Firms and People in Place

Driving Forces for Regional Growth

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PREFACE

An old Chinese saying is that − *life is like climbing mountains*. Each goal we fulfilled is one of the mountain peaks we reached. There is always happiness and hardness during every journey. When looking back at the past journeys, it happens so often that our memory transforms both the hardness and the happiness into beautiful pictures that will be cherished during one's lifetime. For me, the PhD is one of my goals and I made this journey in a very special place − Kiruna, Sweden. The journey has been full of happiness and hardness but I have enjoyed it. Now, as I am approaching the goal, there are many people who deserve to be acknowledged. Without them, my PhD journey would not have been possible or not as memorable as the one I have had.

First of all, I would like to thank my supervisors, professor Einar Holm and associate professor Urban Lindgren, who guided me through my PhD journey during which I sometimes felt helplessly drowning in the ocean of data or desperately lost in the jungle of modelling. Einar made it possible for me to start my PhD project, which gave me a valuable opportunity to observe Sweden in depth, look at China from a distance, and compare the two countries. The self-study 'crash course' introduced by Einar converted me from an economist into a human geographer, which provides me with a new spatial angle for looking at the world. Urban joined the supervision team from day one and helped me in many ways. They both contributed to this thesis through innumerable support, e.g. painstakingly reading the earlier versions of my English writing that was full of linguistic errors, giving me inspiring ideas and constructive comments, and co-authored two of the three papers with me.

Kirsten Holme who was the research manager of SMC provided useful support to my PhD project and warm-hearted help to my daily life in Kiruna. Magnus Strömgren gave me suggestions for using ArcGis and helped me extract data from ASTRID in Umeå. He also made the nice and informative maps in the second paper. Erling Lundevaller helped me with statistics that was an important tool for my analysis. Olof Stjernström assigned me some teaching tasks that gave me valuable experience. Kerstin Westin, Lotta

Brännlund and Margit Söderberg helped me through the administration. Erik Bäckström helped me through computer technical support. I am grateful to all of them.

As a research project in Kiruna, SMC has come to an end. For me, SMC is unforgettable because it provided me with the opportunity to carry out my PhD in an extraordinary place where midnight sun and northern light appear in turn every six months. The Department of Social and Economic Geography at Umeå University to which SMC belonged did not only accept me as a PhD student but also made it possible for me to finish my PhD smoothly in Kiruna. I acknowledge this.

To those former colleagues at SMC, I would like to say thanks for the pleasant times we went through together and all the help I received from you. Ingemar Johansson, Mona Mattsson-Kauppi and Marianne Öhman supported me a great deal during a tough time in Kiruna. You make me feel that Kiruna is a warm place though it lies inside the Polar Circle. *Tusen tack till er, kära kamrater!*

I also would like to send thanks to my friends in other parts of the world, their support and encouragement accompanied me through my research journey in Sweden. Wang Bing helped me before and after I started my work in Sweden, extending a good hand to my dog when I failed to bring him with me and going through those multidisciplinary discussions with both academic and emotional intelligence, which brought insights into my own research. Edgard Dezuari and his lovely wife Marie Josée helped me translate the abstract of the first paper into French and hosted me during a wonderful spring vacation in Switzerland, which made me relax from stressful work and provided a refreshing change from Kiruna's winter blue colours. Chen Jie and his family sent me Chinese movies and TV programmes, which made it possible for me to create a micro Chinese cultural atmosphere in Kiruna when I felt homesick. Heartfelt thanks to you all, dear friends.

To my parents and my own family, a thanks is too weak to express my strong feelings. My parents raised me to who I am. They never spoiled me but encouraged me to be independent and pursue knowledge. They respected every

decision I made in my life as well as in my career. Thus, this thesis is dedicated to my parents for all the love I received from them. For my own family, Max and Qin, you are part of my PhD just as you are part of my life. Max, I know how difficult it was for a teenager to integrate into *Kirunagänget*, especially when you could not say a single word in Swedish! But you made it! I am so proud of you. Your experiences in Kiruna will become a lifetime treasure and benefit you in the future. Qin, your understanding and support mean extremely much to me though I rarely speak it out. I love you more than I have said and more than I can say. I know what you went through these years, and I promise to spend more quality time with you.

An end is always a new beginning. Looking into the future is more exciting than into the retrospect past, just as the next peak is always more appealing for climbers. I would like to write the last sentence of this preface in my native language – Chinese: 百尺竿头，更进一步!

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List of papers

I.   Wenjuan Li (2006): Regional and structural factors in Swedish regional growth during the 1990s. CYBERGEO: *European Journal of Geography*, No 356.

II.   Wenjuan Li, Einar Holm and Urban Lindgren (2007): Attractive vicinities. Submitted to *Population, Space and Place*.

III.   Wenjuan Li, Einar Holm and Urban Lindgren (2007): Localised conditions for economic growth-- testing the endogenous growth hypothesis. (Submitted).

ABSTRACT

The aim of the thesis is to quantitatively study the driving forces and mechanisms for regional growth from an endogenous and exogenous perspective and reveal the most important factors contributing to regional growth, by focusing on three aspects: local labour market, the supply side and the demand side of the labour market. The thesis is designed to use Swedish micro register data to develop spatial models with higher spatial resolution. It was found that endogenous factors are important and probably explain about at least one third of total regional economic growth. Among the endogenous factors, localised demographic composition, labour force and labour market, firms, and business environment have the strongest influence on regional economic growth. The findings from the Swedish context were briefly compared to China's economic growth in the last fifty years.

The thesis consists of three related papers. The first paper studied the endogenous and exogenous factors in 108 Swedish LA regions during the 1990s. By using the SNI92 code, individual longitudinal data and an improved shift-share analysis method, it was found that the endogenous factor is important for regional economic growth because it is able to accelerate, decelerate or reverse the impact from exogenous factors during the period studied.

The second paper studied regional growth from the supply side of the labour market by focusing on population redistribution and place attractiveness. A 'floating grid' approach was developed to understand the factors shaping place attractiveness. The approach disregards administration zones by focusing on a small spatial unit—*vicinity* which is one kilometre square. Each unit has a unique set of surrounding zones that are *local area* and *hinterland*. By constructing spatial models, the total explained variance in place attractiveness was decomposed into partial explanatory effects that are assigned for *physical attraction, demographic, service and labour market factors* over the spatial scales. The finding is that the spatial scale of vicinity and demographic factors contribute most to place attractiveness.

The third paper studied regional growth from the demand side of the labour market by focusing on workplace and its economic performance. The 'floating grid' approach was once more applied while the basic analysis unit is a constructed *workplace* that holds *working-square*, *local area* and *hinterland* as surrounding zones. The economic performance of the workplace was attributed to *external demand, local demand, business environment and labour force factors* over different spatial scales. A method was developed to quantitatively identify intervals of partial explanatory effects that are components of the total explained variance. It was found that working-square and labour force factors contribute most to workplace economic performance.

内容摘要：

企业与人：区域发展的驱动力

李文娟

本书以瑞典上世纪90年代以来的区域经济增长为对象，采用一种全新的地理定量分析方法，通过构建区域经济增长的空间模型，运用瑞典国家统计局的微观个人历史数据库资料，从内涵增长角度深入分析研究区域经济发展的机制和驱动力。研究发现，内涵增长对区域经济增长的贡献至少为三分之一；在世界经济日益全球化的大环境背景下，区域内部的局部条件，如人力资源和企业的活力，仍是影响区域经济增长的重要因素。

运用空间模型来定量分析区域经济增长的关键是构建地域单元及其相应的地理空间统计数据。本研究运用瑞典微观个人历史数据库提供的个人家庭住址和工作单位精确地理座标，创造性地提出了一种全新的空间模型定量分析方法，采用"伞状浮动网格"构建地域单元，建立了"由内及外的区域层次分析法"，用以汇总统计各地域单元的数据。这种新的空间模型分析方法可以打破行政区域的边界，把地域空间分割成大小相等的地域单元。根据瑞典的地域空间特征，本研究把地域单元确定为1*1公里，并以每个地域单元为核心，把5公里范围内的空间确定为该地域单元的"局域"，把5-50公里范围内的空间确定为"腹地"。瑞典微观个人历史数据库包括有历年居住在瑞典境内的每个自然人的工作和生活统计数据，如年龄、性别、婚姻家庭状况、居住条件、教育程度、就业情况、工作类别、收入水平等，同时还包括有每个自然人的家庭住址和工作单位地理座标，精度高达100米。本研究运用ArcGis空间分析工具，通过地理座标把自然人的这些工作和生活数据与区域自然资源及土地利用空间分布关联起来，并进而以地域单元、局域和腹地为基础进行分层统计汇总，以便构建区域经济增长的空间模型，定量分析研究区域发展机制和驱动力，揭示各关键因素对区域增长的贡献份额。

