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# The drivers of growth and innovation in Swedish metropolitan cities since the 1980's

by

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Metropolitan cities are increasingly becoming the undisputed centers of growth and innovation. This thesis investigates the driving forces of urban growth and innovation in the Swedish metropolitan cities from the 1980's and onwards through a mixed method case study. The theories of Richard Florida, Enrico Moretti and Edward Glaeser are used to form three hypotheses of how cities attract high-skill people and achieve urban growth and innovation. The results suggest that Moretti's theories of large successful innovative companies as the drivers of growth and innovation fits the development in Stockholm and Göteborg: the Ericsson company in Stockholm, and Volvo in Göteborg. Malmö-Lund achieved growth and innovation through its human capital potential and its diverse industries, which fits Glaeser's theories.

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# Table of Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Research Problem and Aim	1
1.2	Research Question	2
1.3	Outline of the Thesis	2
1.4	Background	3
1.4.1	Sweden: Golden years, crises, and growth	3
<b>2</b>	<b>Theory</b>	<b>5</b>
2.1	Florida: Creativity	5
2.2	Moretti: Innovators	7
2.3	Glaeser: Human capital	8
2.4	Previous Research	9
2.4.1	Creative class and tolerance in Europe and Sweden	9
2.4.2	Innovation and technological change in Sweden	10
2.4.3	Human capital and industrial diversity in Sweden	10
2.4.4	Previous regional and city-level studies in Sweden	10
2.5	Three hypotheses of modern urban growth	11
<b>3</b>	<b>Data</b>	<b>12</b>
3.1	Metropolitan Regions	12
3.2	Growth indicators	13
3.3	Innovation	14
3.4	Creative Core and Diversity	14
3.5	Human capital	15
<b>4</b>	<b>Method</b>	<b>16</b>
4.1	Case study	16
4.2	Methods for analysis	17
4.2.1	The use of correlation coefficients	17
4.2.2	Method Hypothesis I: Creativity	17
4.2.3	Method Hypothesis II: Innovators	17
4.2.4	Method Hypothesis III: Human capital	18
4.2.5	Operationalized research question	19
<b>5</b>	<b>Results</b>	<b>20</b>
5.1	Housing prices, Population, and Wages 1982-2014	20
5.2	Stockholm: Hypothesis testing	21

5.2.1	Hypothesis I: Creativity .....	21
5.2.2	Hypothesis II: Innovators .....	24
5.2.3	Hypothesis III: Human capital .....	26
5.3	Göteborg: Hypothesis testing .....	28
5.3.1	Hypothesis I: Creativity .....	28
5.3.2	Hypothesis II: Innovators .....	31
5.3.3	Hypothesis III: Human capital .....	33
5.4	Malmö-Lund: Hypothesis testing.....	35
5.4.1	Hypothesis I: Creativity .....	35
5.4.2	Hypothesis II: Innovators .....	37
5.4.3	Hypothesis III: Human capital .....	39
<b>6</b>	<b>Analysis .....</b>	<b>42</b>
6.1	Classification of Swedish metropolitan growth .....	45
<b>7</b>	<b>Conclusion.....</b>	<b>46</b>
<b>8</b>	<b>References .....</b>	<b>48</b>
8.1	Newspaper articles .....	52
8.2	Data sources .....	52

# List of Tables

Table 1: Percent change in values of House prices, Population, and wages. (Statistics Sweden, HILD).....	20
Table 2: Stockholm: Correlation Coefficients: Creative Core measures and Innovation/Growth indicators. 2001-2013. *sig.95% (OECD; Statistics Sweden) .....	22
Table 3: Stockholm: Correlation Coefficients: Innovation and Growth indicators 1977-2013 *sig.95% (OECD; Statistics Sweden) .....	26
Table 4: Stockholm: Correlation Coefficients: Human Capital with innovation and growth. 1985-2013; Graduates with innovation and growth 1977-2013. *sig.95% (OECD; Statistics Sweden).....	28
Table 5: Göteborg: Correlation Coefficients: Creative Core measures and Innovation/Growth indicators. 2001-2013. *sig.95% (OECD; Statistics Sweden).....	30
Table 6: Göteborg: Correlation Coefficients: Innovation and Growth indicators 1977-2013. *sig.95% (OECD; Statistics Sweden) .....	33
Table 7: Göteborg: Correlation Coefficients: Human Capital with innovation and growth. 1985-2013; Graduates with innovation and growth 1977-2013. *sig.95% (OECD; Statistics Sweden).....	34
Table 8: Malmö-Lund: Correlation Coefficients: Creative Core measures and Innovation/Growth indicators 2001-2013. *sig.95% (OECD; Statistics Sweden) .....	36
Table 9: Malmö-Lund: Correlation Coefficients: Innovation and Growth indicators 1977-2013. *sig.95%.(OECD; Statistics Sweden) .....	39
Table 10:Malmö-Lund: Correlation Coefficients: Human Capital with innovation and growth. 1985-2013; Graduates with innovation and growth 1977-2013. *sig.95% (OECD; Statistics Sweden) .....	40
Table 11 Classification of Swedish metropolitan growth patterns .....	45

# List of Figures

Figure 1: The municipalities included in the definition of the metropolitan city area. (Statistics Sweden maps).....	12
Figure 2: Stockholm: Creative core per capita and innovation per capita 2001-2013 (OECD; Statistics Sweden) .....	22
Figure 3: Stockholm: Innovation in ICT and life science in relation to population development. (OECD; Statistics Sweden) .....	25
Figure 4: Stockholm: Human capital concentration and innovation levels over time 1985-2013. (OECD; Statistics Sweden) .....	27
Figure 5: Göteborg: Creative core and Innovation, in levels 2001-2013. (OECD; Statistics Sweden).....	29
Figure 6: Göteborg: Innovation in ICT and life sciences and Population development 1977-2013. (OECD; Statistics Sweden) .....	32
Figure 7: Göteborg: Human capital and innovation in levels 1985-2013. (OECD; Statistics Sweden).....	34
Figure 8 Göteborg: Human Capital and Innovation development .....	34
Figure 9: Malmö-Lund: Creative core per capita and innovation per capita 2001-2013. (OECD; Statistics Sweden) .....	35
Figure 10 Malmö-Lund: Innovation and Population development 1977-2013. (OECD; Statistics Sweden). .....	38
Figure 11: Malmö-Lund: Innovation and Human capital 1985-2013 (OECD; Statistics Sweden).....	40



# 1 Introduction

The growth of cities is a subject approached by many social sciences, as it essentially discusses a central point in the interaction of people (Storper 2013:4-11). The challenge in understanding the development in cities in a contemporary context is to understand the technological change of the last decades. As automatization and global trade has decimated the number of low skill jobs in manufacturing in western economies, the challenge for policymakers ahead lies in understanding how to facilitate innovation and creativity (Florida 2012; Storper 2013; Moretti 2012). Innovation and creativity is intimately associated with metropolitan cities today. Places such as San Fransisco/Silicon valley, Boston, and Seattle are known for their innovative environments, but also as thriving cultural centers (Florida 2012; Glaeser 2005; Glaeser & Gottlieb 2009; Moretti 2012). These cities are growing, and employs not only people with high skill, but create jobs in low-skill services within and around the city (Moretti 2012).

The development in the US can also be seen in Sweden. The three metropolitan regions of Sweden are today the undisputed leaders of innovation and economic development in Sweden (Johansson et al. 2010; Lundquist & Olander 2010). The growth of the three metropolitan regions of Sweden, Stockholm, Göteborg and Malmö-Lund has been significant since the 1970's. This is particularly evident in terms of the increase of the population of the regions in comparison to other regions (Johansson et al. 2010: 33-34), but is also true for wages and housing prices (Statistics Sweden). Just like in the US, innovation have marked Sweden since the 1970's, and especially so in ICT after 1990 (Sjöo 2014:266-278).

## 1.1 Research Problem and Aim

Therefore, understanding which forces have spurred Swedish metropolitan cities to grow is a central question for policymakers today. The literature based in new economic geography suggests that the key factor for creating the innovative city is high skill in the labor force (Florida 2012; Glaeser 2005a; Glaeser & Gottlieb 2009; Moretti 2012). The dynamics of how and why skilled people move to certain cities is hotly debated, however, and there are several models for explaining what attracts skilled, and often young people to move into a certain city, and live and work there. As is common in social sciences, the process of understanding the individual's motivation and action is near impossible to single out. However, three major researchers in economic geography have centered on three models: creative individuals, innovation, and human capital (Florida 2012; Glaeser 2005a; Glaeser & Gottlieb 2009; Moretti 2012).

Both Florida and Moretti have been involved in research on Sweden, but there is a persistent problem in the application of applying American economic geography theory on a small country like Sweden. A statistical and econometric analysis becomes problematic, as Sweden really only have three metropolitan areas, and only barely so. As such, econometric research on a large sample of smaller Swedish cities (Florida et al. 2008; Moretti & Thulin 2013) does not convey the same type of conclusion as research on the large amount of American cities can. The method used in this thesis is similar to the type of mixed method case studies on the development of some American cities by Florida (2012), Moretti (2012) and Glaeser (2005a).

Even though there is much research on the topic of cities and innovation (Enflo et al. 2016), there is a gap in Swedish research of using a mixed method case approach to apply a wide theoretical framework using the theories and methods of Florida (2012), Moretti (2012) and Glaeser (2005a). Previous studies on Metropolitan cities in Sweden have not combined these perspectives in a historical overview (Lindell 2010), or has used county level data (Enflo & Rosés 2014), or without this theoretical framework (Johansson et. al 2010; Lundquist et al. 2008) This thesis uses a mixed method case study approach to the economic development of the three Swedish metropolitan cities by studying data ranging back in time to understand the growth in innovation and city development since the 1980's up until now.

## 1.2 Research Question

Since there is a gap in the research about the Swedish metropolitan cities from a mixed method case approach, this thesis fills that gap by studying the cities from three theoretical approaches. The research question for this thesis is:

- *What was the driving force of growth and innovation in Stockholm, Göteborg and Malmö-Lund?*

## 1.3 Outline of the Thesis

The thesis begins with a background section, which describes the structural changes in the American and Swedish economies in the years following the crisis in manufacturing at the end of the 1970's and leading up until today. After the background, the theoretical framework of Florida, Moretti and Glaeser is presented and discussed, and three hypotheses of what was the driving force in the growth of the cities are formed. The data section describes the variables and indicators used. The method section describes the way the hypotheses are tested.

Each metropolitan city and its development is then examined from the perspective of each hypothesis. The analysis chapter argues which hypothesis explains the development of each city. A conclusion sums up the thesis, and discusses the findings and its implications.

## 1.4 Background

The growth of metropolitan cities in western countries and in Sweden should be understood as a phenomenon relating not only to city-wide policies, but through a global and international perspective relating to technological change.

The period between 1950 and 1970 saw economic growth of 4% each year in many western economies. The increased living standards and production capacity changed the lives of the people in the industrialized world (Schön 2014:319-327). The economic growth was possible due to the technological advances made in the US, and the convergence of the Western European economies to the more advanced US economy (Schön 2014:319-327). The manufacturing industries in the US made cities like Detroit grow due to its automobile industry. Other industrial cities grew prosperous from the increase in productivity in the US manufacturing industry. In 1950, Detroit was the third richest city in the US, and the US continued its economic fortune until the peak of manufacturing industries in the late 1970's (Moretti 2012:30-34).

The demise of manufacturing industries have been iconified through the example of Detroit and the Rustbelt region of the US. The decline of the manufacturing industries in the West began in the 1970's due to a myriad of factors, including increased international competition, oil crises, financial crises, rising labor costs and much more (Schön 2014:375-385). The result was in any case the decline of the American cities in the rust belt area that were specialized in the manufacturing industries. Wages for industrial workers stagnated, and factories started closing down. The situation today is that people has left these regions, and the remaining population are struck by poverty and crime (Moretti 2012:33-39; Glaeser 2012:64-68).

However, all of the US economy did not suffer the same fate as the rustbelt. Instead, the economy became reliant on innovative industries. ICT-revolution and microelectronics gave rise to new economic centers built around innovation and new technologies. Metropolitan regions such as San Fransisco, Austin, Seattle, Raleigh-Durham, and Boston has become standard examples of the new type of industries that create new jobs and is spearheading economic development (Moretti 2012:93-99).

### 1.4.1 Sweden: Golden years, crises, and growth

Swedish cities has undergone a crisis similar to that of American cities. The effects and consequences of the structural change is quite different, however.

The Swedish economy was very competitive in post-war Europe, when demand for steel and heavy manufacturing industry goods were high in demand. The new chemical industries, and advanced manufacturing in automobiles enabled a period of high growth between 1950's up to the early 1970's (Schön 2014:364-375). As prices fell due to globalization and trade, the Swedish industries faced rising costs. Sweden went from being among the top growth countries in Europe before the 70's to have growth rates far lower than other Nordic countries

and the rest of Europe up until the 90's (Schön 2014:402). Just as in the US, the old industries faced rising costs without any prospect of recovery. The wharf industry had received a lot of investment in the early 70's in Sweden, but the industry slowly scaled down, and the great wharfs in Göteborg and Malmö were both completely gone by 1989 (Schön 2014:416-420).

The response to this crisis in industry was rationalization, and many automatization innovations were made. Sweden was hit hard by the crisis in terms of economic performance in the 70's, but the period of recovery and adaption was quite successful (Schön 2014:416,420). Sweden was already moving on to new economic paradigms by the 1980's. The innovations in ICT and life sciences became important drivers of economic growth, and the localization of these new industries shifted to the larger urban areas of Sweden, in comparison to the smaller and specialized manufacturing cities that were important in previous decades (Schön 2014:428-432; Sjöo 2014:77-82).

