E. Andersson (1989), Knowledge, Nodes and Networks: An Analytical Perspective, in Andersson, Å.E., D.F. Batten & C. Karlsson (1989) (Eds.), *Knowledge and Industrial Organization*, Springer Verlag, Berlin, 31-46
- Beise, M. & H. Stahl (1999), Public Research and Industrial Innovations in Germany, *Research Policy* 28, 397-422
- Braudel, F. (1979), *Le Temps du Monde*, Librairie Armand Colin, Paris
- Brouwer, E., H. Budil-Nadvornicova & A. Kleinknecht (1999), Are Urban Agglomerations a Better Breeding Place for Product Innovation? An Analysis of New Product Announcements, *Regional Studies* 33, 541-549
- Casti, J. (1985), Simple Models, Catastrophes and Cycles, *Research Report RR-85-2*, IIASA, Laxenburg
- Cheshire, P.C. and S. Magrini (2009), Urban Growth Drivers in a Continent of Sticky People and Implicit Boundaries, *Journal of Economic Geography*, 9:85-115.
- Chinitz, B. (1961), Contrasts in Agglomeration: New York and Pittsburgh, *American Economic Review* 51, 279-289
- Ciccone, A. & R.E. Hall (1996), Productivity and the Density of Economic Activity, *American Economic Review* 86, 54-70

- Clark, T.N., et al., (2002), Amenities Drive Urban Growth, *Journal of Urban Affairs* 25, 493-515
- De Bresson, C. & F. Amesse (1991), Networks of Innovators: A Review and Introduction to the Issue, *Research Policy* 20, 363-379
- Duranton, G. & D. Puga (2001), Nursery Cities: Urban Diversity, Process Innovation and the Life Cycle of Products, *American Economic Review* 91, 1454-1477
- Duranton, G. & D. Puga (2005), From Sectoral to Functional Urban Specialization, *Journal of Urban Economics* 57, 343-370
- Ejermo, O. & C. Karlsson (2006), Interregional Inventor Networks as Studied by Patent Coinventorships, *Research Policy* 35, 412-430
- Ellison, G. & E.L. Glaeser (1997), Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach, *Journal of Political Economy* 105, 889-927
- Ellison, G. & E.L. Glaeser (1999), The Geographic Concentration of Industry: Does Natural Advantage Explain Agglomeration?, *American Economic Review* 89, 311-316
- Ewers, H.J. & R. Wettman, (1980), Innovation-Oriented Regional Policy, *Regional Studies* 14, 161-179
- Falck, O. & S. Heblich (2008), Modern Location Factors in Dynamic Regions, *European Planning Studies* 16, 1385-1403
- Feldman, M.P. (1994), *The Geography of Innovation*, Kluwer Academic Publishers, Boston, MA
- Feldman, M.P. (2001), The Entrepreneurial Event Revisited: Firm Formation in a Regional Context, *Industrial and Corporate Change* 10, 861-891
- Florida, R. (2002), The Economic Geography of Talent, *Annals of the Association of American Geographers* 92, 743-755
- Fujita, M. (1989), *Urban Economic Theory*, Cambridge University Press, Cambridge
- Glaeser, E.L. & W.R. Kerr (2009), Local Industrial Conditions and Entrepreneurship: How Much of the Spatial Distribution Can We Explain?, *Journal of Economics and Management Strategy* (Forthcoming)
- Glaeser, E.L., J. Kolko & A. Saiz (2001), Consumer City, *Journal of Economic Geography* 1, 27-50
- Greene, F., K. Mole & D.J. Storey (2008), *Three Decades of Enterprise Culture*, Palgrave, London
- Henderson, J.V. (2005), Urbanization and Growth, in Aghion, P. & S Durlauf (2005) (Eds.), *Handbook of Economic Growth*, Elsevier, Amsterdam, 1543-1591
- Hippel, E. von (1994), Sticky Information and the Locus of Problem Solving: Implications for Innovation, *Management Science* 40, 429-439
- Hirsch, S. (1967), *Location of Industry and International Competitiveness*, Oxford University Press, Oxford
- Holmberg, I., B. Johansson & U. Strömquist (2003), A Simultaneous Model of Long-Term Job and Population Changes, in Andersson, Å.E., B. Johansson & W.P. Anderson (2003) (Eds.), *The Economics of Disappearing Distance*, Ashgate, Aldershot, 161-189
- Howells, J. (1983), Filter-Down Theory: Location and Technology in the UK Pharmaceutical Industry, *Environment and Planning A* 15, 147-164
- Huggins, R. (1997), Competitiveness and the Global Region: The Role of Networking, in Simmie, J.M (1997), (Ed.), *Innovation, Networks and Learning Regions*, Jessica Kingsley, London, ?-?
- Jacobs, J. (1961), *The Death and Life of Great American Cities*, Random House, New York
- Jacobs, J. (1969), *The Economy of Cities*, Random House, New York
- Jacobs, J. (1984), *Cities and the Wealth of Nations*, Camden Press, New York