本书在结构上分为总论、三篇核心论文和主要结论。这三篇核心论文相互联系，各有侧重，分别从就业市场、劳动力供给和劳动力需求三个方面深入剖析

区域发展的机制和驱动力。第一篇论文是区域发展的因素分析，主要从内涵和外延角度分析区域发展的驱动机制。论文以瑞典工业部门的标准分类码为基础，对瑞典微观个人历史数据库进行区域单元统计汇总，然后运用移动份额分析法，建立定量模型，确定内涵因素在区域发展中的贡献。通过分析瑞典108个就业市场区在90年代的发展变化，我们发现内涵因素在区域发展中具有非常重要的作用，可以加剧、减缓或甚至逆转外延因素对区域发展的贡献。

第二篇论文从劳动力供给角度研究区域发展的驱动力。劳动力供给与人口分布和迁移、与不同区域对人才的吸引力大小紧密相关。本文选用两个区域吸引力指标，通过构建多层次空间模型来深入分析自然环境、人口状况、服务业和劳动力就业市场等四大类因素对区域吸引力的作用。结果表明，地域单元内的人口因素(如年龄构成、教育程度、种族结构等等)和腹地范围内的就业市场对区域吸引力的贡献最大。

第三篇论文从劳动力需求角度研究区域发展的驱动力。劳动力需求与企业的活力和经济表现关系密切。本文以工作单位为切入点、以工作单位收入变化为增长指标，深入分析了外部需求、区域内部需求、企业经营环境、劳动力数量和质量等因素对企业经济表现的影响，通过构建整体和局部空间模型来确定这些因素对企业经济表现的贡献大小。研究发现，地域单元内的劳动力因素对企业经济表现具有举足轻重的作用，因而是区域经济发展的主动驱动力。

本研究虽然是建立在瑞典的区域发展研究基础之上，但许多结论都具有普遍性。通过比较分析中国过去50多年的区域经济发展过程，作者认为，虽然瑞典和中国是两个完全不同的经济体，但在区域经济发展进程中，许多特点和现象都是非常相似的。这不仅说明区域发展机制具有共性规律，而且也表明本研究的方法和结论对其他区域发展研究具有重要的参考和应用价值。

CONTENTS

Paper I – III

1. PROLOGUE

Regional growth has been intriguing me all along my academic career. The various driving forces of regional growth among different regions and at different development stages can be observed everywhere.

My hometown Zhangjiakou is a middle-size city with rich natural resources (e.g. gold, coal, lead, zinc, etc.) and a beautiful landscape. It is situated 199 kilometres northwest of Beijing and is an important geographic pass between the North China Plains and Inner Mongolia Plateaus. It has a much longer history than Beijing but constantly falls behind Beijing in terms of economic growth. I left for Beijing to study and then started to work there while turning down job offers from my hometown. Today, Zhangjiakou is trying hard to utilise its local natural and human resources to create economic growth, protect the environment, and keep a balance between the advantages (e.g. big market and source of capital) and disadvantages (e.g. brain drain) of having such a giant neighbour as Beijing.

When I was doing a comparative study of Chinese and Israeli collective agriculture in Israel in the later 1990s, I observed a rapid change in the regional landscape. With a large number of Russian Jews coming to Israel during the post Soviet period, new settlements were constructed in the middle of nowhere within a short time period and new jobs were created under governmental subsidises.

When I started my work at the Spatial Modelling Centre (SMC) in 2000, Kiruna was declining both in population and jobs because its core industry (LKAB) was trembling. The low price of steel products in the global market forced LKAB to consider closing down the iron mine. The municipality tried hard to breed new core industries such as space research and tourism, so that Kiruna could survive in the long run. Only a few years later, Kiruna is now planning to move half of the town to another location in order to exploit the ore body that spreads under the current town centre. The reason for this is

the sky-high price on the world market. The driving force behind the high price is the huge demand from countries such as China. The story of relocating half of Kiruna even appeared in a few newspapers in China. The municipality is now focusing on making plans for relocating Kiruna. The change in the global economy and the world market led Kiruna onto a completely different path of development within a short period.

In contrast to Kiruna's fluctuation caused by external factors, Gnosjö in South Sweden is a place where small and medium-sized enterprises dominate and serves as a model for entrepreneurial skills and business success. During the 1990s, Gnosjö provided an example of the fact that a region could be unaffected by general economic downswings.

The above examples give a brief picture of the complexity of regional growth where the driving forces can either be external (exogenous) or internal (endogenous) or both. Geographical, political, historical, social and cultural factors have impacts on regional growth. Due to its importance, there has been a large number of studies on regional growth. However, there is still considerable space for further observations, analyses and new insights. When I got the opportunity to do a PhD, I decided to devote myself to this intriguing issue which is also my long-lasting interest.

2. INTRODUCTION

Human history can be viewed as a process of the interaction between social development and economic growth. The process can be observed and analysed at global, national, regional and local levels. Economic growth at each of the levels directly or indirectly affects every aspect of the society in which we live and we can feel it everyday. Some transnational corporations closed down their plant in one place due to its poor performance but opened a new one in another place. The number of unemployed declined or rose and varied between regions even within the same country. Some friends or acquaintances moved away because their new jobs were in another town or they moved with

the hope that job opportunities would be available in their new place, etc. This kind of information attracts wide attention. Geographers, economists and other social scientists try to explain the driving forces and mechanisms of regional growth; politicians and decision makers try to make the right policies to create regional growth; businessmen try to locate their business in the right place and make more profits; ordinary people try to make a better living by working in a place where they can also enjoy a preferred residential milieu, etc. Economy is everywhere and growth is important to everyone, notwithstanding if he or she is aware of it. Some questions have been constantly asked. Why do some regions grow faster than others, even within the same country? What are the factors that contribute to regional growth? How do these factors independently and interactively affect regional growth? The questions have been the topic of many studies for more than a century, but the answers can still not completely explain the complexity of regional growth. More and further studies are needed.

3. GEOGRAPHIC AND ECONOMIC APPROACHES IN REGIONAL GROWTH

Regional growth is an important part of economic growth. Theories and models on the issue have been developed among different disciplines, such as geography, economics, and regional science. General economic growth theory is applicable to regional growth although the spatial dimension was absent in the earlier stage. In contrast, economic geography focuses on human's economic activities (e.g. production) and spatial dimension has always been one of its key components. Economic geography plays an important role in the studies of regional growth. Regional science has its roots in geography, economics and other related disciplines, which promotes both geographers and economists working in the fascinating field of regional growth. The continuous efforts for coping and explaining the changes of economic landscape have promoted the theoretical and methodological development of these disciplines.

General growth theories deal with economic growth through aggregate models where spatial factors were not concerned. Neoclassical and Keynesian growth theories are two main approaches through which aggregate growth models were constructed. According to the models, growth is supposed to be exogenous with the assumptions of constant returns to scale and diminishing returns to each input; thus long-run growth rates are determined by exogenous factors such as saving or capital accumulation, demand or exogenous technical change that offset the 'law' of diminishing returns (e.g. Solow 1956, Cass 1965, Kaldor 1957, 1961). The exogenous growth models predicted a convergence of different economies (i.e. countries in the world or regions with a country) to a common level, which was not widely observed. In order to cope with the paradox, knowledge (Arrow 1962) and human capital (Romer 1986, 1990, Lucas 1988) were introduced into the growth models, which are viewed as a milestone of the emergence of endogenous growth theory that differentiated from the exogenous approaches. Exogenous growth theories are often referred to as 'old' and endogenous growth theories as 'new'. The point of departure of the 'new' growth theories is Young's (1928) concept of the increasing returns of large production and Marshall's (1890) distinction between internal and external economies of scale. According to the endogenous growth theories, increasing returns can be achieved by externalities of knowledge and learning (Arrow 1962) and human capital (Romer 1986, 1990, Lucas 1988). According to the 'new' growth theories, it is possible for endogenously closed economic systems (e.g. a region or a country) to become self-sustaining and experience dynamically increasing returns.

Within economic geography, different aspects of production were emphasised in the early days. Some emphasised commodities and trade that met the need of world trade and colonisation at the time (Chisholm 1889, Smith 1913). Some focused on place, e.g. country or region (Whitbeck & Finch 1935). After World War II, the emergence of Fordism shifted the focus of economic geography into mass production of standardised products. During the 60s and 70s, the change of economic landscape could not be fully understood by the existing theories, and the various social institutions on which economic activ-

ity depends and through which it is shaped (Martin 2000) became the focus within institutional economic geography. Since the 1980s, the approach of post-Fordism has emphasised flexible production of customised products. In response to flexible production, there is a renaissance of the 'industrial district' (Marshell 1890) and successful industrial districts can be observed all over the world.

Location theory, central place theory and gravity models have been viewed as the classic approaches to explain regional structure or dynamics from different aspects. Von Thünen's work (1826) on patterns of agricultural land use and Weber's study (1909) on industrial location are viewed as classic location theories that emphasise land rent and transport cost. Christaller (1933) developed his central place model to explain the rationality of a hierarchical structure of city systems. Palander (1935) introduced market area analysis in the context of spatial competition. Hoover (1937) developed a framework in which the location effect of market areas and their spatial extent can be examined. Lösch (1940) produced the first general theory of location with demand as a major variable. Hägerstrand's study (1953) on diffusion process has used both spatial and temporal dimensions, and has later been named time-space geography. The gravity model (Stewart 1947, Warntz 1959, 1964) used the law of physics to explain patterns of travel and trade between places and has been widely applied in studies of regional attraction and development. Isard (1956, 1960) tried to fuse the location theory with other branches of economic theory.