The Swedish financial crisis in the beginning of the 90's was a trend break, and facilitated both financial and political reforms, bringing Sweden into the European Union in 1995. The financial crisis had not crippled the new and innovative industries, instead, it weeded out the less productive actors on the market, and economic development continued (Lundquist et al. 2008; Schön 2014:437-440). It was really after the 1990's crisis that the metropolitan regions in Sweden really started diverging in terms of both employment and share of high-skill industries (Henning et al. 2016). The population of the metropolitan regions really started to increase in the beginning of the 90's (Statistics Sweden; Johansson et al. 2010).

The ICT sector in Sweden flourished in the 1990's and primarily based around the Ericsson company (Sjöo 2014:80-82). The dotcom crisis in 2000 caused harm to many ICT companies, including Ericsson (Sjöo 2014:82). Since then, the ICT industry grew in 2000's, with several recent notable brand names such as Skype and Spotify coming out of Sweden (Davidsson 2015), and the Swedish metropolitan regions are leading in innovation in Europe and, on par with US (Schön 2014:441-447). In per capita terms, Sweden ranks number 3 in European patent applications 2016. Also in total number of patents, Sweden ranks number 11. (European Patent Office 2016).

The development of the Swedish and American economies have therefore been similar in trends and in economic structure. The geographical scope between Sweden and the US has of course very important implications on the consequences of this technological and structural shift in the economy. Still, the pattern of some metropolitan centers emerging as the winners in the US can also be seen in Sweden, where Stockholm, Göteborg and Malmö-Lund emerges as the regions where people immigrate to, and where the economic activity clusters (Lundquist et al. 2008).

## 2 Theory

Today, the literature about why the large metropolitan cities are making a comeback in the modern economy is growing. The understanding of the city as an entity of variation and innovation in terms of economic geography has since become more commonplace in the economic literature.

In particular, Florida, Moretti and Glaeser has become very influential economists in understanding which cities becomes successful. They agree that the success of a region is closely tied to high skills, and that it is the cities which are the best at attracting these individuals that have the best opportunities of growth. They do not agree on the details of what skills mean, and why individuals are attracted to cities, however. Their extensive research on American cities can be summarized into roughly three hypotheses of what the driving forces of urban growth and innovation is in today's economy.

### 2.1 Florida: Creativity

Florida argues that to understand the success of a region and city, one must see the city in a wider context than simply human capital and firms. Florida observed that young university graduates moved away from his hometown Pittsburgh, which used to be an important manufacturing city, but has today less than half of its population compared to 1950 (Florida 2012:345-349). People left Pittsburgh for cities like Austin and San Francisco, which could offer creative people to live an attractive life in terms of opportunities to express themselves both privately and professionally (Florida 2012:287-303).

Florida's argument is that some places just seem to change their social norms and way of doing business. These places are not prejudiced, both in terms of which companies are created, and which new ideas might be an outcome when creative people are encouraged to develop their identities freely (Florida 2012:65-80). The creative and the people capable of producing innovation and economic development want to live in these open and tolerant cities, and also move there (Florida 2012:287-303). As a result, the city which has succeeded to capture this atmosphere are the cities which are marked by high growth and innovation (Florida 2012:228-265).

The creative class is defined as the people who do something creative in their work, which is a very broad term (Florida 2012:38-39). A more interesting group is a sub-category of the creative class, the so called: super-creative core. This group includes: engineers, natural scientists, think-tank researchers, analysts. However, it also includes creative individuals such as poets, architects, artists, writers, musicians. Florida argues that the difference from other group is that the creative core's job is not only to solve problems, but to formulate them. The

output of this type of work is not a product or a service, it is the innovation that is the output and goal (Florida 2012:38-39).

To be able to rank and categorize the levels of this type of atmosphere Florida uses several measures, most notably the concentration of artists, and arguably the most famously, the concentration of gay people. Florida finds that cities that scores high in these measures also are ranked highly in human capital and innovation. This relationship is motivated through several quantitative studies (Florida 2012: 228-265; Florida et al. 2008; Mellander & Florida 2006). Florida's theories have been popular, but have also been subject to a substantial amount of criticism in its methodological approach.

The main set of criticisms have been directed at the weaknesses of using the definitions of creative class and bohemian values. For example that human capital is a better measure than creative class (Glaeser 2005b), or that the causal relationship between creative class and tolerance in relation to innovation and growth is mistaken (Moretti 2012:200-205).

However, the criticism oversimplifies Florida's arguments. Florida argues that a creative and tolerant environment facilitates the creative process, and this effect which is difficult to operationalize (Florida et al. 2008). He argues that forcing a causal relationship between jobs and city growth is a false dichotomy, the interesting question is instead why people and jobs choose to remain in the city (Florida 2012:262). However, Florida (2012:183-193) still argues that people move to creative and tolerant cities, and leave those who are not, indicating an implied causal direction.

The success of a city or region is determined by their creative potential. Cities succeed where creative individuals live and work, be they engineers, computer professionals, university employees or artists. The more creative people, the better the city will perform. In addition to this, a city which is open to gays and has a lot of people working in artistic professions are better at innovation, and are more productive, thus causing growth.

## 2.2 Moretti: Innovators

Moretti has a quite different approach as to why certain cities are more successful, and he differs from Florida primarily in terms of causality. Moretti joins the literature that identifies that innovators, and even a single innovative company can revitalize a city (Moretti 2012).

Where Florida sees the localization of innovators and talent as a function of their cultural preferences, Moretti identifies the difference between declining manufacturing cities and revitalized cities as innovation and high-tech jobs (Moretti 2012:80-100). Moretti argues that innovative key individuals and their companies can have a significant impact on the impact of regional development. When high-tech companies enter a region, they bring a lot of growth potential. Each worker in high-tech industries can support 5 jobs in other sectors of the economy (Moretti 2012:60). This could either be in artisanal crafts and services, which Moretti sees most clearly in the hipster trend for high-end consumption and services (Moretti 2012:40-45). Therefore, attracting innovative companies has the potential of revitalizing the region, only then can the region develop a cool urban culture like the one Florida describes as a product of successful innovation (Moretti 2012:200-205).

Seattle is used as an example. Seattle was a failing city in the 70's, they were depending on declining low-skill manufacturing industries, and there were not any sign of endogenous change. The change came when Microsoft moved there, and today the city is bustling with innovative and high-tech companies, and has developed a vibrant culture (Moretti 2012:74-81).

Moretti argues that once a good labor market is formed around a successful company, the company attracts skilled people, and an abundance of skilled people attracts companies. This is the reason for why even though local innovation might happen, the companies will relocate to an innovative city to take part in the knowledge transfers between employees and entrepreneurs, and the skilled labor market that comes as a result of this (Moretti 2012:136-155). This effect highlights the importance of keeping a successful company in the region to attract other companies interested in the innovations of the successful company this (Moretti 2012:153-155).

Moretti's narrative of city development is based around the multiplication effect of innovative jobs. The introduction of an innovative company, or the general innovation rate of a region, will attract skilled people and companies looking to take part in the innovative process. In order to measure this effect, the number of patents in high-tech sectors per capita in the counties that the three cities are located in is sometimes used as an indicator of innovative activities. The Moretti-hypothesis would therefore mean an increase in innovation leads to positive regional development.

## 2.3 Glaeser: Human capital

The third theoretical approach in this thesis is focused on skills in terms of human capital, and its effect on city innovation and growth. Human capital is often used synonymously with education, and by extension labor productivity. Glaeser does not use human capital in the traditional sense. Instead, human capital is not interesting because of higher productivity per se in this case, but it allows a city to have a diversified economy (Glaeser & Gottlieb 2009).

The rustbelt cities of USA depended on specialized manufacturing, and they have been on the decline in the second half of the 20<sup>th</sup> century (Glaeser 2012:55). Glaeser argues that the successful cities in history have all been successful in their ability to adapt to new economic challenges. Boston was on the decline like the rustbelt cities up until the 1980's. The future of Boston was expected to follow the declining path of Detroit as discussed in the background section. Boston changed course and has become an economic powerhouse in the North-Eastern USA. Glaeser argues that due to the high levels of education and the large variety of skills of people in the region due to the universities in the region (Glaeser 2005a). Higher education is especially important in explaining the growth of cities both in general, but especially in times of crisis (Glaeser & Gottlieb 2009).

Having highly educated people in the city will therefore not only create growth, but also innovation (Glaeser & Gottlieb 2009). Glaeser argues that the success of a city depends on the collected skills of the people in the city. Having a variety of skills, either attained through education or through a diverse collection of industries allows a city to continue to innovate and grow (Glaeser & Gottlieb 2009).

Glaeser summarizes his theory well in his review of Moretti's book (Glaeser 2013). Glaeser agrees that Florida and Moretti are correct in their emphasis on skills and creativity, while criticizing their explanation of what the mechanisms are (Glaeser 2013). Moretti's idea of the great innovation event through the large and successful company is only a temporary factor if not translated into a diverse set of industries as a result of high human capital (Glaeser 2013). The cities based upon specialization around a successful company will not survive when global demand change, just like rustbelt cities. This is where the city with a diverse skillset will survive and thrive (Glaeser 2013). This is not only valid for the 80's and 90's, but also visible in the 2008 crisis, where cities with high human capital concentration suffered less unemployment (Glaeser et al 2014).



## 2.4 Previous Research

This section presents the various types of research already made on the subject of Swedish metropolitan cities, and the impact of skill on innovation and growth. The research in the topic of city development in general is vast, and the study of cities and regional development has been approached by a wide spectrum of social science subjects and academic disciplines (Enflo et al. 2016).

### 2.4.1 Creative class and tolerance in Europe and Sweden

The effect of creative class and bohemian individuals has been tried in Europe, and seems to work relatively well in a Western European context (Rutten & Gelissen 2008). Although much of the criticisms made against Florida remains, the theory is certainly applicable outside of the US. However, the Nordic countries are perhaps not similar enough for making Florida's research applicable, so argue Andersen and others (2010). They argue that the Nordic welfare states have too few metropolitan regions for the effect to work, as people will move to the largest city in the country to find job due to size, and not attractiveness (Andersen et al 2010). However, by modifying the meaning of the creative class, it is quite possible to describe Swedish cities in terms of creative class (Asheim & Hansen 2009; Hansen & Niedomysl 2009).

The concentration of homosexuals as an indication of the tolerance is interesting as a concept. Even if previous studies in Sweden suggest that there is a considerable concentration of gay people in Stockholm, Göteborg and Malmö, this concentration cannot be attributed to a tolerant atmosphere, but can only be explained due to the size of these places (Wimark 2014). The migratory pattern of homosexuals in Sweden is very similar to heterosexual people today, that homosexuals do not signal tolerance in any other way than heterosexuals, argues Wimark (2014). As a result, the claim that homosexuals signals a tolerant atmosphere should be contextualized before drawing conclusions.

Borén and Young criticize the application of American lifestyle patterns in terms of bohemian and tolerant values to a Swedish context (Borén & Young 2013). The migratory choice to locate to the metropolitan cities for artists in Sweden is not due amenities in a greater context, but is almost entirely a consequence of demand (Borén & Young 2013). Stockholm is where the money and opportunity exists for an artist, even though they do not like the city as a tolerant and interesting cultural phenomenon (Borén & Young 2013). Therefore, even if there are a lot of artists in a region does not mean that the city itself is culturally interesting and tolerant.

The definitions and underlying mechanisms in actual quantitative terms is often quite vaguely defined by Florida (Florida et al 2008; Florida 2012). As Hansen and Niedomysl (2009) points out, the empirical basis for Florida's claim on why people move from cities is primarily focus groups or anecdotal evidence. Correlations in cross-sectional data over space is also popular, but does not describe changes over time (Florida et al. 2008; Florida 2012).

## 2.4.2 Innovation and technological change in Sweden

Moretti and Thulin (2013) have studied the multiplication effect of high-tech jobs in Swedish cities, and find that increases in high-tech jobs leads to increases in local service jobs. However, this study has a series of problems, as up to 51 regions are used, which is not limited to the metropolitan regions. The econometric findings are interesting, but say only little about the economic development as a whole over time.

The research by Lundquist, Olander and Henning (2008) shows that industries that use new technology are primarily located in the metropolitan areas. They have specifically studied value creation, and that the Swedish metropolitan regions are increasingly the scene for technical innovation (Lundquist et al. 2008). Innovative industries are therefore in the metropolitan areas, and especially innovative companies can be identified.

## 2.4.3 Human capital and industrial diversity in Sweden

Elg (2014) have studied the connection between human capital levels and production with innovation in Sweden, but this study is primarily a policy guiding study, where the methodology and empirical research is unspecific. The study on national levels of human capital in Ljungberg and Nilsson (2009) is a good overview of the effects of human capital, but lacks a regional approach. Glaeser's research is based on American cities only, but his studies are extensive. Glaeser and Berry (2005) found that cities that had high human capital levels in 1970 also had high human capital levels in 1990 in the US. Glaeser's own research is very direct in its claims. Cities with high concentration of human capital and new students will attract high tech companies (Glaeser & Gottlieb 2009) and allow a diverse set of industries (Glaeser 2005a).

## 2.4.4 Previous regional and city-level studies in Sweden

Florida, Moretti and Glaeser belongs to a growing body of literature which uses specific cities and their circumstances as examples of their theories: Pittsburg for Florida (2012: 183-193), Seattle for Moretti (2012: 85-90), and Boston for Glaeser (2005a). As some researchers have noted, the difficulties of generalizing findings from cross-sectional data of cities on a macro level are many (Sydow et al. 2010; Henning et al. 2013). The choice available to researchers is often to take on a quantitative macro approach and lose the details, or to choose a case study approach.

There is an extensive literature about the regional economic history of Sweden (Enflo et al. 2016). Schön (2014) provides a comprehensive view of the technological and political changes that shaped Sweden, but does not go into extensive details about city-level development over time.