- Jaffe, A., M. Trajtenberg & R. Henderson (1993), Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations, *Quarterly Journal of Economics* 63, 411-427
- Johansson, B. (1985), Dynamics of Metropolitan Processes and Policies, *Scandinavian Housing and Planning Research* 2, 115-123
- Johansson, B. (1993), Economic Evolution and Urban Infrastructure Dynamics, in Å.E. Andersson, D.F. Batten, K. Kobayashi and K. Yoshikawa (eds), *The Cosmo-Creative Society – Logistical Networks in a Dynamic Economy*, Springer-Verlag, Berlin.
- Johansson, B. (1996), Location Attributes and Dynamics of Job Location, *Journal of Infrastructure, Planning and Management* 530, 1-15
- Johansson, B. (1997), Infrastructure, Market Potential and Endogenous Economic Growth, paper presented at the Kyoto Workshop 1997, Department of Civil Engineering, Kyoto University, Kyoto
- Johansson, B. & C. Karlsson (2001), Geographic Transaction Costs and Specialization Opportunities of Small and Medium-Sized Regions: Scale Economies and Market Extension, in Johansson, B., C. Karlsson & R.R. Stough (2001) (Eds.), *Theories of Endogenous Regional Growth – Lessons for Regional Policies*, Springer, Berlin, 150-180
- Karlsson, C. & L. Pettersson (2005), Regional Productivity and Accessibility to Knowledge and Dense Markets, *CESIS Working Paper 32*, The Royal Institute of Technology, Stockholm
- Keeble, D. & S. Walker (1994), New Firms, Small Firms and Dead Firms: Spatial Patterns and Determinants in the United Kingdom, *Regional Studies* 28, 411-427
- Kobayashi, K. (1995), Knowledge Network and Market Structure: An Analytic Perspective, in Batten D.F., J. Casti & R. Thord (1995) (Eds.), *Networks in Action. Communication, Economics and Human Knowledge*, Springer, Berlin, 127-158
- Krugman, P. (1991), *Geography and Trade*, MIT Press, Cambridge, MA
- Lakshmanan, T.R. (1989), Infrastructure and Economic Transformation, in Andersson, Å.E., D.F. Batten & B. Johansson (1989) (Eds.), *Advances in Spatial Theory and Dynamics*, North-Holland, Amsterdam, 241-262
- Lakshmanan, T.R. & W.G. Hansen (1965), A Retail Market Potential Model, *Journal of the American Institute of Planners* 31, 134-143
- Lakshmanan, T.R. & M. Okumura (1995), The Nature and Evolution of Knowledge Networks in Japanese Manufacturing, *Papers in Regional Science* 74, 63-86
- Lösch, A. (1943), *Die räumliche Ordnung der Wirtschaft*. Gustav Fischer, Stuttgart
- MacLellan, D. (1990), Urban Change through Environmental Instruments, in *Urban Challenges*, Allmänna Förlaget, Stockholm, 51-76
- Malecki, E. & P. Oinas (1998), *Making Connections – Technological Linking and Regional Economic Change*, Ashgate, Aldershot
- Marshall, A. (1920), *Principles of Economics*, 8<sup>th</sup> ed., MacMillan, London
- Michelacci, C. & O. Silva (2007), Why so Many Local Entrepreneurs, *The Review of Economics and Statistics* 89, 615-633
- Michie, J. (2003), *The Handbook of Globalization*, Edward Elgar, Cheltenham
- Myrdal, G. (1957), *Economic Theory and Under-Developed Regions*, Duckworth, London
- Noyelle, T.J. & J.T.M. Stanback (1984), *The Economic Transformation of American Cities*, Rowman & Allanhead Publishers, Totowa, NJ
- Quigley, J. (1990), The Quality of Housing, in *Urban Challenges*, Allmänna Förlaget, Stockholm, 39-50
- Revilla Diez, J. (2002), Metropolitan Innovation Systems: A Comparison between Barcelona, Stockholm, and Vienna, *International Regional Science Review* 25, 63-85

- Saxenian, A. (1999), *Silicon Valley's New Immigrant Entrepreneurs*, Public Policy Institute of California, San Francisco, CA
- Sen, A. & T. Smith (1995), *Gravity Models of Spatial Interaction Behavior*, Springer, Berlin
- Shefer, D. & A. Frenkel (1998), Local Milieu and Innovations: Some Empirical Results, *The Annals of Regional Science* 32, 185-200
- Stam, E. (2007), Why Butterflies Don't Leave. Locational Behavior of Entrepreneurial Firms, *Economic Geography* 83, 27-50
- Stuart, T.E. & O. Sorensen (2005), Social Networks and Entrepreneurship, in Alvarez, S., R. Agarwal & O. Sorensen (2005) (Eds.), *Handbook of Entrepreneurship: Disciplinary Perspectives*, Springer, Berlin, 211-228
- Suarez-Villa, L. & M.M. Fischer (1995), Technology, Organization and Export-Driven Research and Development in Austria's Electronics Industry, *Regional Studies* 29, 19-42
- Thünen, J.H. von (1826), *Der isolierte Staat in Beziehung auf nationale Ökonomie und Landwirtschaft*, Gustav Fischer, Stuttgart
- Varaiya, P. & M. Wiseman (1984), Bifurcation Models of Urban Development, in Andersson, Å.E., W. Isard & T. Puu (1984) (Eds.), *Regional and Industrial Development Theories, Models and Empirical Evidence*, North-Holland, Amsterdam, 61-68
- Varga, A. (1998), *University Research and Regional Innovation: A Spatial Econometric Analysis of Academic Technology Transfer*, Kluwer, Boston
- Winter, S. (1984), Schumpeterian Competition in Alternative Technological Regimes, *Journal of Economic Behavior and Organization* 5, 287-320