Since the last two decades of the 20th century, there has been an emergence of 'new' location theory together with 'new' economic geography and industrial cluster (e.g. Porter 1990, 1996, Krugman 1991, 1996, 1997, Sunley 2000, Ottaviano and Thisse 2005), which is actually a fruit of geographers and economists having worked with the 'new' endogenous growth theories. The key point of the 'new' theories is that agglomeration brings increasing returns because of cost reduction and knowledge spillovers. Knowledge-related externalities are referred to as sources of increasing returns (Krugman 1996). The externalities are associated with either specialization (localisation) or diversity

of local employment (urbanisation). The externalities of localisation and the externalities of urbanisation are often termed as localisation economies and urbanisation economies (Hoover 1937; Dicken and Lloyd 1990), which are also both viewed as agglomeration economies. Therefore, the creation of knowledge is geographically localised (Storper 1992, 1997) and the expansion of knowledge can be achieved through different forms of learning (Lundvall and Johnson 1994).

From the above very brief literature review, it can be seen that geography and mainstream economic theories have lived separate lives during a large part of the twentieth century (Reiner and Riiser 1994) and focus on different aspects of regional growth. The emergence of the 'new' growth theories makes geographers and economists work in the same field, which has resulted in the traditional one-dimension economic models, such as production function, or those 'old' growth models being reformed into two-dimension models where regional or industrial factors are included. A spatial dimension has been reintroduced into economic theory, which has drawn economic geography and location theory from the periphery to the centre of mainstream economic theory (Ottaviano and Thisse 2005).

However, there is still a long way to go for further integration of geography and economics regarding regional growth. A large number of empirical studies results in inconsistent conclusions when the study focus is on a different level, e.g. regions, industries or firms. For example, the approach of path dependence believes that 'history matters' and that regional institutions can lock regions into particular development trajectories (Arthur 1994), but Ottaviano and Puga (1997) found that similar regions could endogenously differentiate into cores and peripheries. Malmberg et al (2000) studied Swedish export firms by using micro statistic data. It was found that internal scale economies together with urbanisation economies (Jacobs externalities) have a larger impact than localisation economies (MAR Marshall-Arrow-Romer externalities) on export performance. Eriksson et al (2007) used the Swedish LA region and longitudinal individual data to study effects of localisation, urbanisation and

scale of job change, and suggested that the concentration of similar activities may be gainful for small regions. Engestoft et al (2006) reported that little evidence supports the claims concerning the existence and performance of frequently identified and examined industrial clusters in Denmark. Obviously, studies that cover at least an entire country and consist of both generalized economic sectors and different spatial scales would be a new alternative for studying regional economic growth.

4. AIM AND STRUCTURE OF THE THESIS

The aim of this thesis is to study the relative impact of endogenous factors on regional economic growth and develop methods for utilising large-scale spatial micro data. In the thesis, regional economic growth was analysed from three aspects: regional growth measured by employment growth at the local labour market level, regional growth measured by in-migration rate and income level at the level of residential vicinity which represents the supply side of the labour market, and regional growth measured by working income at the workplace level which represents the demand side of the labour market.

The research questions of the thesis can be summed up as follows:
- Which are the endogenous and exogenous driving forces for regional growth?
- How strong is the impact of endogenous factors on regional economic growth?
- Why are some places more attractive to people than others?
- What are the important localised conditions behind firms' economic performance?

Three related papers were completed in order to answer the research questions. The first paper made efforts to identify endogenous and exogenous factors and analyse the interaction between endogenous and exogenous factors during economic downswings and upswings. The second and third papers are extensions of the first one and aimed at identifying the most

important endogenous factors that have an influence on regional economic growth and thereby test the endogenous growth hypothesis. The structure of the thesis is illustrated in Figure 1.
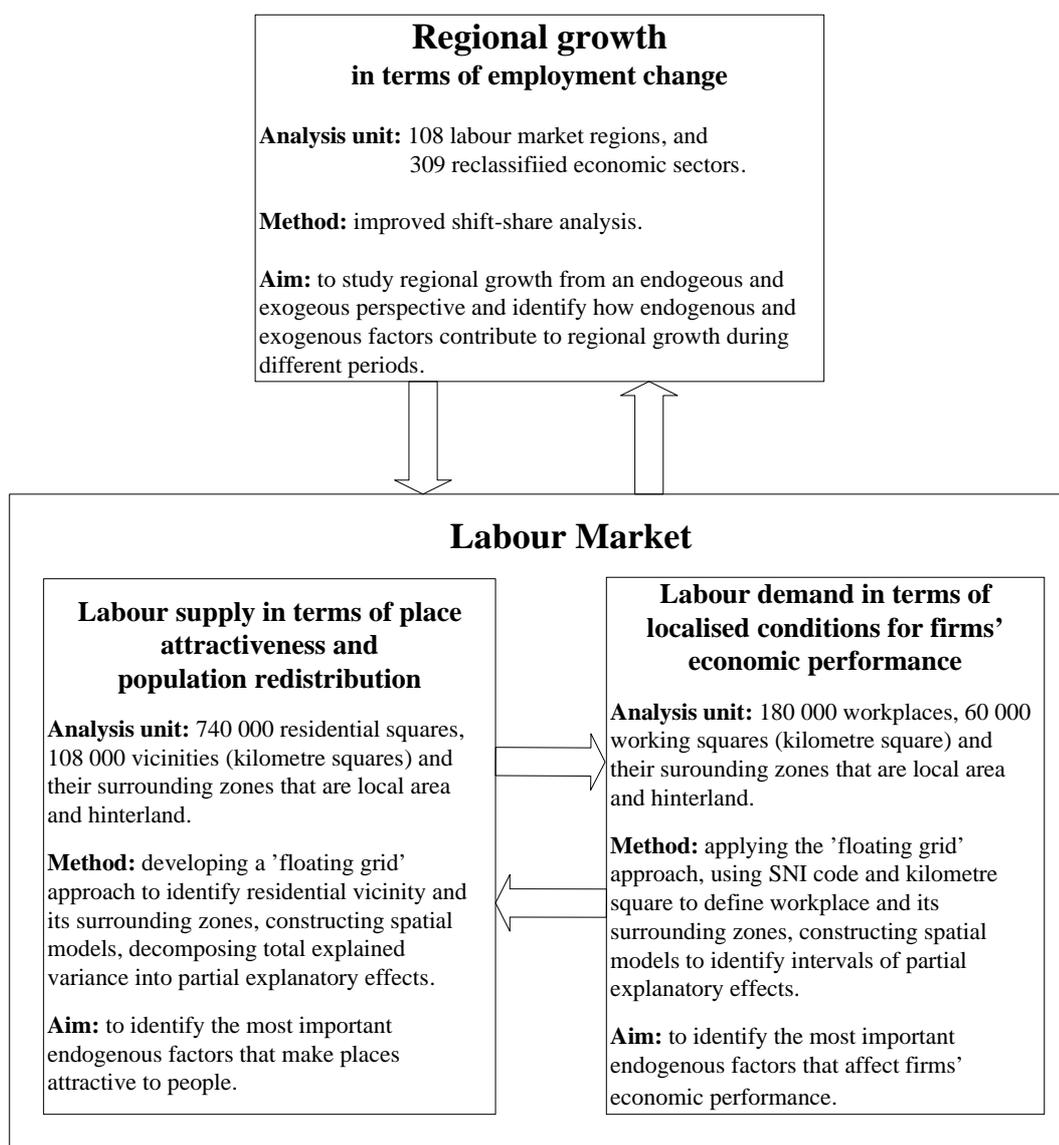
Regional growth
in terms of employment change

Analysis unit: 108 labour market regions, and
309 reclassifiied economic sectors.

Method: improved shift-share analysis.

Aim: to study regional growth from an endogeous and exogeous perspective and identify how endogenous and exogenous factors contribute to regional growth during different periods.

Labour Market

Labour supply in terms of place attractiveness and population redistribution

Analysis unit: 740 000 residential squares, 108 000 vicinities (kilometre squares) and their surrounding zones that are local area and hinterland.

Method: developing a 'floating grid' approach to identify residential vicinity and its surrounding zones, constructing spatial models, decomposing total explained variance into partial explanatory effects.

Aim: to identify the most important endogenous factors that make places attractive to people.

Labour demand in terms of localised conditions for firms' economic performance

Analysis unit: 180 000 workplaces, 60 000 working squares (kilometre square) and their surounding zones that are local area and hinterland.

Method: applying the 'floating grid' approach, using SNI code and kilometre square to define workplace and its surrounding zones, constructing spatial models to identify intervals of partial explanatory effects.

Aim: to identify the most important endogenous factors that affect firms' economic performance.

Figure 1. Structure of the thesis.

The findings from the three papers answered the research questions and also pointed out possible applications for growth policy. Furthermore, in order to check the validity of the findings, a comparison with China's economic

growth in the last fifty years was made. Some common characteristics of regional growth were found in the two different contexts.