Others have used county-level data, using production of the region as a way of assessing the growth of regions (Enflo & Rosés 2014). These studies are useful in terms of assessing productivity, but loses the intricacies of city-level research. Some have chosen to take on the perspective of automatization and technological change as the main drivers of urban growth, and offer a different perspective, such as Henning (et al. 2016) and Lundquist (et al. 2008).

These are useful perspectives, but the actual city-level studies in a historical perspective are more rare. Johansson and others (2010) have conducted an excellent study, which provides a good overview of the population, wage and housing prices development of Swedish metropolitan cities, as well as technological change, and offer a similar answer to this thesis as to the drivers of growth. However, the study by Johansson and others (2010) is lacking the theoretical framework regarding human skill and creativity. Lindell (2010) has studied the metropolitan regions of Sweden, including the perspectives of Florida, but mainly from a policy-perspective meant to guide future investments, rather than an explanation.

## 2.5 Three hypotheses of modern urban growth

There are therefore three theories in the literature as to why cities grow and become successful. They all agree on the premise that innovation and creativity is the engine of the modern economy, but they disagree on the explanation of why some cities are successful and why others are in decline. Their views can be summed up in these three hypotheses, which

- *What was the driving force of growth and innovation in Stockholm, Göteborg and Malmö-Lund since 1980?*
  - *Was it creativity, innovators, or human capital?*

### I. **Creativity**

People working in creative professions in the city and a tolerant cultural environment makes a city innovative and prosperous.

### II. **Innovators**

Local innovation and innovative companies attracts skilled people, and create growth through multiplication effects.

### III. **Human capital**

A wide distribution of skills and industries creates a stable and prosperous region.

This thesis will apply this theoretical framework on a Swedish context and compare the three metropolitan cities with these explanations with available data to assess if the three hypotheses can explain the development of Swedish metropolitan cities from the crisis in manufacturing until today.

# 3 Data

The data used in this thesis is primarily from Statistics Sweden and OECD, but is divided into categories based on the theoretical discussion and previous research. It is based on geography, growth indicators, and the operationalization of the theoretical variables: Creative Core, Innovation, and Human capital.

## 3.1 Metropolitan Regions

Sweden has three major urban regions, where a lot of people live, and which have had a significantly bigger population growth (Johansson et al. 2010). Statistics Sweden has made several revisions of what the extents of the metropolitan city. In particular, the definition used in this thesis was made in 1970, and there was a revision in 2005, along with later definitions of labor market regions etc. Because some of the older data on wages and housing prices are presented by the 1970 definition, this definition is used. As Johansson and others (2010) have noted, the geographical area of the available labor market has grown in relation to the 1970 definition, but should not be a significant issue to the interpretation, as the literature is interested in the concentration of skilled people in interaction, rather than the total productivity in the larger region.

Figure 1 shows the extent of the 1970 definition of the metropolitan areas used in this thesis, and is the definition of the city unless specified otherwise.



Figure 1: The municipalities included in the definition of the metropolitan city area. (Statistics Sweden maps)

These are the municipalities included in the metropolitan area.

- **Stockholm Metropolitan municipalities:**  
Stockholm, Vallentuna, Upplands Väsby, Järfälla, Ekerö, Huddinge, Botkyrka, Salem, Haninge, Tyresjö, Upplands-Bro, Täby, Danderyd, Sollentuna, Värmdö, Nacka, Sundbyberg, Solna, Lidingö, Vaxholm, Sigtuna, Österåker.
- **Göteborg Metropolitan municipalities:**  
Göteborg, Kungälv, Härryda, Partille, Öckerö, Stenungsund, Tjörn, Ale, Lerum, Mölndal, Kungälv.
- **Malmö-Lund Metropolitan municipalities:**  
Malmö, Lund, Trelleborg, Staffanstorps, Burlöv, Vellinge, Kävlinge, Lomma, Svedala.

## 3.2 Growth indicators

The economic development of a city can be measured in several ways. However, in urban economics there are three main indicators of city growth or development: housing prices, population, and mean wages (Glaeser & Gottlieb 2009). These are indicators also used in a Swedish context (Johansson et al. 2010). The assumption is that these variables reflect the economic situation of the region. A region with high population, but with low wages and low housing prices might not be doing well, for example (Glaeser & Gottlieb 2009).

American labour markets are different from European labour markets in that American labour markets are more mobile (Glaeser & Gottlieb 2009). However, there is much evidence that the Swedish labour market is responsive to changes in conditions, and will respond by internal migration (Enflo & Rosés 2014; Aronsson et al. 2001; Lundberg 2003; Bjerke 2012; Berck et al. 2016). Thus, the assumptions that these indicators would reflect economic development in the region seems to hold.

The data used to indicate house prices in this thesis is the purchase price of “small houses” is used, which is essentially a one-household home, such as a villa. This data is also provided by Statistics Sweden, and available from 1981 (Statistics Sweden).

The population figures are a total sum of the inhabitants in the municipalities included in the metropolitan area defined above. The data is gathered from the Statistics Sweden database, and available since before the 70’s.

Wages, or income, has been changed in definition over time and different measures of regions (Statistics Sweden). Before 1991, the HILD-database wage of blue-collar industrial workers within the metropolitan region for this period (HILD), and the wage of the white-collar industrial workers has been collected through manual inputs from Statistics Sweden statistical yearbooks (Statistics Sweden). These wage levels and has been combined into an approximation of the mean wage of the city before 1990, and have been smoothed into the

1991 figures from Statistics Sweden. After 1990, the mean income is more reliably accounted for by Statistics Sweden database under income (Statistics Sweden).

### 3.3 Innovation

Innovation in this thesis is defined as number of patents, and number of patents per capita, and is available from 1977-2013. In the regional innovation dataset available from the OECD, the patents are only referring to Biotechnology, pharmaceuticals, and medical technology, and ICT (OECD). For practical reasons, the first three sectors have been combined into a composite life science measure. Patents, and patents per capita as a measure for innovation is common to use in this field. Florida (2012:229) and Moretti (2013:94-98) use it as a measure of innovation.

A problem with this dataset is that the region is the county, or “län”, which is a considerably larger region than the metropolitan areas in the case of Göteborg and Malmö-Lund. However, it is fair to assume that most patents are registered by companies located within the major urban region since that is where the innovative companies are (Johansson et al 2010:195-200), and can rather safely be assumed to reflect the innovation capacity of the metropolitan city. This is why the patents per capita measure is based upon the population of the metropolitan region, where the people working in these industries live and work (Johansson et al 2010:195-200), and not the county.

### 3.4 Creative Core and Diversity

The effect of the creative class measure might be better to use in terms of its super creative core section. The creative class measure is often very similar to human capital measures, and it is sometimes difficult to distinguish between human capital and the creative class (Glaeser 2005b; Mellander & Florida 2006), the measure of the super creative core is perhaps a better operationalization. There is some debate as to what constitutes the super creative core, and how it should best be divided in a Swedish context, but there is evidence that various definitions works for explaining developments (Mellander & Florida 2006; Asheim & Hansen 2009).

The creative core is a modified version of Florida’s (2012:38-39) super creative core class. Because of the limitation to Statistics Sweden’s definition of labor in 1998 (Statistics Sweden), these figures may not perfectly capture the creative class, but is still very descriptive. The biggest flaw with this dataset is that the time span of 2001-2013 is very small in comparison to human capital or innovation. This is the best data available for the thesis, however, and the period is interesting nonetheless. The creative core is divided into three categories in this thesis:

- **Science core**  
- Life science professionals, Mathematicians, Computer professionals, Engineers.
- **Bohemian core**  
- Artists, Journalists, Actors, Comedians, Comic writers, Athletes.
- **Total creative core**  
- All of the above + university teachers.

Besides the creative core, a simple measure of the concentration of gays is used. Using the number of registered homosexual partnerships per region before marriage was legalized in 2009. RFSL also released the number of people in homosexual registered partnerships and marriages per 10000 inhabitants for 2006 and 2014 (RFSL 2006; RFSL 2015).

### 3.5 Human capital

The number of individuals with a bachelor degree and the number of graduates from universities are used to indicate the human capital level in the regions. This data is taken from Statistics Sweden's dataset UREG and SUN (Statistics Sweden). Human capital is defined here as the share of inhabitants with a bachelor's degree. This is the equivalent definition to college graduates most use to indicate human capital in terms of higher education (Florida et al. 2008; Glaeser 2005b; Glaeser & Gottlieb 2009).

In addition to this, the number of students graduated with a degree per year by the universities and "högskolor" (universities with less administrative privileges) in the region will also be used as an alternative measure to assess the human capital potential of the metropolitan city. The universities in question are listed in Statistics Sweden's database (Statistics Sweden). The impact of universities in the growth of cities (Glaeser & Gottlieb 2009). The purpose of including this measure is to make an addition to the regular human capital measure, to check if the local production of graduated students has any effect on either innovation or growth, in line with the third hypothesis about human capital.

## 4 Method

This thesis is a mixed method case study on the growth of Stockholm, Göteborg and Malmö-Lund. The methods used are both the use of data series over time and correlations, and a qualitative narrative approach based on previous research and observation. This method chapter starts with a motivation for the method used, and is followed by a description the method used by each hypothesis.

### 4.1 Case study

A challenging aspect of replicating the American literature in the context of Sweden is the fact that the sample size of cities is so low. The three metropolitan cities of Sweden have all grown in the last decades. There are no proper examples of a rustbelt equivalent unless considering middle-sized Swedish cities, which are not comparable in terms of the literature about an actual city in international terms.

An econometric approach would not be suitable for the subject matter, as most of the indicators in urban development are suffering from high correlation. The US is better suited for an econometric study, as the sample size of metropolitan cities in Sweden is three. Like Florida (2012), Moretti (2012) and Glaeser (2005a), this thesis will use both some statistical analysis as well as constructing a narrative of each city with the help of various data sources and previous studies which then can be discussed and compared.

Besides the work by Florida (2014), Moretti (2013) and Glaeser (2005a), another good example of the type of method in this thesis is the studies by Fredin and Jogmark (2017). This is a good example of a case study of two middle-sized Swedish cities, where both quantitative and qualitative data combines into a narrative of the economic development of two cities.

The potential weakness of a narrative approach is the risk of bias and arbitrary choices. However, this is why the three different hypotheses with clearly defined goals are used as a way to study the cities similarly.

Therefore, a case study on the three metropolitan cities of Sweden in a historical perspective will provide a new perspective in the research on Swedish metropolitan regions. Instead of observing a large number of municipalities, an in-depth case study like this is a new way of testing the theories of Florida, Moretti, and Glaeser in the Swedish literature.



## 4.2 Methods for analysis

### 4.2.1 The use of correlation coefficients

This thesis uses Pearson's correlation coefficient to illustrate the correlation, and relationship between variables and indicators in levels. These should not be interpreted as the main analysis tool of this thesis, but should be seen as a way of illustrating the similarities in trend in growth and the other variables. An asterisk denotes that the correlation coefficient is statistically significant at 95% confidence interval.

### 4.2.2 Method Hypothesis I: Creativity

To investigate the first hypothesis that a city with many people working in a creative profession makes the city more creative and attractive. The hypothesis is tested by both statistical data and previous research, and then discussed as to the validity of the claim of the hypothesis. The importance of the creative core is studied by investigating which professions are common in the creative core of the city. If the creative capital per capita corresponds and correlates to growth and innovation over time, and whether this and previous literature would indicate that creative capital explains the growth of the city since the 80's.

In addition to this, an innovative and growing city is hypothesized to be so by being a culturally tolerant city. The tolerance of a city is operationalized as having a high concentration of bohemian creative core and a high concentration of gays. These two indicators together with previous research are used to indicate a tolerant atmosphere in the city. The significance of these indicators is then debated. A correlation table will serve as a supporting illustration for the relationship between indicators.

The hypothesis is considered to explain the growth of the city and its innovation if the previous literature and the data collected can explain that the creative core and tolerance are the mechanisms of the growth and innovation in the city.

### 4.2.3 Method Hypothesis II: Innovators

The second hypothesis posit that innovation, and important innovative companies brings wealth into the city. The hypothesis is tested by both statistical data and previous research, and then discussed as to the validity of the claim of the hypothesis. The indicators of the second hypothesis is the regional innovation data from OECD and various data sources on the important companies in the metropolitan city. Since the data is available for a longer time, the relationship over time between innovation and growth becomes more interesting to study than in the first hypothesis.

Correlations between innovation and growth are used to indicate the relationship between innovation and growth. A strong positive correlation suggests that the two variables are

linked, supporting the claim of the hypothesis. Apart from the correlations, the impact and the importance of the innovative companies in either ICT or life sciences is discussed. The hypothesis is considered to explain the growth of the city and its innovation if the previous literature and the data collected can explain that innovative companies are the mechanisms of the growth and innovation in the city.

#### 4.2.4 Method Hypothesis III: Human capital

Human capital is tested by analyzing the concentration of highly educated people, and the number of graduates within the metropolitan city area, which is the indicators Glaeser has used in studying the effects of human capital (Glaeser & Saiz 2004).

The expected relationship is that if the metropolitan city has high rates of human capital, and/or high production of graduates in the city region, then the growth of the city may be explained by the high-skill companies attracted to the skills, and the potential of the human capital in the city (Glaeser & Gottlieb 2009). The correlation coefficient between human capital indicators in relation to growth and innovation is used to illustrate the relationship between human capital levels and graduates in relation to innovation and growth indicators. Variety is analyzed both in terms of human capital, but also through examples of the industries in the region from previous research.

The hypothesis is considered to explain the growth of the city and its innovation if the previous literature and the data collected can explain that human capital and diverse industries are the mechanisms of the growth and innovation in the city.

## 4.2.5 Operationalized research question

Research question: *What was the driving force of growth and innovation in Stockholm, Göteborg and Malmö-Lund?*

In order to answer the research question, a structured method is required. This is why the hypotheses are used as a mean of testing whether the hypothesis is supported or not supported. It is necessary to stress that this method of research does not establish causality in direct terms. In the context of intricate historical processes, direct causality is difficult to establish. However, having a historical perspective over time offers a better explanation than large cross-sections in a small sample country like Sweden.

- **Hypothesis I: Creativity**
  - Can creative core and tolerance explain the growth of the city?
    - This is tested by analyzing the creative core, the bohemian core, and the gay population.
- **Hypothesis II: Innovators**
  - Can innovation and innovative companies explain the growth of the city?
    - This is tested by analyzing patents and the success of local companies.
- **Hypothesis III: Human capital**
  - Can human capital and diverse industries explain the growth of the city?
    - This is tested by analyzing the impact of human capital through highly educated and graduates, and the diversification of local industries.

# 5 Results

This chapter starts with an introductory section describing the growth pattern in Stockholm, Göteborg, and Malmö-Lund. The following sections tests the three hypotheses for each metropolitan city.

## 5.1 Housing prices, Population, and Wages 1982-2014

The growth relation to population and size has been very similar, although they differ in total numbers. The growth periods are divided into periods similar to how Sjöo (2014:83) divides the development in Sweden, starting with growth in 1982 through the crisis in the 90's, with a second period of growth starting 1995 up until 2014. Table 1 illustrates how much the cities grew in this period.

Table 1: Percent change in values of House prices, Population, and wages. (Statistics Sweden, HILD)

		Stockholm	Göteborg	Malmö-Lund
House Price increase	1982-1994	127%	108%	113%
	1995-2014	331%	299%	287%
Population increase	1982-1994	10%	10%	10%
	1995-2014	28%	20%	24%
Wage increase	1982-1994	13%	12%	11%
	1995-2014	52%	55%	51%

As seen in table 1, the growth of all three cities are rather similar. Some exceptions include house prices, where Stockholm has a higher growth in the later period due to the increased concentration of people (Johansson et al. 2010: 38-51). Overall, however, the growth is very similar, showing that the Swedish cities are well integrated, and that people are willing to accept the high increase in housing prices due to cities are becoming more productive and geared towards innovation and creativity (Florida 2012; Glaeser & Gottlieb 2009; Johansson et al. 2010: 171-188; Moretti 2012). In addition to this, the BRP per capita in the metropolitan cities are very similar levels for the period 2012-2014 (Statistics Sweden), supporting the view of similar growth patterns in the cities even when using BRP per capita.

## 5.2 Stockholm: Hypothesis testing

This section will test the three hypotheses of which mechanisms are explaining the growth and development of Stockholm, divided into three parts.

### 5.2.1 Hypothesis I: Creativity

Stockholm is in several global studies ranked as one of the most creative metropolitan regions in the world. In Florida's ranking, Stockholm is listed as the city with the second highest percentage of creative class in the Non-american world at 46% (Florida 2012:270). This concentration of creative class is equal to that of Silicon Valley (Florida 2012:270).

#### **Creative Core**

The creative core constitutes around 7-8% of the total population of the total population 2001-2013. This is 1% more than Göteborg, and 2% over Malmö-Lund (Statistics Sweden). Out of the total number of the creative core in the Stockholm metropolitan area in 2013, 46% were computer-related professionals in the municipality of Stockholm (Statistics Sweden). ICT and computer services is clearly the dominating industry within the creative core in Stockholm.

The local government has since 1999 launched a series of initiatives to provide more amenities to the ICT-cluser in Kista, which was very specialized around the Ericsson company (Windén & Carvalho 2016). Attempts have been made to brand Kista as a "Science city", making the area become more an urban extension, and less like a specialized workplace (Windén & Carvalho 2016). Windén and Carvalho find that the local companies has found the improved selection of cafés and hotspots as a particularly positive development in recent years (Windén & Carvalho 2016).

The creative core as a whole in this period is therefore much related to the performance of the ICT industry, which is prospering in Stockholm, even though the dotcom crisis in 2000 caused a lot of layoffs within ICT, but the sector is recovering (Bienkowska 2007; OECD 2012; Windén & Carvalho 2016).

Innovation in ICT accounts for about 60-80% of total innovation in Stockholm during this time period, and the creative core is clearly tied to the dotcom crisis in ICT in 2000 (OECD). Even so, Florida's argument does not fit the description. As is clear from figure 2, the creative core seems related to innovation, but there is no clear evidence that the creative core is driving innovation. It could just as well be the reverse relationship. This goes against the hypothesis, where innovation is an outcome of creative individuals.

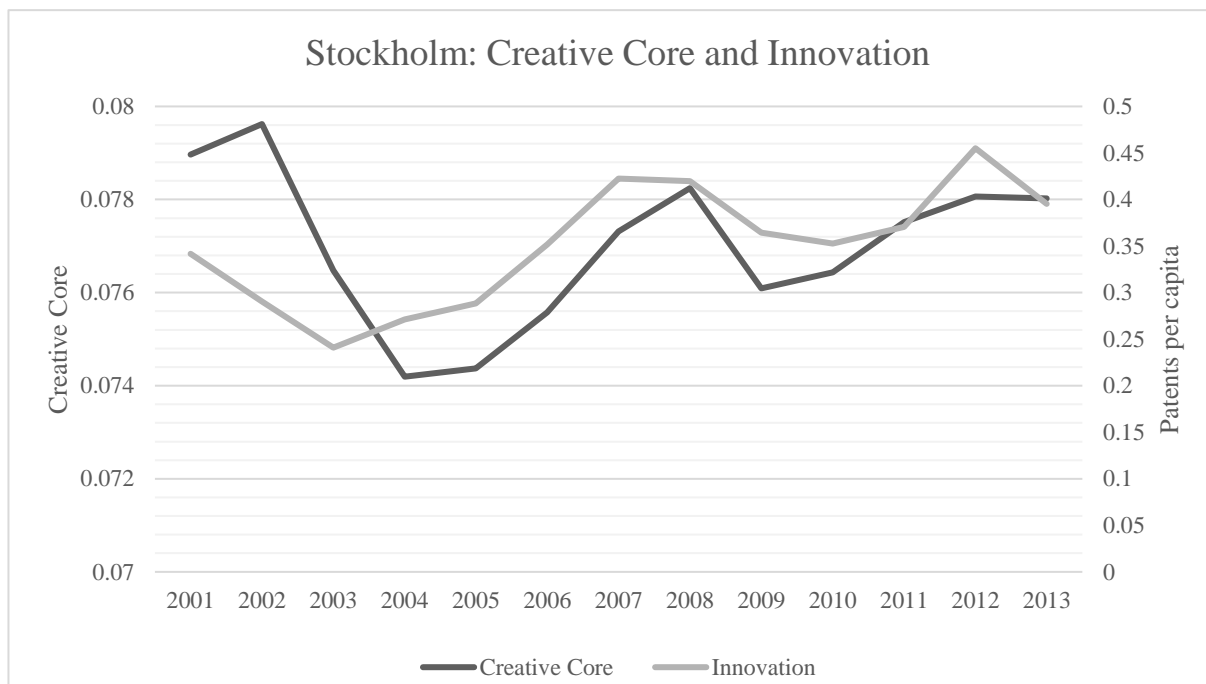


Figure 2: Stockholm: Creative core per capita and innovation per capita 2001-2013 (OECD; Statistics Sweden)

Also when considering the creative core in relation to the city’s growth, the hypothesis is not supported. The creative core in relation to population has declined during this period, while the city has grown in both housing prices, population, and wages, despite a short decline after the crisis (statistics Sweden). Table 2 illustrates this by showing that the creative science core group does not follow the same trend as the growth indicators, which is upwards.

Table 2: Stockholm: Correlation Coefficients: Creative Core measures and Innovation/Growth indicators. 2001-2013. \*sig.95% (OECD; Statistics Sweden)

	Life science innovation	ICT innovation	Total Innovation	House price	Population	Wage
Science core	-0.01	0.22	0.25	-0.08	0.03	-0.06
Bohemian core	-0.33	0.89*	0.90*	0.90*	0.77*	0.88*
Total Creative Core	-0.09	0.39	0.41	0.10	0.18	0.11

## **Tolerance**

The concentrations of bohemians are clearly the highest per capita among the Swedish metropolises at around 1.2-1.3% of the total population. A caveat for this high concentration is that the journalist group also included in this measure, and may therefore be more in the capital city. Other research confirms that Stockholm attracts artists to come to Stockholm because that is where the job opportunities are (Borén & Young 2013). The artist scene in Stockholm is not an attractive one per se, and the housing prices and other entry barriers are very high in Stockholm, according to a study on artists in Stockholm (Borén & Young 2013). Despite this, Stockholm has a lot of bohemians, and their share grow during the time period, following the development in growth indicators and innovation, as shown in table 2.

The positive association should be interpreted as some form of support for the hypothesis, as there is clearly an increasing interest in a bohemian lifestyle. However, the relationship could just as well indicate that a richer population allows for more artistic professions, rather than the dynamic relationship that Florida hypothesizes. The interpretation of the impact of the bohemian core is therefore very difficult, as the results are not causal in either direction.

Stockholm has by far the highest concentration of gay couples out of the three cities. In addition, the gap between Malmö and Stockholm has increased between 2006 and 2014 (RFSL 2006; RFSL 2015). Florida argues that a high concentration of gay individuals shows that the city in question is attractive to heterodox people and ideas (Florida 2012:239-240). However, the research by Wimark (2014) suggests that older generations of gay people may have chosen to move to big cities for tolerance, but the younger gay generations follow the same patterns as heterosexuals. Due to both contrary evidence in previous research in Sweden and the lack of a dataset stretching back further than 2006, the hypothesis that gays are an important factor is not convincing.

## **Summary**

Stockholm does not offer any clear indication that the hypothesis is correct. This may be due to the time period, which includes both the dotcom crisis and the 2008-crisis, where these relationships may be disrupted. It is pretty clear that the number of people working in computer professions are related to innovation in ICT, but the inclusion of the other professions and innovation in Life sciences just makes the relationship less clear. Stating that innovation in ICT is related to the relative number of people working with computers is rather obvious, however, and does not support Florida's theory overall.

There is at least no indication that Stockholm is unattractive to either bohemians or gays, it seems to attract them more successfully than Göteborg and Malmö-Lund, but like Wimark (2014) argues, this could simply be a function of Stockholm's size, and cannot be said to provide sufficient evidence for the hypothesis to explain Stockholm's growth and innovation.

## 5.2.2 Hypothesis II: Innovators

The innovations and companies in ICT and life sciences are discussed below.

### ICT

The IT sector has been very successful in Stockholm, and much of the IT-sector is centered in Kista, a district in north-western Stockholm. Kista became a center for electronics in the 70's when Ericsson and IBM located there (Bienkowska 2007). There was significant public investments made in Kista, and the engineering students became connected to the companies in the area (Bienkowska 2007).

Ericsson had some notable innovations in wireless technology, and this attracted Microsoft, Intel, Compaq and Siemens, in the 90's (Bienkowska 2007). In 2001, most of the people employed in the ICT-sector worked in Kista. The telecom crisis in 2000 led to a loss of half of Ericsson's staff which was a heavy blow to the area (Bienkowska 2007). However, the ICT industry in the area has since diversified, and the area has developed from being an Ericsson facility to become a hub for innovation, with a lot of actors, both students and startups (Windén & Carvalho 2016). This fits the description of how new businesses takes on the skills already present in the region (Neffke et al. 2011), in this case, the skills from Ericsson spill over to new companies.

Some notable of Stockholm-associated startups are Spotify, Skype, and game developer companies. Stockholm has emerged as a center for new ICT software through the firms that developed during the 2000's (Davidsson 2015; Schön 2014:445-448). These companies has had successes, but some startup companies have been bought by foreign firms and relocated outside the country (Davidsson 2015; Schön 2014:445-448). The innovation and entrepreneurship exists, but as of yet, there are few in comparison to Ericsson (Davidsson 2015; Schön 2014:445-448).

Innovation in the ICT sector is, and has been very high in Stockholm, but it clearly suffered from both the dotcom crisis in 2000 and the 2008 crisis as can be seen in figure 3. The impact of the innovations in Ericsson company, and the attracted competitors (Bienkowska 2007) seems to correspond to the surge in innovation in ICT in the 90's, seen in figure 3 (OECD). Schön also highlights the importance of Ericsson, and that the investments made in the 1980's are essential in understanding the contemporary ICT industry in Stockholm today (Schön 2014:444-448). Still, the importance of Ericsson in ICT innovation is very important for Stockholm and Sweden. Ericsson was the 12<sup>th</sup> highest ranking company in applications for patents, and accounts for 30% of total patents from Sweden to the European patent office 2016 (European patent office, 2017).