5. DATA SOURCES

The data sources used in the thesis are a micro register database and the 1:250 000 Swedish general maps. The database is collected by Statistics Sweden (SCB) and contains more than 130 variables depicting the annual social and economic status of each individual living in Sweden. It also has the location information (geographic coordinates by 100 * 100 meter squares) of each individual's residential area and workplace, etc. The general maps are released by the Swedish Land Survey (*Lantmäteriet*) and contain detailed information of landscape, land use and infrastructure. The data from the two sources can be aggregated or disaggregated depending on research purpose and geographic resolutions.

The spatial scope of the thesis covers the entire Sweden, which includes 740 000 residential hectare squares and 180 000 workplaces. All the economic activities listed in the Standard Industrial Classification Code SNI92 were sorted into either 309 or 57 sectors for different study purposes.

The register data makes it possible to define the basic spatial unit in hectare-square (100 * 100 meter squares) by using ordinary geographic coordinates. The original 100-metre geographic coordinate was the first choice for spatial resolution and all the data was calculated for hectare square. However, at the stage of modelling, an error appearing as random 50-metre coordinate shifts from year to year for a certain amount of locations was discovered. This kind of minor errors caused a substantial bias in regression models, so the 100-metre coordinates had to be replaced by kilometre coordinates within which most of the errors of 50-metre coordinate shifts disappeared, but the spatial resolutions of the thesis changed from hectare square to kilometre square.

6. METHODOLOGY

The methodology used in the thesis is quantitative, which includes improving the traditional shift-share analysis method, developing a 'floating grid' approach, and two methods for identifying partial explanatory effects from total explained variance of the regression model.

The traditional shift-share analysis method is a simple and transparent way of examining regional disparities and has been widely applied in regional studies. The regional disparities can be expressed by total shift and regional share, structural effect and structural shift, different effect and different share. The simplicity and transparency of the method are sometimes also viewed as its drawbacks, being too simple to describe a complicated phenomenon. In the thesis, the shift-share analysis was used in a new alternative way in which the total observed employment growth in each region was decomposed into two parts: the growth from structural factor and the growth from regional factor; meanwhile micro register data was used instead of macro statistic data; industries were reclassified by considering both sectors and the size of each sector instead of making a general classification; local labour market regions were used instead of large administrative regions; and a complete cycle of economic downturn and upturn (1990-1999) was chosen as the study period.

It was a pioneer work to construct an interactive growth model with different spatial scales. In order to achieve this task, a 'floating grid' approach was developed in the thesis. The idea of the floating grid is to disregard administrative regions but focus on relatively homogenous and equal-sized spatial units; each spatial unit holds a unique set of surrounding zones that are defined by concentric zones around the spatial unit at a certain distance. Each surrounding zone contains a set of unique properties for the spatial unit. In contrast to the traditional fishnet-like grid system, the floating grid system is actually like an umbrella whose axis is the spatial unit and the surface of the umbrella is the surrounding zones. The surrounding zones of neighbouring units could overlap but never be exactly the same (see Figure 2).
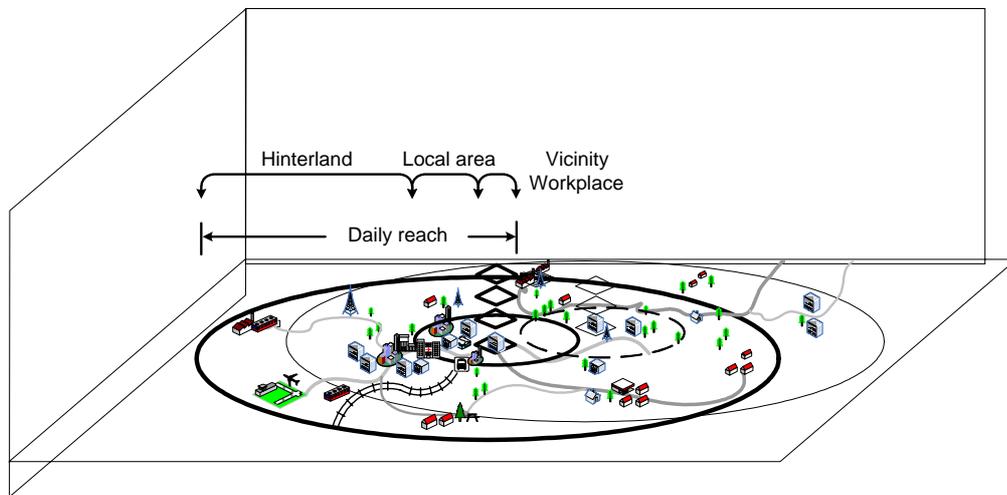
Figure 2. The 'floating grid' approach.

In addition to the 'floating grid' approach, two alternative methods were developed to identify partial explanatory effects from total explained variance in interactive spatial models; in this way, the most important variables or factors can be unveiled. The partial explanatory effect is defined as the contribution by each of the variable groups. In the thesis, variable groups are sorted both according to categories and spatial scales. One method is to reveal the distribution of partial explanatory effects and another is to identify intervals of partial explanatory effects. The two methods are described in detail in the second and third papers.

The data preparation and model construction were computation intensive, especially when the basic spatial scale was set for hectare squares. Because of the errors in the coordinates, kilometre square was used as the basic analysis unit. However, all efforts in using hectare square as a basic analysis unit were still worthwhile, since the discovery of the coordinate errors was useful feedback for SCB and will benefit future data collection and studies.

7. SUMMARY OF PAPERS AND FINDINGS

Paper one—Regional and structural factors in Swedish regional growth during the 1990s. The paper studied endogenous and exogenous factors that contribute to regional growth in 108 Swedish labour market regions (LA region)[1] during the 1990s while a complete economic cycle (decline-recovery) occurred. The aim of the paper is to decompose the entwined endogenous and exogenous factors and find out how the endogenous and exogenous factors affected economic growth over the labour market regions.

Based on the Swedish Standard Industrial Classification (SNI92) and the micro register database, all economic activities in Sweden were reclassified into 309 sectors and aggregated into 108 LA regions. Using an improved shift-share analysis method, regional growth in terms of employment change during the 1990s has been decomposed into two components—growth due to an endogenous regional factor and growth due to an exogenous structural factor. The regional factor is referred to as the sum of internal (endogenous) factors and the structural (exogenous) factor the sum of external factors. The findings from the paper can be summarised as follows.

The contribution of the regional factor can either be positive or negative for economic growth. The same industry could perform very differently in different LA regions, due to the variation of regional factors. The regional factor acted differently in core and periphery regions during the periods of economic downturn and upturn. During the economic downturn, the regional factor contributed negatively in core regions but positively in periphery regions; during the economic upturn, the contribution of the regional factor was reversed, i.e. positive in core regions and negative in periphery regions.

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[1] In Sweden, LA region means labour market region, i.e. daily commuting areas, and is defined by Statistics Sweden SCB. The number of LA regions varies from year to year. For this paper, 108 LA regions were used.

The structural factor played a negative role for most of the LA regions during the whole 1990s. In the economic downturn, the structural factor contributed negatively to growth in almost all LA regions. In the upturn period, the structural factor began to contribute positively in some core regions but still contributed negatively in periphery regions. This indicates that it takes less time for core regions to adjust the mismatch of labour demand and supply than it does for other average and periphery regions.

Regional growth in every LA region was a joint effect of the regional and the structural factor. The regional factor acted as a modifier for the structural factor in regional growth, i.e. it could reinforce or alleviate, or even counteract the structural factor. Although the counteraction of the regional factor only occurred in small and periphery LA regions during the period studied, it gives evidence that under certain conditions the counteraction exists.

The findings indicate that the structural factor creates a macro environment for a region and the regional factor generates a micro milieu for industries within the region. When the structural factor has an exogenous effect on economic growth, the regional factor reacts endogenously in three different ways: making a region unaffected; reversing the impact of the structural factor; aggravating or relieving the impact of the structural factor. The findings in this paper support the endogenous growth theories and confirm some observations of regional growth in the real world.

Paper two—Attractive vicinities. This paper studied regional growth from the aspect of population distribution and redistribution that is related to the supply side of the labour market. The patterns of population distribution are the result of layers of innumerable social, economic and cultural processes in the past, and the spatial changes in population distribution tend to work at a slow pace. The contemporary changes in population distribution could be understood as a process that takes place at the margin of historically given patterns. Thus, population redistribution is closely related to the attractiveness of place, in other words it is a response to the shift of attractiveness between

places. The attractiveness of a place can be attributed by site and situation factors.

In this paper, an approach of 'floating grid' was developed to analyse the relations between place attractiveness and population redistribution from a new angle. The core of the approach is to disregard administrative regions but focus on the site and situation attributes of almost homogenous spatial units. The basic spatial unit is the kilometre-square where an individual's residential place and its immediate neighbourhood are located. This kilometre-square is referred to as *vicinity*. The surrounding of vicinity has been divided into two functional parts, *local area* and *hinterland*. The site and situation attributes for vicinity and its surroundings are assigned into four categories, *physical attraction, demographic, services, and labour market factors*. Two indicators, i.e. net migration rate and income level, were used to measure place attractiveness. Using micro register data and geographical data, a total of 108 000 vicinities that cover all 740 000 residential squares in Sweden have been identified. The four categories of site and situation attributes were calculated into vicinity, local area and hinterland.