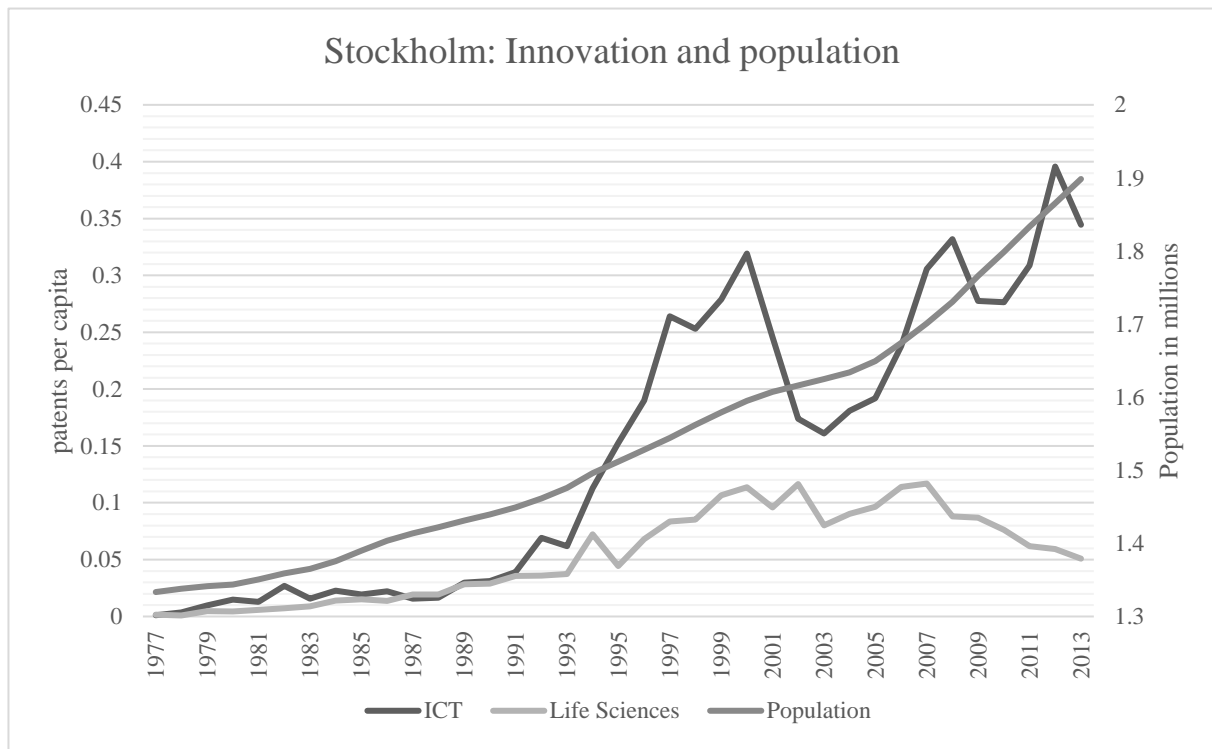


Figure 3: Stockholm: Innovation in ICT and life science in relation to population development. (OECD; Statistics Sweden)

### Life sciences

Stockholm has a strong life science field, smaller firms based around the Karolinska Hospital/university (Waxell 2011). Astra Zeneca in nearby Södertälje, which is not in this definition of the Stockholm region, but within commuting distance, was important for innovation in the region as well, but the research department closed down, at a loss of 1100-1200 jobs in 2012 (Mellgren 2012). There is a growing concern within the life science industry that the research capacity in Swedish life sciences is going down, as Astra Zeneca is declining (Olausson 2013). The data from OECD confirms that the innovation frequency has been stagnant for a long while, and declining until 2013, as can be seen in figure 3.

Table 3: Stockholm: Correlation Coefficients: Innovation and Growth indicators 1977-2013 \*sig.95% (OECD; Statistics Sweden)

	<i>House Price</i>	<i>Population</i>	<i>Wage</i>
<i>Life science innovation</i>	0.63*	0.72*	0.76*
<i>ICT innovation</i>	0.84*	0.92*	0.88*
<i>Total Innovation</i>	0.83*	0.91*	0.88*

## Summary

Stockholm fits the Moretti-hypothesis very well. The innovations generated around Ericsson seems to have had a very notable effect, as well as the potential for skill transfers, as the company and the innovations by them so clearly marks the growth of ICT in the Stockholm region. Life sciences have been influential but is not close to the ICT innovation numbers. As shown in table 3, the upwards trend in the growth indicators correlates well with innovation, especially ICT.

### 5.2.3 Hypothesis III: Human capital

Since 1985, the concentration of highly educated in the Stockholm region has been around 2% higher than in the two other metropolitan regions. The concentration of highly educated started growing significantly after 2000, and continue to do so in all regions, while Stockholm keeps its advantage (Statistics Sweden). Johansson and others argue that Stockholm has had the most diverse local labor market in Sweden, with some specialization in industries unique to Stockholm (Johansson et al. 2010:192-196).

The share of highly educated in the Stockholm region has grown from 8% in 1985 to 21% in 2013. This increase is impressive, but is only slightly above the other metropolitan areas. There does not seem to be a substantial difference between the metropolitan cities, so the actual levels are perhaps limited in their economic significance, except that Stockholm has a larger number of highly educated both in real figures and in relative terms.

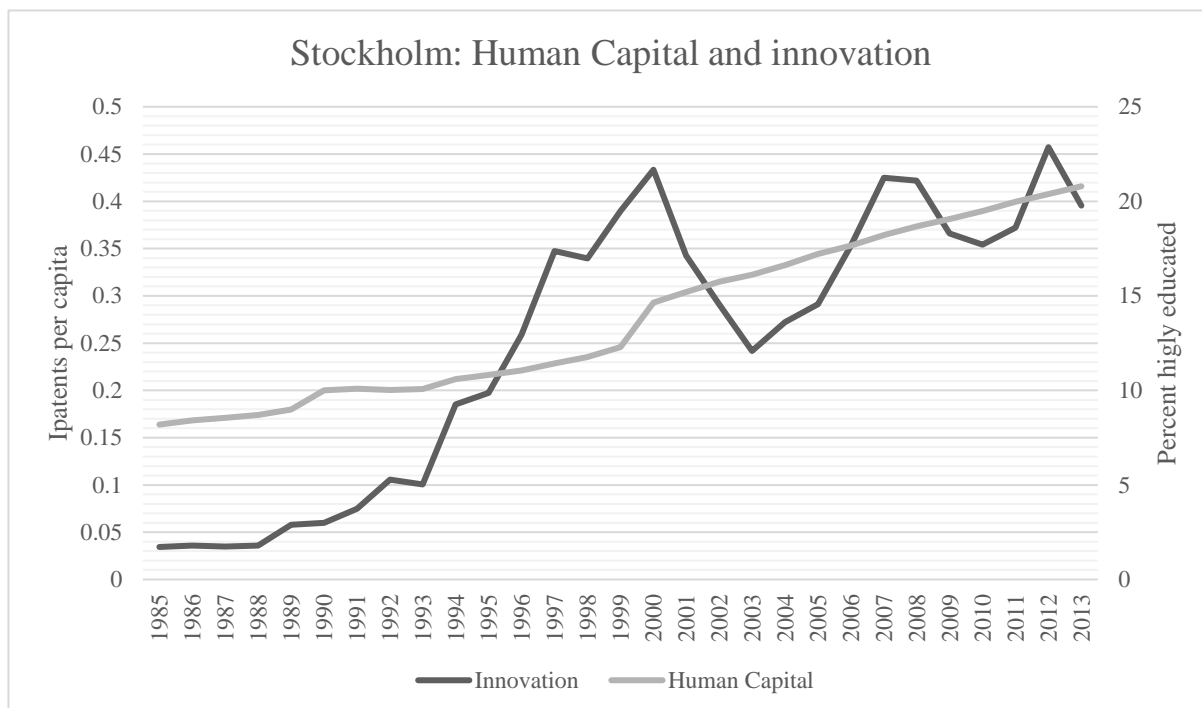


Figure 4: Stockholm: Human capital concentration and innovation levels over time 1985-2013. (OECD; Statistics Sweden)

The ICT sector is very important, and the technical universities in the city are today linked to the firms in the Kista ICT cluster. However, the success of Ericsson in the 70's preceded the ties with the universities by many years (Bienkowska 2007). The dotcom crisis struck innovation in Stockholm hard (Sjöo 2014:80-83), but also the 2008 crisis seemed to have hit innovation in Stockholm, according to figure 5, and there has since been recovery. This ability to withstand a crisis, and still be competitive in the field fits the Glaeser hypothesis, but it is mainly meant to indicate the diversification (Glaeser 2005a; Glaeser & Gottlieb 2009). Stockholm's recovery could indicate that the ICT sector was successful enough to withstand a crisis, without forcing Stockholm to diversify.

Table 4 describes the correlation between the number of university graduates produced within the Stockholm metropolitan area, and human capital levels compared to innovation and growth. The relationship between Human capital and the number of graduates in relation to the other factors are similar, and the relationship between growth indicators and human capital is strong, and so is ICT-innovation especially. This shows that the growth trend of the city, correlates very well with the increased concentration of human capital and the production of graduates, and so does innovation. These results correspond well with previous studies (Glaeser & Gottlieb 2009).

Table 4: Stockholm: Correlation Coefficients: Human Capital with innovation and growth. 1985-2013; Graduates with innovation and growth 1977-2013. \*sig.95% (OECD; Statistics Sweden)

	Life science	ICT	Innovation	House price	Population	Wage
Human Capital	0.62*	0.84*	0.84*	0.98*	0.97*	0.99*
Graduates	0.62*	0.82*	0.80*	0.92*	0.92*	0.92*

As is with the other hypotheses, the correlation between human capital in relation to growth and innovation is difficult to interpret. Human capital, and the skill-potential in the city may be important in the long run, as Glaeser argues (2005a), but the theory does not explain specific events and processes very well. The success of Ericsson, and the formation of the ICT-cluster in Kista is difficult to argue as the result of human capital levels. The volatility of innovation in Stockholm is following the trend of human capital relatively well, but the hypotheses of Florida and Moretti suggest a more detailed relationship.

### Summary

Stockholm has a high human capital concentration, and produces many new students. The industries in Stockholm are can handle crises. The availability of a skilled and varied labor force may have been a necessary component in the growth of Stockholm, but the economic growth and innovation in Stockholm as a function of human capital cannot by itself explain the massive success of the ICT sector in the city.

## 5.3 Göteborg: Hypothesis testing

This section will test the three hypotheses of which mechanisms are explaining the growth and development of Göteborg, divided into three parts.

### 5.3.1 Hypothesis I: Creativity

Göteborg has a history of manufacturing and working class culture. While Stockholm and Malmö-Lund are listed in the top 10 cities of creative class concentration in Florida's research, Göteborg is not on the top 20 (Florida 2012:270). The composition of the creative class in Göteborg is different from Stockholm and Malmö-Lund as it to a higher degree consists of engineers and life science analysts (Asheim & Hansen 2009; OECD). The characteristics of the creative core in Göteborg 2001-2013 (Statistics Sweden) is reflected in Asheim and Hansen (2009).

## Creative core

The creative core of Göteborg lies around 6-7% of the total population in the metropolitan area. The levels are less than Stockholm, but higher than Malmö-Lund. Engineers and advanced technical professionals in the central Göteborg municipality makes up between 38 and 43% of the creative core between 2001 and 2013, and accounts for a majority of the growth in the creative core during this period. Just like computer professionals are dominant in Stockholm, engineers are dominant in Göteborg. High-skill manufacturing, and the innovations in this sectors are not covered in the OECD dataset, but previous studies confirm that advanced manufacturing is important in Göteborg (Johansson et al. 2010:192-196).

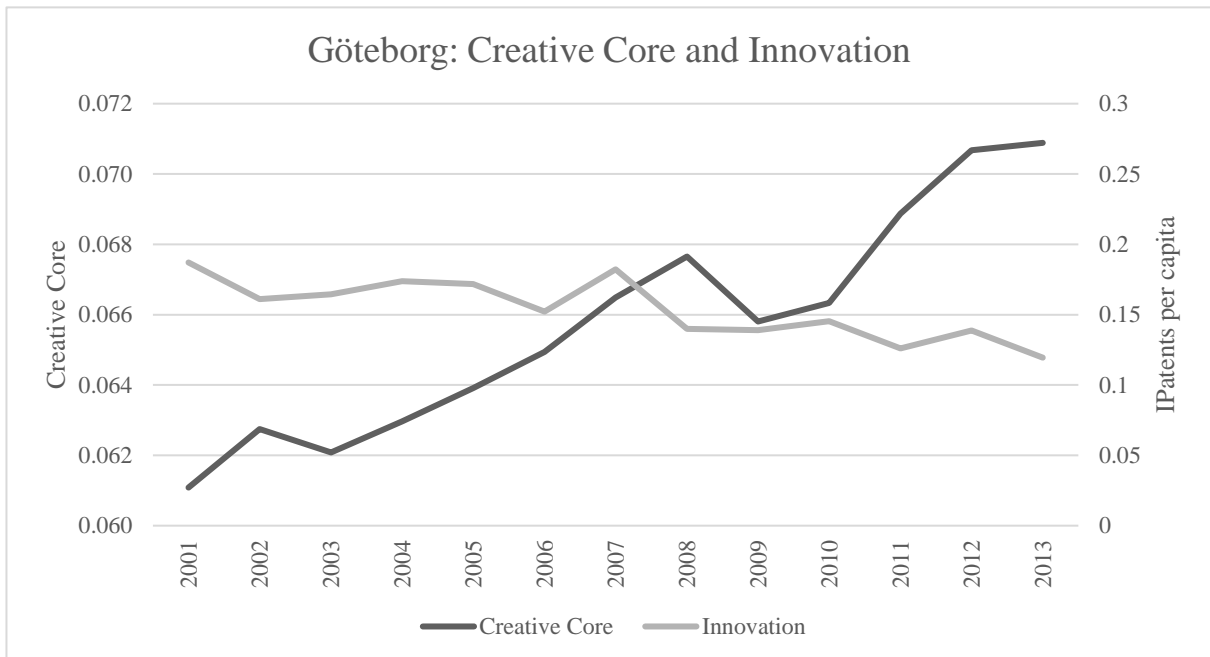


Figure 5: Göteborg: Creative core and Innovation, in levels 2001-2013. (OECD; Statistics Sweden)

As figure 6 shows, however, innovation per capita in these two sectors is decreasing in the time period, while the creative core steadily increases during the time span, also including a significant amount more computer professionals. The levels themselves are also clearly lower than Stockholm's and Malmö-Lund's. These results does not correspond to the hypothesis, as innovation is decreasing in both ICT and Life sciences despite a growing creative core in Göteborg.

The correlation coefficients in Table 5 support this observation, as the creative core is highly correlated to the growth indicators, but not innovation in ICT and Life science. Florida's theories of creative individuals bringing talent and innovation does not seem to fit at all. Even if the innovation in advanced manufacturing is not included, there is a large growth in the number of computer professionals as well. The very close association between innovation and creative core found in Stockholm is not found here at all. In fact, the relationship is directly negative. Growth is highly correlated with the creative core, however, and follow the same trend, so the hypothesis is supported in this aspect, even if the causal relationship might be reversed. But it is quite clear that the hypothesis is not supported in terms of innovation, since a higher concentration of creative core does not correlate or follow with one another.

Table 5: Göteborg: Correlation Coefficients: Creative Core measures and Innovation/Growth indicators. 2001-2013. \*sig.95% (OECD; Statistics Sweden)

	Life science	ICT	Innovation	House price	Population	Wage
Science core	-0.85*	-0.84*	-0.78*	0.94*	0.93*	0.95*
Bohemian core	-0.87*	-0.88*	-0.77*	0.95*	0.88*	0.92*
Total Creative Core	-0.87*	-0.86*	-0.80*	0.95*	0.95*	0.96*

## Tolerance

The bohemian core in Göteborg is around 0.5% in the time period, which is almost half of what it is in Stockholm, but on the same level as Malmö-Lund. Göteborg is regarded as an interesting art scene by artists, according to Borén and Young (2013), but a lack of finance may be an issue. The correlation between the creative core and growth is clearly positive, but innovation does not follow the same trend at all.

Göteborg has less gay couples than Malmö and Stockholm, especially in 2006 (RFSL 2006; RFSL 2015), but still more than smaller cities in Sweden (Wimark 2014). Again, Wimark's criticism that this concentration is more about size than anything undercuts the interpretation (Wimark 2014). However, it is noteworthy that Göteborg has fewer gays than Malmö (RFSL 2006; RFSL 2014) and also has less innovation in ICT and Life sciences. The impact of this fact cannot plausibly be argued to have a significant effect, however. Especially as the bohemian core is not out of the ordinary.

## Summary

Göteborg is a creative city in terms of its engineering and advanced manufacturing labor force. Innovation in ICT and Life sciences are underperforming in relation to Stockholm and Malmö-Lund, but advanced manufacturing may be the creative outlet for the creative core in Göteborg instead. Just like the interpretation of the impact of the creative core in Stockholm, it is difficult to argue that the hypothesis is supported or false. The correlations with the growth indicators are high, but could just as well be an outcome rather than a cause. Just like Stockholm, a quite high presence of bohemians and artists correlates well with the growth of the city, but cannot be argued to be driver of growth and innovation.

### 5.3.2 Hypothesis II: Innovators

The innovations and companies in advanced manufacturing, ICT and Life sciences are discussed below.

#### **Advanced manufacturing**

The most important sector in Göteborg's modern history has been manufacturing. The shipbuilding industries and the harbor was very important to the initial growth of Göteborg. The shipbuilding industries started declining in the later 70's and continued until the largest shipbuilding plant halted production (Schön 2014:419). Göteborg recovered relatively well, due to the successful automobile industry in the region (Johansson et al. 2010:192-196). The automobile industry was important in two ways. Not only through the high-skill technology, but also through the growth of sub-contractors to the industry, which was important during the 1980's (Lundquist et al. 2008).

Volvo has been essential in understanding the economic development of the economic development of Göteborg. Volvo has been among the very top of innovative companies in Sweden for a long time, even though the number of innovations have continuously declined since the 1970's (Sjöo 2014:214-220). The automobile industry grew in the period after the 90's, but took a sharp hit in the global financial crisis of 2008 (Schön 2014:442). Volvo cars was especially hit hard, but Volvo trucks recovered well (Schön 2014:442). Volvo remains a powerful actor in innovation, as Volvo is among the top patent filings from Sweden this year, even though Volvo's number of patents only amounts to around 20% of Ericsson's number (European patent office 2017).

The continued importance of manufacturing and innovation in this sector has sometimes been underestimated in the literature of Florida, Moretti and Glaeser, perhaps reflecting the American automobile industry's decline. Manufacturing in Sweden is innovative, and since the stagnation of the 70's and 80's, advanced manufacturing began to grow again in the mid 90's (Sjöo 2014:61-66; Lundquist et al. 2008). A reason for the underestimation of advanced manufacturing is the increasingly blurred lines between business services and manufacturing (Henning et al. 2016). Henning and others argue that many jobs in Göteborg have transferred from pure manufacturing into a mix of manufacturing-specialized business services (Henning et al. 2016). This type of knowledge intensive business services are important in facilitating economic growth in the long run (Brenner et al. 2017). This dynamic is similar to the ICT industry, and the multiplication forces described by Moretti (Moretti & Thulin 2013) and Neffke (Neffke et al. 2011).

## ICT and Life sciences

Innovation in ICT has been very low here in comparison to Malmö and Stockholm. As illustrated in figure 7, the innovation in ICT stagnated around the time of the dotcom crisis. Life sciences in Göteborg have created a cluster in Mölndal, where over half of the region's employed (Region Västra Götaland 2017). Innovation in biotechnical subjects have been on par with Malmö and Stockholm, but has since 2005 been declining quicker than the other cities. However, Göteborg has good prospects in life science. More people are working in the sectors, and Astra Zeneca relocated its research facilities to Mölndal, and closed down their research in Lund 2010, and Södertälje 2012 (Region Västra Götaland 2017). The financial crisis in 2008 seem to coincide with a significant negative impact on the performance of the life science innovation in Göteborg.

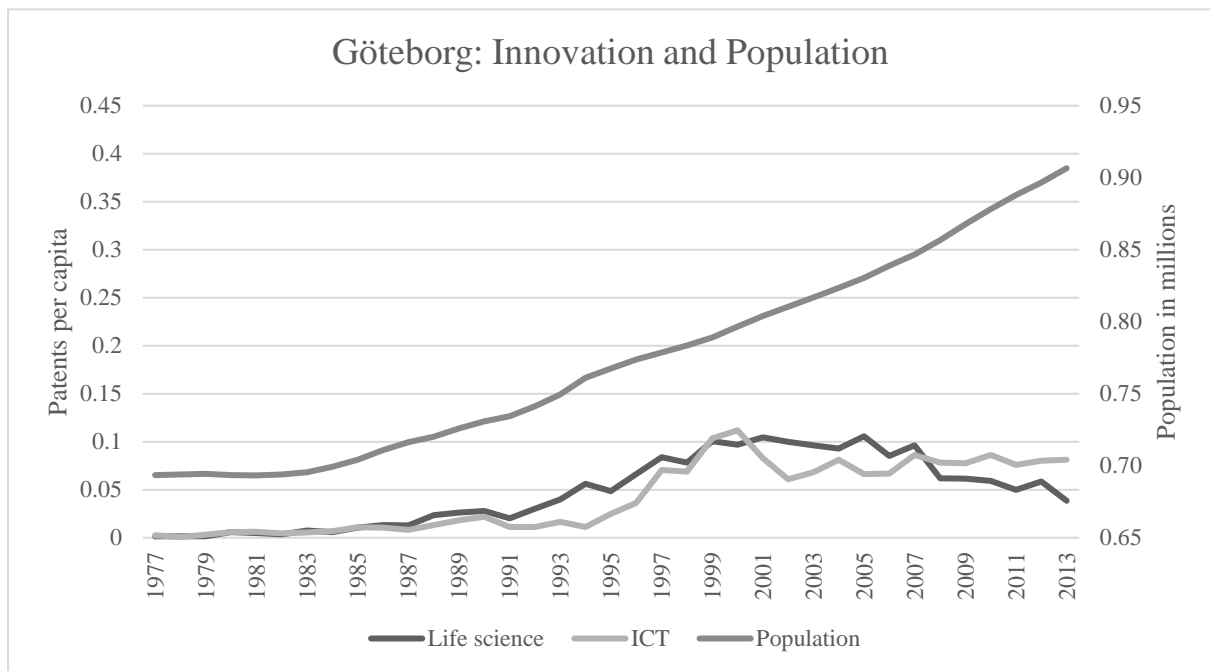


Figure 6: Göteborg: Innovation in ICT and life sciences and Population development 1977-2013. (OECD; Statistics Sweden)

The correlations between innovation and growth in table 6 shows that the growth trend in innovation matches relatively well. The stagnation and decline of ICT and life science after 2000 probably account for the less strong correlations.



Table 6: Göteborg: Correlation Coefficients: Innovation and Growth indicators 1977-2013. \*sig.95% (OECD; Statistics Sweden)

	House Price	Population	Wage
Life science	0.48*	0.70*	0.68*
ICT	0.75*	0.87*	0.86*
Innovation	0.65*	0.82*	0.80*

## Summary

The innovation in life sciences are on equal terms with Stockholm and Malmö-Lund, but ICT has not performed similarly. The innovative power of Volvo, and the continued importance of high tech manufacturing seems to have been important in Göteborg. This supports the Moretti hypothesis, as high-skilled innovators create multiplication effects. Volvo seems to be an important actor still for the economic future Göteborg region, and has been during the last decades. The trend in innovation correlates fairly well with the development in growth indicators.

### 5.3.3 Hypothesis III: Human capital

Göteborg has had a very similar human capital level development as Stockholm and Malmö-Lund, but started to lag behind since 2000. The production of graduated students in the region in real numbers have been on the same level as Malmö-Lund, and below Stockholm. In per-capita figures, Göteborg is doing better than Stockholm, but considerably worse than Malmö-Lund. The majority of students are educated in Göteborg University, Chalmers, the technical university contributes, but most of the increase has happened through Göteborg University. As such, the availability of local human capital is good, and both the concentration of educated and the production of graduates have increased at a similar rate to Malmö-Lund and Göteborg.

Glaeser argues that human capital is especially important in the case of handling crises that affect the local industries (Glaeser 2005a). Innovation in the ICT sector in Göteborg experienced significant growth in the 1990's, but the dotcom bubble seems to have caused stagnation and decline for innovation, as illustrated in figure 8. The ever growing concentration of human capital in the city does not at all follow the declining trend in ICT and life science innovation. This relationship is not the type of connection that could be expected from Glaeser's previous research (Glaeser 2005a; Glaeser & Gottlieb 2009). However, the capacity to recover from the shipbuilding crisis and use them in the automobile industry could be interpreted as that there was enough human capital to specialize in advanced manufacturing instead (Schön 2014:419; Johansson et al. 2010:192-196).

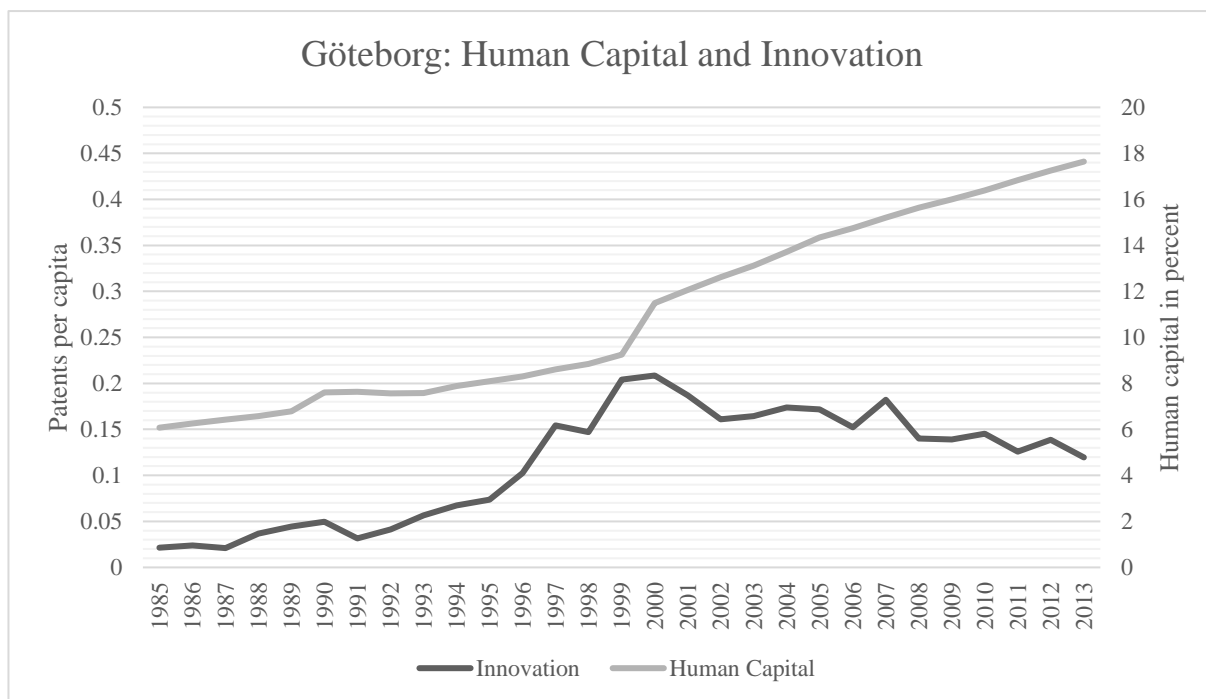


Figure 7: Göteborg: Human capital and innovation in levels 1985-2013. (OECD; Statistics Sweden)

As can be seen in Table 6, the correlation between human capital and graduates in relation to growth are clearly very strong, even though the association between human capital and innovation in ICT and Life sciences are weaker than in Stockholm and Malmö-Lund, which should be expected from the declining trend in innovation.

Table 7: Göteborg: Correlation Coefficients: Human Capital with innovation and growth. 1985-2013; Graduates with innovation and growth 1977-2013. \*sig.95% (OECD; Statistics Sweden)

	Life science	ICT	Innovation	House price	Population	Wage
Human capital	0.50*	0.77*	0.68*	0.98*	0.98*	0.99*
Graduates	0.52*	0.75*	0.66*	0.93*	0.90*	0.89*

## Summary

Göteborg has a concentration of human capital and there is clear growth in Göteborg. Innovation in ICT and life sciences does not follow the same trend, however, and is declining, when human capital is growing. Perhaps the skills within the human capital concentration is better captured by using Florida's creative measure, or Moretti's view on innovative companies.