A spatial migration model and a spatial income model were constructed to study the relations between place attractiveness and population redistribution, which are referred to as full models. The full models explain 10.83% of the variation in place attractiveness measured as migration and 66.42% measured as income. In addition to the full models, partial models were constructed in order to unveil how the explanatory variables of each category and spatial scale contribute to place attractiveness. A measure labelled *effect* was introduced and a method was developed to identify how the explanatory variables contribute to place attractiveness independently and interactively.

The explorative method developed in the paper provides an alternative way of analysing place attractiveness. The empirical analysis in the paper reveals that place attractiveness is mainly manifested by an attractive vicinity; and socioeconomic factors, e.g. demographic factors, play an important role in

shaping the attractive vicinity. The models indicate that spatial demographic factors are the most important and that regional labour market factors are the second most important socioeconomic drivers for attractiveness. Physical attraction, such as closeness to beach, river or lakes, play a minor role in attractiveness as compared to other socioeconomic factors. The variable categories combined with the spatial dimensions, vicinity and demographic factors, contribute most to place attractiveness. Thus, the main finding of the paper is the complementing impact on place attractiveness of population-related amenities in vicinity and labour market situation in the hinterland.

Paper three— Localised conditions for economic growth – testing the endogenous growth hypothesis. The aim of this paper is to reveal an eventual impact of localised conditions on workplace economic performance, which furthermore is a test of the endogenous growth hypothesis. Workplace of firms, companies and organizations is the basic analysis unit in the paper, because the economic performance of workplace affects regional growth via employment change or income change.

The 'floating grid' approach was once more used but zone properties were related to workplace economic performance. In this paper, *workplace* is defined as the aggregate of all employed with the same square coordinates and the same sector code for their places of work. Thus, the workplace is actually a constructed 'work place'; thus most errors emerging from irrelevant changes in ownership of the workplace or changes in the classification code of firms can be avoided. Every square with at least one economic activity (employment in at least one sector) is regarded as a *working-square* (in contrast to residential-square only). If the number of sectors in the utilised classification is *n* and there is at least one employed from each of them working in a single square, the square can be said to host *n* workplaces. By using kilometre square and reclassifying 57 sectors (SNI57), a total of about 60 000 working-squares and 180 000 workplaces were identified. In addition to workplace and working-square, two centric surrounding zones were defined as *local area* and *hinterland.*

The spatial area from a workplace to the end of its hinterland is referred to as *daily-reach area.*

A spatial model was constructed where the change of working income at the workplace within a five-year period was the dependent variable; and 32 explanatory variables over the spatial scales were categorized into *external demand, local demand, business environment and labour force factors*, where factors within the daily-reach area are defined as endogenous factors. The model is referred to as a full model. The total explained variance of the full model is 28.58 %, which means that the selected localised variables explained 28.58% of the variation in regional economic growth, mainly endogenous growth. Departing from the full model, a method was developed to decompose the total explained variance into a *partial explanatory effect* that is created by the factors in each category and spatial scale. The method is to identify possible intervals for the partial explanatory effects.

The findings indicate that both endogenous and exogenous growths exist; the endogenous hypothesis was tested and confirmed. The full model indicates that at least about one third of the growth is achieved by the factors within the daily-reach area, which can be interpreted as endogenous factors probably contributing to total regional growth. Within the scope of endogenous growth, the results from the models confirmed that at least part of the increasing returns is created by the externalities of knowledge, learning and human capital, which supports the claims that increasing returns can be achieved by such externalities (Arrow 1962, Romer 1986, 1990, Lucas 1988).

The models also indicate the importance of spatial scale and geography. According to the models, both diversity and localisation only contribute positively to economic performance within certain distances. Furthermore, among the different spatial scales, the one-kilometre square seems to be the most important as compared to local area and hinterland. On the one hand, the distance of human's accessibility is increasing and the interactions between

people and economic activities are reaching further and further under the age of globalisation while, on the other hand, proximity is still very important.

8. ECONOMIC GROWTH BEYOND THE SWEDISH CONTEXT – A COMPARISON

In this thesis, Swedish regional economic growth has been studied from an endogenous and exogenous perspective, but the findings are assumed to be applicable beyond the Swedish context. Some characteristics found in the thesis can be observed in a completely different context such as China. Sweden is a small-sized, highly industrialised and urbanised country while China is a large-sized developing country on its way to rapid urbanisation. However, from the aspect of economic growth, similar patterns can be observed in both countries, which bring insights for understanding general economic growth.

8.1 Dynamics of endogenous and exogenous growth

The thesis shows that in the Swedish context, endogenous and exogenous growth are dynamics and play different roles in different regions and different periods, and endogenous growth probably explains at least about one third of total regional growth.

China's economic growth during the last 50 years shows similar character-ristics and is often observed in two different eras: before and after the economic reform in 1978. Before the economic reform, China was a closed and central-planned economy that experienced economic growth through in-dustrialisation and urbanisation despite a great deal of political and economic turmoil, i.e. the Great Leap Forward (1958-1959) that caused a three-year economic recession (1959-1961) and the Cultural Revolution (1966-1976) that slowed down total economic growth and caused stagnation in some sectors.

China's economic growth before 1978 provides evidence supporting the endogenous growth theory. During the period of international isolation, notwithstanding if the isolation was self imposed (Dicken 2003, p188) or imposed by foreign countries (most Chinese people's point of view), no foreign direct investment (FDI) flowed into China and there were no large imports or exports, e.g. in 1978 China's foreign trade was only about 5% of its GDP with a deficit of 1.14 billion USD (NBSC 2006). Thus, economic growth was mainly created by internal factors. During the pre-reform era, China had preliminarily industrialised its economy, which provided a solid basis for the rapid post-reform growth. Using constant price and taking the year 1952 and 1978 as 100, Table 1 lists the poor conditions in 1949, the initial conditions for the economic reform in 1978, and the rapid growth after the reform. Actually, when the economic reform started, China had already built up a comprehensive industrial system, including food, daily goods and textile, car, ship, airplane and satellite manufacturing industries. The industrial system might not have possessed the most advanced technologies, but it was able to support a country with a population amounting to nearly one billion at the time. Nowadays, when products 'made in China' are sold all over the world, it is not an overnight miracle and not simply due to the 'open door' policy but also due to the accumulation of nearly 30 years of substantial endogenous economic growth.

Table 1a. The change of China's GNP and output of economic sectors

before the economic reform in 1978.

(year of 1952 = 100, at constant price)

Year	GNP	Agricultural output	Industrial output	Construction output	Transportation output	Commercial output
1949	58.9	67.3	40.9	4.8	48.0	62.5
1952	100.0	100.0	100.0	100.0	100.0	100.0
1978	485.0	171.5	1814.7	584.1	560.8	316.8

Source: MOA 1992.

Table 1b. The change of China's GNP and output of economic sectors

after economic reform in 1978.

(Year of 1978 = 100, at constant price)

Year	GNP	Primary industry	Secondary industry	Tertiary industry	Construc-tion	Transport, storage and post	Wholesale & retail trades
1978	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1985	193.4	155.4	197.9	231.9	218.7	185.9	276.8
1990	282.5	190.7	304.1	363.0	298.8	297.2	346.5
1995	494.2	233.7	677.7	607.1	597.4	532.7	523.7
2000	750.6	277.0	1081.8	955.1	799.1	973.0	801.3
2005	1204.4	336.0	1801.6	1540.0	1266.9	1690.4	1246.4

Source: NBSC 2006.

After the economic reform, China has opened its 'door' to the outside world and the central-planned economic system has gradually been transformed into a market oriented one that attracts an increasing amount of FDI from other countries and exports an increasing amount of goods to the whole world. The rapid growth was achieved by both internal and external factors although China's post-reform growth was viewed as more exogenous than endogenous, e.g. FDI, exchange rate and trade surplus, etc. As a matter of fact, endogenous factors still play an important role, e.g. macro and regional economic policies, huge domestic market, accumulation of human capital, and externalities of lo-calisation and urbanisation contribute to China's post-reform economic growth.

8.2 Different response from core and periphery regions to economic turbulence

During the 1990s, Sweden experienced the worst period in its economic his-tory since the 1930s and constant price GDP decreased in three consecutive years (SCB 2001). In 1990, low inflation and stable currency policies replaced the low unemployment policy that used to be the main goal of Swedish eco-nomic development. Meanwhile, there was also a tax reform in 1990-1991. Initially, the new policies were not successful and Sweden had to give up its

stable exchange rate policy in November 1992, leading to an immediate depreciation of the Swedish currency by more than 25%. Core regions acted as an economic locomotive in both the economic downturn and upturn, i.e. when the national economy entered a downturn period, the core regions declined more than the average; when the national economy began to recover, the core-regions recovered more quickly than the average.

China's core and periphery regions responded to the economic turbulence in the same way. Before going further into the economic turbulence, it is necessary to take a brief glance at China's regionalisation. China consists of 23 provinces (excluding Taiwan), five autonomous regions (i.e. Inner Mongolia, Tibet, Guangxi, Ninxia and Xingjiang), four central administrative authorities (i.e. Beijing, Tianjin, Shanghai and Chongqing) and two special administrative areas (i.e. Hong Kong and Macau). China is a huge country whose land territory is larger than the main continent of Europe. The regional disparities in terms of population and economic development are significant, e.g. 8 000 people per km^2 in Macau and two people per km^2 in Tibet; in 2005, GDP per capita in Shanghai was more than 50 000 CNY and about 5 000 CNY in Guizhou which is a Southwest mountain province. Currently, from the perspective of regional development, China can be viewed as four regions that are Northeast, East, Central, and West China, as illustrated in Figure 3. The Northeast was China's heavy industry base where mining and steel production, oil field and petroleum refinement, motor vehicle and airplane manufacture were core industries. The region has been stagnating since the economic reform and has become a kind of rust belt. Now, it is on its way to revitalize. East China is the highly developed region where some of the economic capacity of the individual provinces is approximately as large as that of the entire South Korea. West China is a less developed region where the five autonomous regions are located. Now, this is the region which is the focus of the national development policy, i.e. 'Go the Greater West'. Central China's development level is somewhere between the East and the West.
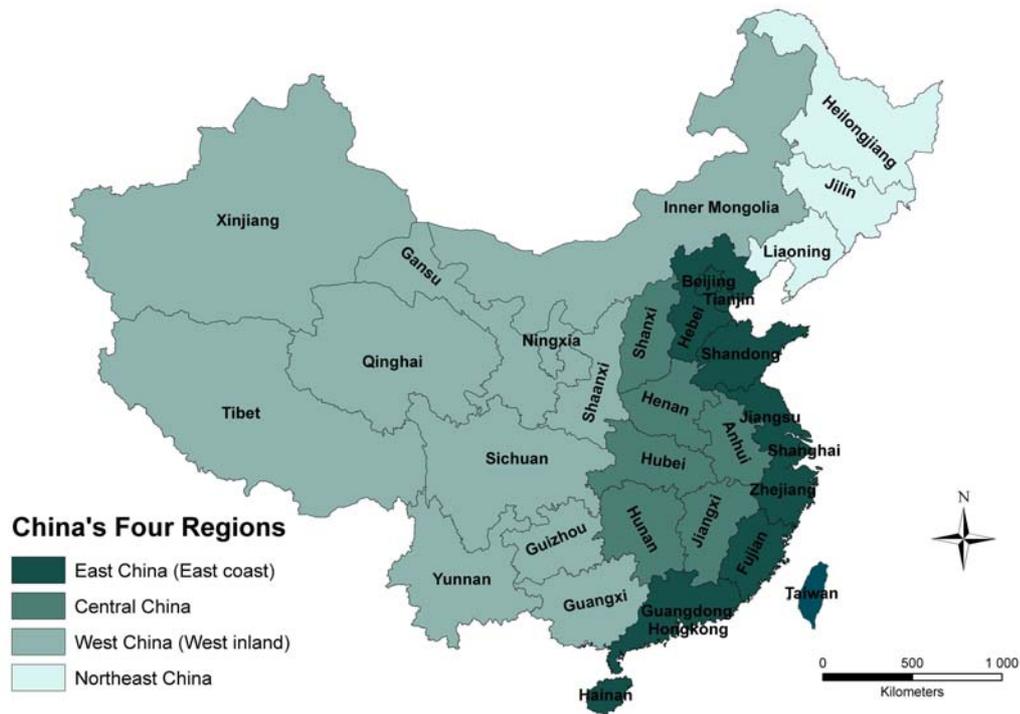
Figure 3. China's current regionalisation.

In China, the largest economic turbulence occurred at the end of the 50s and at the beginning of the 60s, mainly caused by the unsuccessful policy of the Great Leap Forward[2]. During the crisis, the core and periphery regions in China responded very differently. Taking China's agriculture as an example, the east and central regions were hit hard by the crisis but the east recovered more quickly than Central China. The Northeast was almost unaffected and the West was lightly affected. The higher is the level of development, the stronger is the response to economic turbulence.

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[2] In 1957, China's agricultural production reached a new historical record. The central government declared that China had fulfilled the 'socialist transition' and initiated 'the Great Leap Forward' aimed at industrialising and urbanising the economy as quickly as possible. In 1958, the policy was extremely over implemented with even the agricultural sector being involved in steel production. The farmers thus involved in steel production could not harvest all their crops. Thus, the grain reserves dwindled. In 1959, flood and drought occurred in both South and North China, thereby reducing production. Food shortages and famine occurred in 1960.

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8.3 Externalities of specialisation and diversity

According to endogenous growth theory, increasing returns are achieved by externalities of knowledge and learning (Arrow 1962) and of human capital (Romer 1986, 1990, Lucas 1988). These externalities are often referred to as MAR (Marshall-Arrow-Romer) externalities associated with specialization (localisation) and Jacobs externalities (Jacobs 1969) associated with diversity of local employment (urbanisation). Using Swedish micro register data, it was found in this thesis that both specialisation and diversity contribute positively to workplace economic performance, and thereby to regional growth.

In the case of China, after the economic reform, resource endowment, comparative advantages and regional specialisation have been emphasised in development policies and the positive impact of regional specialisation on economic growth has been widely studied (e.g. Pan & Zhang 2002, Bai et al. 2004, Liang & Xu 2004). Before the economic reform, China's industrial development policies actually emphasised diversity rather than specialisation.

Since 1949, China has aimed at creating a comprehensive industrial system not only for the country but also for different regions. During the Cold War period, the idea of a comprehensive industrial system was even applied at some of the city levels. The justification for this was that every single city could have survived or resisted for a certain time if a war had broken out and the city had been isolated from the other parts of the country. The comprehensive industrial system at the regional and city level normally included food, textile and daily goods industries that could meet the basic needs for people to survive; and various machinery manufactures that could be turned into making arms and weapons for people to fight. Such comprehensive industrial systems at the regional and city level were actually created during the period. When the Cold War ended and China entered the post-reform era, the industrial system at the regional and city level was criticized by some researchers as 'repeated investment and repeated construction' and uneconomic, which led to industrial restructuring that aimed at regional specialisation and spatial

division of labour. The restructuring resulted in some highly growing provinces and cities as well as rust-belt provinces and cities. Theoretically, the regional and city level comprehensive industrial system actually fit into Jacobs economies of the city (Jacobs 1969) and externalities of diversity could be achieved within the system.

8.4 Population and age structure

People are the most important agents for economic growth. Different approaches to population and demography were developed in different historical periods and closely connected to the socioeconomic conditions at the time. Malthus (1798) proposed his well-known doctrine 'population increasing in a geometric ratio, while the means of subsistence increase in an arithmetic ratio' because he noticed the decline in living conditions in 18th century England and thought that poverty and famine were natural outcomes of population growth. During the 1950s, there were baby booms in many countries after World War II and the world economy grew well; thus the economic interpretation of population growth at that time viewed population as a function of economic development (Coontz 1957). Agricultural productivity largely increased with technological progress such as the Green Revolution. Boserup (1965) pointed out that population determines the agricultural methods, in contrast to agricultural methods determining population in Malthus's time. Boserup's theory helps us understand the 'agricultural intensification' in developing countries. Later on, the improvement in health care and medical service, the decrease in infant mortality and the increase in longevity, the rapid population growth in the world made norms such as 'population explosion' and 'carrying capacity' popular. In response to the new situation, *Limits to growth* (Meadows et al 1972) echoes some of Malthus's concerns. Nowadays, developed countries such as Japan and West European countries are facing a low population growth and even depopulation in some places, and population is thus becoming an important indicator of growth. In the thesis, it was found that both population density and average age affect

place attractiveness and that firms' economic performance hence affects regional growth.

China is known for both its huge population and its birth plan policy, but China's population growth has rarely been used as an indicator of economic growth although population and age structure have been closely related to China's economic development. China's long history, large land territory and moderate climate resulted in a relatively advanced agricultural system (e.g. two or three harvests annually, crop rotation, multi-crop inter-plantation, etc.), gardener-like peasants and a very rich variety of crops. The long history of handcraft sectors (e.g. silk, porcelain and tea) also resulted in a large number of skillful artisans. Thus, China's economy was able to support a relatively large population for more than a thousand years. When the Industrial Revolution occurred in Europe, China still enjoyed a large trade surplus (silver inflow) and the Chinese Emperor did not really care what was going on in the world although a group of the Chinese elite tried hard to convince the Emperor to reform and develop modern industries, but failed. The Opium War[3] broke China's 'door' from outside and China then entered a more than a one-hundred-year period of wars that included both foreign invasions and civil wars. The huge size of land territory might have helped China not to become a colony of any single power, but the weak and shortsighted ruling group together with the complicated geo-politic situation turned China into semi-colonies of several powers (e.g. Britain, France, Japan, Russia, Germany, Portugal, etc.). In 1949 when the wars were finally ended, Mainland China had a war-torn economy and 541 million inhabitants with a life expectancy of 35 years.