## 5.4 Malmö-Lund: Hypothesis testing

This section will test the three hypotheses of which mechanisms are explaining the growth and development of Malmö-Lund, divided into three subsections. Note: The metropolitan city of Malmö-Lund has a dual core of two major urban centers: Malmö and Lund. Lund’s population is around 33% of Malmö’s population.

### 5.4.1 Hypothesis I: Creativity

Malmö-Lund is ranked the 8<sup>th</sup> highest concentration of creative class inhabitants in non-America, according to Florida (2012:270). The share of the population within the Creative class is 41%. To illustrate the comparison, this is just below London, and just over Berlin (Florida 2012:270).

#### Creative core

The creative core is between 5-6%, which is slightly less than in Göteborg and Stockholm. The dual core of the Malmö-Lund region, and the complementarity between them is quite clear from a creative class perspective. Lund has a very clear advantage in per capita terms of the super creative core of the creative class, which is to a large part people employed by the university, but also a sizable share of engineers and computer professionals (Statistics Sweden). 40% of the total jobs of the creative core in the metropolitan city region were in Lund, and 52 % were in Malmö in 2013 (Statistics Sweden).

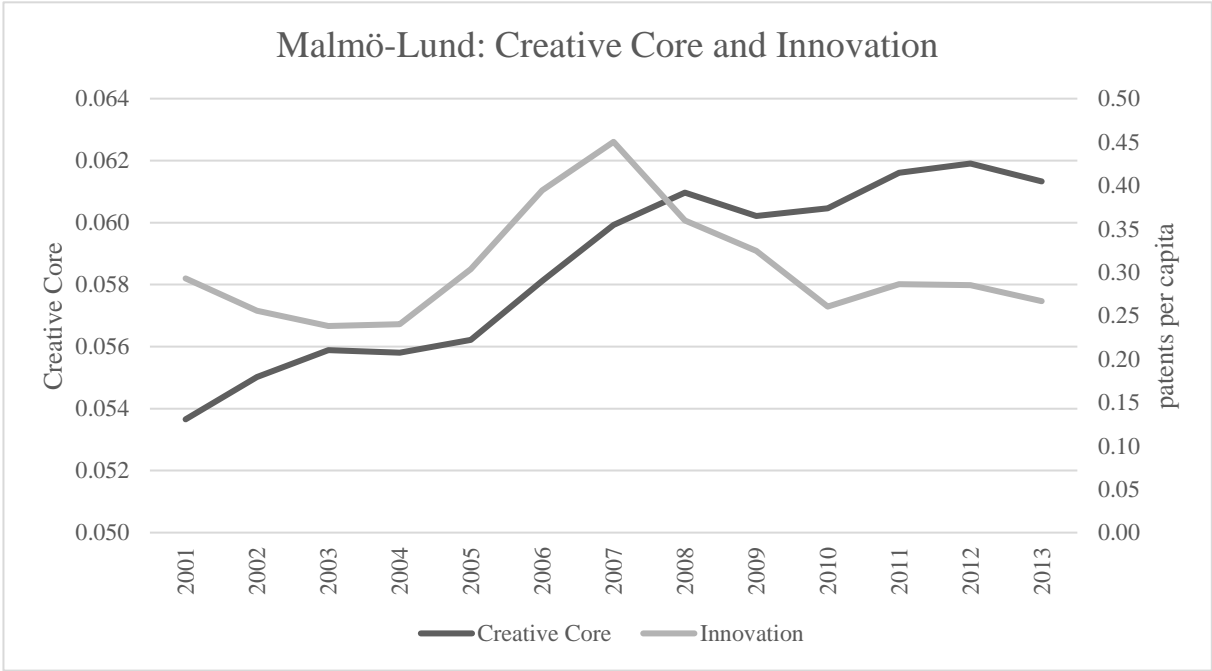


Figure 9: Malmö-Lund: Creative core per capita and innovation per capita 2001-2013. (OECD; Statistics Sweden)

In contrast to Stockholm and Göteborg, Malmö-Lund have around the same concentration of engineers and computer professionals. What is noteworthy is the university employees, which has been between 11-15% of the creative core. Stockholm and Göteborg has had around 6 and 8 % respectively (Statistics Sweden). The importance of a strong university in creating a creative and atmosphere is underlined by Florida and Mellander (2006). Another interpretation of this number could also be the relative lack of engineers and/or computer professionals in the region. Innovation per capita is high in Malmö-Lund. The global financial crisis of 2008 correspond to a distinct decline in the trend of innovation, however, described in figure 10. The creative core grew in the period 2001-2013. Most of the increase is due to a growing number of engineers and computer professionals.

Malmö-Lund has relatively high innovation in ICT and Life science in 2001-2013, around the same levels as Stockholm up until the financial crisis in 2008, which seems to have had a clear negative effect on the innovation and also on the creative core, which can be seen in figure 10. Just as in Stockholm, the creative class seems to follow innovation quite well during this time period. The science core and the total core correlates well with growth, as seen in table 8. Again, these correlations support Florida's hypothesis that the creative core is correlating with growth. Innovation does not correlate very well, but it could also be due to the financial crisis of 2008 that had an external effect.

*Table 8: Malmö-Lund: Correlation Coefficients: Creative Core measures and Innovation/Growth indicators 2001-2013. \*sig.95% (OECD; Statistics Sweden)*

	<i>Life science</i>	<i>ICT</i>	<i>Innovation</i>	<i>House price</i>	<i>Population</i>	<i>Wage</i>
<i>Science core</i>	-0.44	0.49	0.29	0.95*	0.92*	0.92*
<i>Bohemian core</i>	-0.16	0.65*	0.51	0.88*	0.69*	0.74*
<i>Total Creative Core</i>	-0.45	0.47	0.28	0.97*	0.94*	0.95*

## **Tolerance**

The bohemian core is around 0.5% during this period in Malmö-Lund, which is very similar to Göteborg. Most of these artists live in Malmö municipality, and less in Lund. This illustrates a geographical sorting. Contrary to the city Florida imagine as a melting pot of creative jobs, engineers mingling with artists, it seems as if there is a spatial sorting or specialization in Malmö-Lund. Instead of interacting during the workday, perhaps a lot of people go to Malmö for cultural consumption in the nights or weekends, and have a high-skill job in Lund. There is probably a similar sorting in Stockholm and Göteborg, only that there is not clear differences in administrative regions. In any case, the bohemian group correlates relatively well with ICT and growth, as seen in table 8, not proving, but not excluding the hypothesis.

Gay couples are relatively common in the municipality of Malmö. More so than in Göteborg municipality, but less than in Stockholm (RFSL 2006; RFSL 2015). The interpretation is

difficult, but it could indicate that Malmö-Lund has a more tolerant environment. Again, however, Wimarks (2014) found that the size of the city is a better explanatory variable than anything else.

## **Summary**

Malmö-Lund is a creative metropolitan area, especially in its diverse set of skills, with a lot of university employees, computer professionals, and engineers. The creative core increases, just like the growth of the city, and there is innovation somewhat linked to the creative core, but not fully. The 2008 crisis may have disrupted the relationship. Just like Stockholm and Göteborg, a quite high presence of bohemians and artists correlates well with the growth of the city, but cannot be argued to be a cause of it.

### **5.4.2 Hypothesis II: Innovators**

Malmö did not develop an alternative to the shipbuilding industries like Göteborg did, and it is only very recently that Malmö has recovered. Lund, and its university have been important for the localization of innovation in the Malmö-Lund metropolitan area. There are several notable companies in the science parks around Lund University, but not by a single large company.

#### **Life sciences**

Malmö-Lund's proximity to Copenhagen, and the life science industry in this larger Oresund region is referred to as Medicon valley, and knowledge sharing between Copenhagen and Malmö-Lund has been important (Moodyson et al. 2008). Schön argues that Copenhagen probably profited more, but that there has also positive effects in Malmö-Lund (Schön 2014:443).

Some notable companies includes Gambro, a medical technology company that was founded in Lund 1965, and which succeeded in establishing a large company by the 1990's (Schön 2014:430). There were also companies in the medical technology sphere in Lund that developed in the 1990's are Active Biotech and CellaVision (Schön 2014:443). The medical technology boom in Sweden did however start to stagnate after the early 2000's, and there have been several setbacks for the industry in Lund. For example, Astra Zeneca decided to close their Lund facilities in 2010, consolidating in Göteborg instead (Schön 2014:442-443). The recovery in jobs within life science seem to have recovered somewhat and Astra Zeneca has been replaced with the company Medicon valley (Bjerkessjö et al. 2017; Severinsson et al. 2012) and smaller companies (Martin & Moodyson 2013; Waxell 2011).

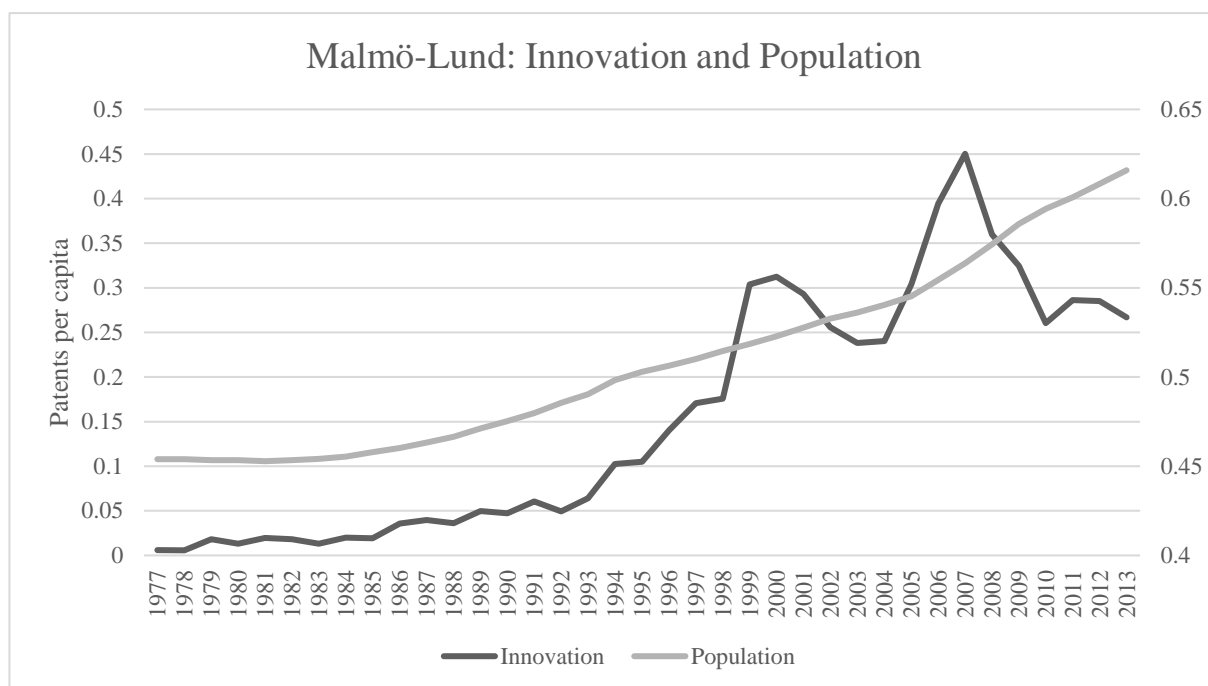


Figure 10 Malmö-Lund: Innovation and Population development 1977-2013. (OECD; Statistics Sweden).

## Manufacturing

Other large companies in Lund with engineer based production are Alfa Laval and Tetra Pak. They have been, and continue to be large employers in Lund, and have been important for the region historically. However, their type of innovations have not yielded a same type of positive spill-over effects like ICT has the capacity to do, and what ICT has had on the Swedish economy (Oulton 2012). It is clear that advanced manufacturing has not been as successful in Malmö-Lund as in Göteborg, for example (Lunquist et al. 2008).

## ICT

ICT innovation in the Malmö-Lund region has been quite successful. The performance has been substantial in per capita, even performing better than Stockholm just before the 2008 crisis. Just like Stockholm, ICT has performed better than life sciences.

There has been some important companies which established themselves around the science park Ideon, which started in the early 1980's in Lund (Bengtsson & Lind 2004). The company Axis, which started in 1984, and has since become a powerful actor in surveillance technology, and has been an important player in Lund (Schön 2014:445-446). Sony Ericsson and ST Ericsson has also had a significant presence and impact in Lund (Henning et al. 2010), but has had a series of layoffs in recent years (Bjerkesjö et al. 2017).

The Ericsson company was a very important actor in the region, but had trouble growing past the tripling of its employees in Lund (Henning et al. 2010). It seems that Malmö-Lund has been too small to support a large company (Henning et al. 2010) such as Ericsson in

Stockholm or Volvo in Göteborg. The ICT sector today in Malmö-Lund is in a transitional phase moving increasingly to startups (Bjerkesjö et al. 2017), which could be an indication of the type of skill transfers that Neffke and others describe (Neffke et al. 2011; Neffke & Henning 2013).

Nevertheless, as table 9 suggests, there is high correlation between innovation and growth in Malmö-Lund, in particular related to ICT. The trend between growth and innovation can therefore be said to be highly correlated.

*Table 9: Malmö-Lund: Correlation Coefficients: Innovation and Growth indicators 1977-2013. \*sig.95%.(OECD; Statistics Sweden)*

	<i>House Price</i>	<i>Population</i>	<i>Wage</i>
<i>Life science</i>	0.76*	0.82*	0.85*
<i>ICT</i>	0.87*	0.88*	0.92*
<i>Innovation</i>	0.86*	0.88*	0.91*

## Summary

Moretti’s hypothesis of the big company entering the city and transforming it does not seem like a good fit for Malmö-Lund. It could be argued that Gambro was such a company, which created a surge in medical technology, as well as Sony Ericsson and Axis launching ICT in the region. But it seems that Gambro has not played the same role like Ericsson played in Stockholm, and the layoffs in Astra Zeneca and Ericsson suggests that these companies did not succeed in becoming a true breakthrough actor in the region.