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[3] Chinese Emperor Daoguang issued a law to prohibit opium trade inside China in 1838 because about two million Chinese (estimated number) were habitual opium users. A senior officer was sent to Guangdong to control the illegal opium trade. About 1100 tons of opium stock belonging to the British East India Company were destroyed in May 1939. In August 1839, the British Parliament voted to declare war against China for 'free trade'. In 1842, the British military force entered Nanjing (Nanking) and a 'peace' treaty was signed and known as the Treaty of Nanjing.

Under the circumstances in 1949, both China's leadership and ordinary people were in favour of having a large population and a comprehensive industrial system that would improve people's living conditions as well as support a strong national defense in case of any future foreign invasion. A baby boom started after 1949. In 1953, China carried out a population census which indicated that the total population had reached about 600 million, about 36% of which were in the age group 0-14. In the same year, Ma Yinchu, a Chinese economist, advocated the introduction of birth control, but he was widely criticized for being a Chinese 'Malthusian'. The baby boom continued until 1959 when the famine occurred. The second baby boom started in 1963 when China recovered from the big economic downturn and ended in the early 1970s when a family plan policy that basically accepted Ma's opinion was introduced. The two baby booms did not only double China's population but also shaped China's population age structure. According to the population census in 1982, the composition of age groups 0-14, 15-64 and 65+ was 34%, 61% and 4%, respectively. The census in 2000 shows that the composition has changed to 23%, 70% and 7%, respectively.

By studying OECD's population age structure and economic growth, Lindh and Malmberg (2000) found the most positive effect on growth of the age group 50-64. There is no similar study on China's population, age group and economic growth, but if Lindh and Malmberg's finding is a general phenomenon, then China's rapid growth since the year 2000 is also created by the first baby boom of the 1950s, in addition to other factors such as economic policies and FDI, etc. Furthermore, the positive effect of the two baby booms on China's growth will probably last until the year 2030.

8.5 Mobility, immobility and economic growth

Lindh and Malmberg (2000) proposed two hypotheses when reporting the age effects on economic growth in OECD countries. One is that the accumulation of experiences plays a key role for economic growth and the other is that

the low mobility of the 50-64 year-old groups may actually have a positive impact on productivity growth. The second hypothesis indicates the economies of immobility. Fischer (1999) studied the immobility in EU countries and reached similar conclusions. The findings from the thesis and the experience of China's economic growth provide some evidence for the economies of immobility.

This thesis studied place attractiveness and workplace performance in different periods, and it was found that the mobility of the labour force is weaker than that of the workplace. For example, between the years 2000 and 2001, only about 14.7% of the population of working age (20-64 years old) changed residential vicinity. Among those movers, only 3.8% moved more than five kilometres while the remaining 11% only moved within the local area. A great deal of workplace relocation can be observed using the concept of 'workplace' proposed in the third paper. Between 1998 and 2003, only 46% of the total workplaces remained unchanged. Among the remaining 54%, 52 000 old workplaces (amounting to 32% of the total workplaces in 1998) disappeared and 75 000 new workplaces (amounting to about 40% of total workplaces in 2003) emerged in new locations. Thus, it seems that jobs follow people more than the other way around, although both people and workplaces move. A similar phenomenon was also observed in the USA (Bradbury *et al.* 1982).

Other studies on migration and commuting provide similar results of immobility of population. Population redistribution is only a marginal change in the existing patterns of population distribution and the change is slow and gradual. Each year, only about 2.5% of the Swedish population migrate between local labour market regions (Fischer & Malmberg 2001), only one fifth of which is primarily related to work (Garvill *et al.* 2000). Taking commuting into account, only long distance commuters are related to mobility and immobility because long distance commuting is referred to as a substitute for job-related migration (e.g. Green *et al.* 1999, Eliasson *et al.* 2001). The estimated number of long distance weekly commuters in Sweden is about 200 000 (Fransson

1991) or 5% of the labour force which amounted to about 215 000 in the year 1999 (Jansson 1999), but the actual number of individuals registered with tax deduction claims for dual living or temporary work was much smaller than the estimated number, e.g. only 72 451 in 1999 (Öhman & Lindgren, 2003). Even if considering these 5% of the labour force as long distance commuters as well as the 3.8% of the more-than-five-kilometre migrated labour force, the mobility of the labour force is still weaker than that of the workplace.

China's experience provides another angle for considering immobility and economic growth. Before 1959, people in China could move freely among different provinces, from a rural to an urban area or the other way around. Due to the unsuccessful policy 'Great Leap Forward', there was a food shortage at the end of the 1950s and a household registration system (HRS) aimed at stopping the large-scale migration wave was introduced. According to the HRS, everyone should register with the local authorities. People were divided into urban and rural residents depending on where they lived when the HRS was introduced. The HRS makes it very difficult for people to migrate although it is not completely impossible. Nowadays, the HRS is becoming looser but still functions in some ways. The debate in China now focuses on how HRS obstructs economic growth and should be abolished in the near future. Nevertheless, it is clear that China's pre-reform growth coexisted side by side with the HRS.

8.6 Accumulation of human capital

According to endogenous growth theory, human capital is the source of increasing returns and the models in the thesis clearly indicate the positive relations between the proportion of university-educated people and regional growth. The same phenomenon can be observed in China. Figure 4 shows the distribution of China's population, high education institutes (universities and colleges), graduates from high education, and total enrolment in high

education in 2005. The figure is like a mirror of China's regional economic development level.
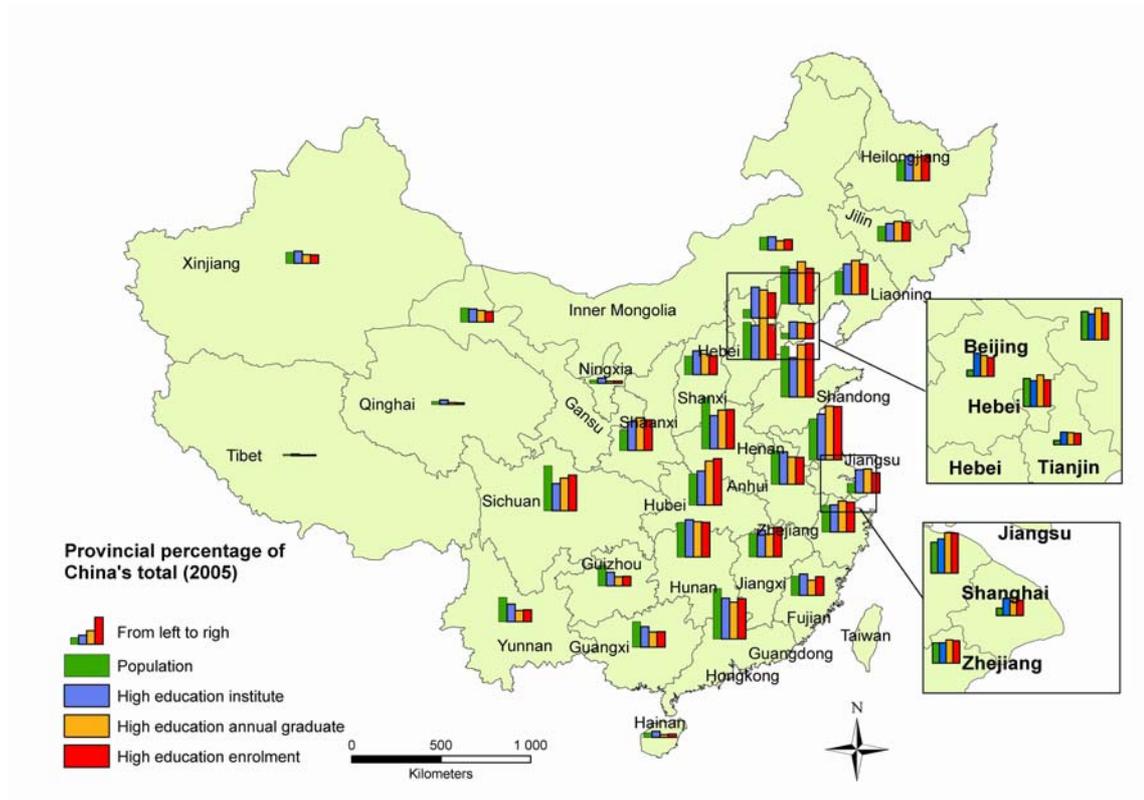

Figure 4. Distribution of China's population and high education.

It can be seen that high education capacity is closely related to population distribution and the level of economic development. The proportion of high education institutes, graduates and enrolment in Northeast China, most of East China and a few provinces in Central China is higher than that of the population; while in West China, the proportion of the population is higher than that of high education institutes, graduates and enrolment.

If looking at other indicators such as university students per 100 000 inhabitants or GDP per capita, the provincial disparity is more obvious. Two indexes were calculated based on 2005 statistics data (NBSC 2006). One is the index of GDP per capita (i.e. provincial GDP per capita/national average

GDP per capita) and another is the index of high education (i.e. the number of university students per 100 000 inhabitants/the national average number of university students per 100 000 inhabitants). Using the former as dependent variable (gdp) and the latter as explanatory variable (educ), regression shows that the explanatory variable can explain about 70% of the variation in the dependent variable at 99% of statistical significance ($p<0.01$).

Figure 5 is a scatter plot that illustrates the obvious provincial disparity and how the two indexes are closely correlated. It can be seen that eleven of the twelve provinces in planes I and II are located in either East or Northeast China; most of the provinces in Central and West China are in plane III; and the four provinces in plane IV belong to Northeast, West and Central China. The importance of human capital for economic growth based on aggregate provincial data can clearly be seen from Figure 5, which resembles the findings in the second and third papers of the thesis, which were based on micro Swedish spatial data.
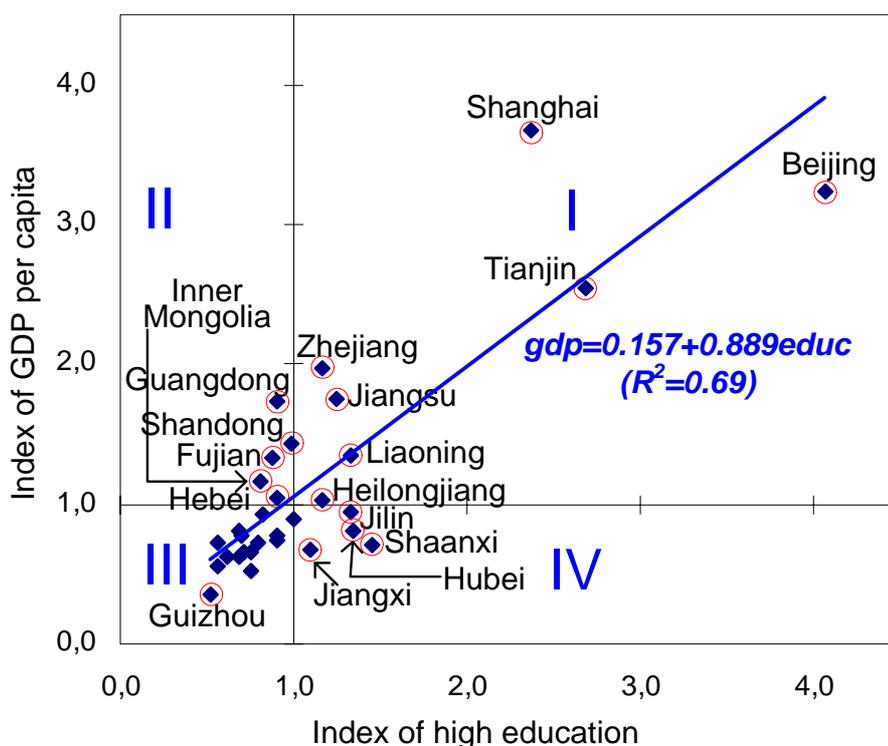

Figure 5. Scatter plot of China's provincial index of high education and GDP per capita.

8.7 Globalisation and regional growth

Under the accelerating pace of globalisation, it has been observed that regions become more important than ever because trade takes the form of interaction between functional regions rather than countries (Karlsson et al. 2001). Regional growth is therefore an important component of global and national economic change. The important role of geographic scales revealed in this thesis calls for more attention on spatial scales of economic growth. On a global scale, the world economy is becoming increasingly integrated and interdependent; at the regional level, the immediate milieus of residential place or workplace still play an important role in economic growth.

If taking the whole world as one spatial domain and all countries as actors in the domain, which are the driving forces or where are the generators of global growth? During the 20th century, North America and Western Europe have unarguably been the world's core and generators of growth, but not every country in the periphery can catch up with that growth pace. There are different theories trying to explain the uneven development, such as the theory of economic growth (Meier and Baldwin 1957), the Dependency Theory (Frank 1967, Portes 1976, Spybey 1992), etc. The exogenous and endogenous growth theories provide answers from another perspective.

Along with accelerating globalisation, the world's economic landscape has changed with East Asia emerging as another generator of global growth, mainly because of Japan's economic success and China's rise, in addition to other NIEs such as the Four Asian Tigers, Hong Kong, Taiwan, Singapore and South Korea. 'Global triad' becomes a term for Europe, North America and East Asia (Dicken 2003). In retrospect, it can be seen that although the particular political conditions in East Asia, such as the Korean War, financial aids from the United States, tensions over the Taiwan Strait, British and Chinese influence on Hong Kong's sovereignty, etc. had an influence on

exogenous economic growth, endogenous factors, e.g. proper development strategies, favourable business environment, hard working labour force and accumulation of human capital, were common endogenous factors for the economic take-off and continuous growth in Japan, the Tigers and China. Endogenous growth can explain a great deal of the development in East Asia.

All countries in the world face both challenges and opportunities under the wave of globalisation. There are common benefits as well as conflicts of interest among countries. Global growth is dynamics that depends on the development strategies and policies of all countries and organisations, while regional growth is closely connected to globalisation in different ways and over different spatial scales. The future growth of each individual country or region will partially depend on its endogenous factors and partially on the exogenous impact of globalisation. The interaction of endogenous and exogenous driving forces creates growth or causes decline for individual countries. Under such a macro environment, an individual country or a single region might only have a very limited influence on exogenous factors but can focus on creating endogenous growth, which helps the country or region surf the wave of globalisation with good preparation and avoid the danger of being wiped out.

8.8 Economic growth—learning by doing and learning from each other

During the long history of human beings, social development and economic growth have interacted and made the world differentiate into developed and developing countries, growing and declining regions, or cores and peripheries, etc. Today's economic landscape was initiated by the so-called *first nature* in the prehistoric period and is gradually modified by the *second nature* that is viewed as the outcome of human beings' activities to improve on this first nature (Ottaviano and Thisse 2005). Actually, the second nature is the interaction of manifold economic, social, cultural, and politic forces, etc. In a metaphorical expression, the long process is like a marathon where some runners are in

leading positions, some are in the last positions and the rest is in between. The positions of runners are dynamic, some catch up or even take over the leading positions, some are unchanged, and some slow down and fall behind. The mechanism of the dynamics can be understood by the first and second natures and explained by endogenous and exogenous factors.

The endogenous growth theory emphasises 'learning by doing' because knowledge must be acquired (Arrow 1962). At global and national levels, learning by doing can be applied in the aspect of policymaking. The experiences and lessons of developed and quickly growing countries, respectively, could be useful knowledge for themselves and for developing and least developed countries. From this aspect, learning-by-doing is also a process of learning-from-each-other.

From the economic point of view, China's further growth will increasingly depend on endogenous factors, e.g. possessing a well-educated and highly skillful labour force, increasing creative and innovative capability, improving firms' competition in the global market, building up a suitable social warfare system that covers the entire population, reducing the provincial disparity and income gap between different social groups, sustainably utilising resources and protecting the environment, etc. For all these aspects, China can learn a great deal from Sweden and other developed countries. Meanwhile for countries like Sweden, the current economic system is not perfect and obviously needs some improvements or reforms. How to create economic growth while maintaining the high quality of living standard under an ageing society is new knowledge that needs to be acquired. Learning-by-doing and learning-from-each-other could be an effective way of acquiring this new knowledge.

The model of China's fast growth might not be applicable to some developing and the least developed countries, because not every country has the same endowments as China, e.g. huge land territory, a large population with one majority nationality, rich total resources (though a very limited per capita), a long history and continuous culture of more than 5 000 years, well regulated

interpersonal relations and machine-like rules (with a calculated flexibility), etc. However, China's economic development provides evidence for endogenous growth, indicates that an individual country could experience economic growth brought by its endogenous factors, and resembles the findings that localised conditions have a strong influence on regional growth. Therefore, endogenous growth is applicable to any country or region.

9. EPILOGUE

As mentioned in the prologue of the thesis, the complexity of regional growth and its driving forces calls for further observations, analyses and new insights. The thesis tried to make some contributions to explain regional economic growth. The main findings from the thesis can be summarised as endogenous factors being important for regional economic growth and probably explaining at least one third of total growth. Among the endogenous factors, localised demographic composition, labour force and labour market, firms, and business environment have the strongest influence on regional economic growth. The findings imply that in an era of globalisation, the immediate milieus of residential place and localised conditions of workplace play critical roles for regional economic growth. Spatial scale is of importance in observing and analysing regional economic growth.

The methodologies developed in the thesis provide a new alternative, i.e. using large-scale micro data and adding multi-spatial scales into spatial models, to analyse regional growth and further improve the existing growth models.

The comparison between Sweden and China does not only provide evidence of endogenous growth within different spatial scales, it also indicates that driving forces and mechanisms for economic growth share common characteristics at different stages of development, i.e. China as a developing country and Sweden as a developed country.

The findings are not merely theoretical and methodological but applicable for making regional development policies. Although a single region can hardly have a large influence on trends of national or global growth, the region can improve its endogenous factors which have a large influence on regional economic growth. Therefore, in addition to the policies that try to attract more people, firms or investments from outside, e.g. place marketing or other strategies, an important alternative is to focus on improving localised conditions for people who are living and firms that are currently located in the region. The improvement in the localised conditions would make the region more attractive and help firms improve their economic performance, thereby bringing endogenous growth to the region.

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