### 5.4.3 Hypothesis III: Human capital

The human capital potential of Lund University and the well-integrated labor market of Malmö-Lund, with ties to Copenhagen and Helsingborg. The production capacity of students in the region is very high. Malmö-Lund has consistently had the highest number of graduated students per year per capita since the 70’s up until today. This number is primarily produced by Lund University, but also Malmö University after 1998.

Before 2000, the human capital levels in Malmö-Lund was on the same level as Göteborg, but has since then grown slightly higher, while Stockholm keeping its advantage. Malmö-Lund has the highest per capita production of graduates among the metropolitan regions, which gives great opportunities for students to form local connections to the science parks in the region, and connect students into the local labor market (Bengtsson & Lind 2004; Benneworth et al. 2009; Henning et al. 2010).

The correlations between human capital levels and the number of graduates in relation to innovation and growth are positive, and highly correlated, shown in table 10. As expected, they follow the same trend.

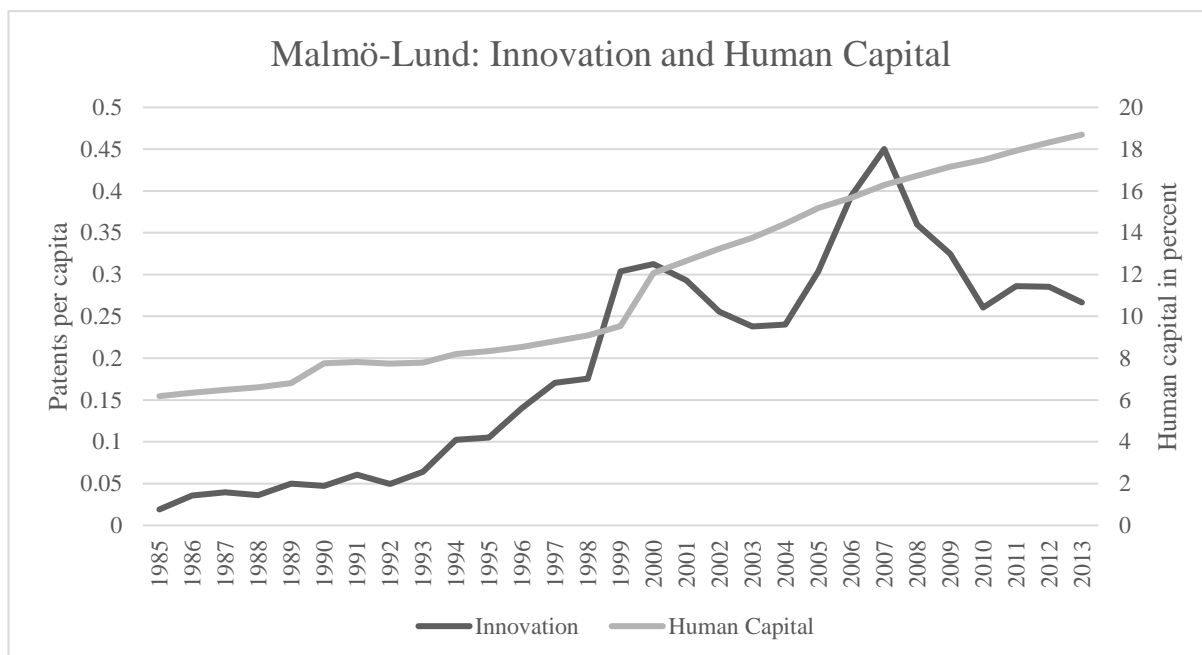


Figure 11: Malmö-Lund: Innovation and Human capital 1985-2013 (OECD; Statistics Sweden)

Table 10: Malmö-Lund: Correlation Coefficients: Human Capital with innovation and growth. 1985-2013; Graduates with innovation and growth 1977-2013. \*sig.95% (OECD; Statistics Sweden)

	Life science	ICT	Innovation	House price	Population	Wage
Human capital	0.77*	0.86*	0.86*	0.99*	0.97*	0.99*
Graduates	0.73*	0.83*	0.82*	0.93*	0.96*	0.94*

## Variation

The diversity of industries in the region is wide in Malmö-Lund, though lacking a larger actor that Stockholm and Göteborg have. Glaeser's description of Boston fits Malmö-Lund well. Just like Boston, Malmö struggled after the shipbuilding industries declined, but the university in Lund and the human capital potential from it changed the course, similar to Boston (Glaeser 2005a).

Malmö-Lund's innovation rate is very good, but the impact of the dotcom crisis and 2008 is clearly visible in figure 12. There was recovery after the dotcom crisis, but innovation had not recovered after the 2008 crisis as of 2013. Malmö-Lund region was on Stockholm level per capita before the crisis, but did not recover as successfully as Stockholm (OECD). Sony Ericsson has also had a significant presence in Lund, but has had a series of layoffs in recent years but from which there has been no severe negative effects in terms of unemployment for previous employees, there has instead been a series of new young companies (Bjerkesjö et al. 2017). The ICT company Axis, has been an important company in the region (Schön 2014:445-446).



The expected problems of the layoffs following Astra Zeneca's departure in Lund were significant, but not critical. In the absence of Astra Zeneca, the company Medicon Valley Alliance established itself two years after the departure in the same facilities, and a lot of the previous employees and management (Bjerkesjö et al. 2017). There is a lot of smaller medical companies with ties to the medicon valley area (Martin & Moodyson 2013), and there is an unusually wide spectra of specialization in the life science in Malmö-Lund (Waxell 2011).

The resilience, and the apparent opportunities for the creation of new companies in both Malmö and Lund started around Lund university and the science park IDEON, which were successful in creating a good climate for a wide range of high-skill enterprises (Benneworth et al. 2009; Henning et al. 2010). This trend seems to have picked up pace with new types of innovation projects, such as Media Evolution in Malmö, which was founded in 2008 as a form of incubator for small start-ups in a wide variety of sectors (Bjerkesjö et al. 2017). Despite these successes, the fact that that larger companies have chosen to move away from Malmö-Lund is indicative of a problem in the future. A potential risk for startups could be moving to larger labor markets, such as Stockholm, to access the much larger labor market there, just as Stockholm companies have experienced exits from Stockholm to the US (Davidsson 2015; Schön 2014:445-448).

## **Summary**

Malmö-Lund fits Glaeser's description of the resilient human capital intensive city, which has developed and recovered from crises through the skills produced within the region's universities. However, the fact that larger companies leave the region for Göteborg, for example, indicates that there are other factors important to companies than high human capital, like specialization around a big company that generate spillovers, as Moretti argues.

## 6 Analysis

This section will discuss the answers to each test of the hypothesis, and answer the research question:

- *What was the driving force of growth and innovation in Stockholm, Göteborg and Malmö-Lund?*
  - *Was it creativity, innovators, or human capital?*

### **Hypothesis I: Creativity**

- Can creative core and tolerance explain the growth of the city?

Although the creative core and tolerance is consistently correlated to the trend of increased house prices, population, and wage, the relationship between the creative core and tolerance in relation to innovation is not uniform in Stockholm, Göteborg and Malmö-Lund. The lingering criticism towards Florida's unwillingness or inability to explain the mechanisms of the causal relationship between urban growth and various definitions of creative class is still an important criticism (Glaeser 2005b; Hansen & Niedomysl 2009; Moretti 2013). Therefore, it is not possible to fully ascertain that a creative and tolerant atmosphere is the reason why Stockholm, Göteborg and Malmö-Lund grew from the results yielded from Florida's hypothesis.

High correlation between creative core and growth is what we would expect to find, according to previous studies using similar approaches but in cross sectional data (Florida 2012; Florida et al. 2008; Rutten & Gelissen 2008). It is unfortunate that a dataset stretching further back could not be found in relation to innovation and creative core. The dotcom crisis and the 2008 crisis probably disrupted the correlation well. The results from the time period in between the crises still enough to suggest that there is a relationship between innovation and creative core concentration over time, similar to the cross-sectional findings from previous studies (Florida 2012; Florida et al. 2008; Rutten & Gelissen 2008).

These studies, and the data collected in this thesis is still unable to actually show that these factors influence migratory choices for individuals. Previous research in Sweden and the Nordic countries have shown that there is good reason to doubt that these correlations are actually indicative of a creative and tolerant atmosphere. Andersen and others (2010) found that jobs are the most important factor for people to move to a city, and since small country like Sweden has so few choices in large cities, people will move to the largest city in the country to find job due to size, and not attractiveness (Andersen et al 2010). Hansen and Niedomysl (2009) also finds that employment is the most important factor for people moving between Swedish regions.

Therefore, the results from testing hypothesis I are inconclusive. Creative class is clearly tied to innovation and growth, but the data indicates that the creative core and tolerance is a result of growth and innovation, rather than the origin.

## **Hypothesis II: Innovators**

- Can innovations and innovative companies explain the growth of the city?

Moretti's hypothesis is exemplified by the case of Seattle, where it was transformed by Microsoft, and the multiplication effect there. Sweden, with its three metropolitan cities does not offer a similarly spectacular example. However, the link between innovation and growth of the metropolitan cities in Sweden is quite clear. Moretti and Thulin (2013) showed that high-skill jobs are shown to create local service jobs in Swedish cities.

The correlation between innovation and growth is high in Stockholm and Malmö-Lund, but the findings in Göteborg suggests otherwise. This reflects the impact of specialization in the sectors which the innovative company in the region works in.

The results indicate that the success of Ericsson in Stockholm, and Volvo in Göteborg attracted highly skilled people to the city which started working as computer professionals and engineers, and can be argued to have had a similar effect like that of Microsoft in Seattle (Moretti 2013:85-90). The evolution of companies connected to, and working in the same sector as these companies, fits the description of both Moretti (2013:148-154) and previous studies on the evolution of businesses (Neffke & Henning 2013; Henning et al. 2013; Neffke et al. 2011). Malmö-Lund has had several important companies, but for some reason these companies have not reached the same size, and the effect has not become as pervasive as in Göteborg and Stockholm.

Innovative companies offer an exogenous event, like Moretti's example of Microsoft moving to Seattle (Moretti 2013). Interpreting the success of a company as a clear causal act towards growth is unwise. Did the companies make the city grow, or did the cities make the companies grow? The true relation is probably more complex, and beyond the scope of this thesis, but it is clear from other accounts that the success of Ericsson acted as an exogenous-like effect in making Stockholm a center for ICT business and research (Bienkowska 2007; Winden & Carvalho 2016).

The impact of an innovative company is narratively strong. Even though innovative companies require a labor market with high human capital and creativity to be innovative, the success of Volvo and Ericsson are exceptional international success stories, and cannot plausibly be dismissed as a function of human capital or a creative core. Therefore, the results from testing hypothesis II suggests that Stockholm and Göteborg fits the Moretti description well, as the success of the large companies have created innovation and spill-over effects that helped to make the cities grow.

### **Hypothesis III: Human capital**

- Can human capital and diverse industries explain the growth of the city?

Human capital is often used in the literature to describe the level of skills and productivity in people. It is therefore not surprising that human capital levels line up very well with the growth of the metropolitan cities. Human capital runs into the same problem of being a very general indicator, just like creative class. It can explain the growth of wages, but could also be an outcome of people's living standards (Ljungberg & Nilsson 2009). Still, the success of innovative companies could never be realized without a highly skilled labor force. Innovation and human capital seems to be linked in the same way according to the OECD dataset, which is what was to be expected from Glaeser's hypothesis (Glaeser & Gottlieb 2009). The exception seems to be Göteborg, where the rising high human capital levels did not follow the negative innovation trend. The dataset does not include innovation from advanced manufacturing, which seems to be significant, however.

Glaeser argues that human capital has the added benefit of enabling a city to adapt to shocks, and to have a diverse set of industries which can outlast the current successful industries (Glaeser 2005a). The specialization of Stockholm in ICT and advanced manufacturing in Göteborg does not necessarily mean that their industries are not diverse. Stockholm was hit severely by the dotcom crisis, but also managed to recover into a strong position, but perhaps this effect is better explained as the power in the innovation in ICT, instead.

Malmö-Lund fits the description of a Glaeser human capital city. The strong connection between higher education and local industries have given Malmö-Lund a wide spectrum of skills that transform into successful companies (Benneworth et al. 2009; Bjerkesjö et al. 2017). Even Malmö-Lund has repeatedly suffered from layoffs in the larger companies, their recovery has transformed into new businesses (Bjerkesjö et al. 2017), in ICT and life sciences, thanks to the supply of skills from Lund University (Henning et al. 2010).

The results from testing hypothesis III suggests that Malmö-Lund can be described as having grown due its human capital potential. Without having a large company to turn to after the crisis in the 70's, the local human capital produced a series of smaller successful companies. Stockholm's resilience to shocks shows that there is a strong human capital base, but Moretti's narrative explain Stockholm in a more clear way.

# 6.1 Classification of Swedish metropolitan growth

The growth and innovation of Stockholm and Göteborg is so closely tied to the long success of Ericsson and Volvo that the economic development of the two cities is difficult to imagine without them, and fall under Moretti’s hypothesis. The growth and innovation in Malmö-Lund is on the other hand intimately connected to the human capital potential of the varied companies in Lund and the large labor market in Malmö, and therefore fall under Glaesers hypothesis. Although illustrative, Florida’s hypothesis cannot explain the mechanisms of growth in a clear way.

Table 11 illustrates which hypothesis best explains the growth and innovation in the three metropolitan cities.

*Table 11 Classification of Swedish metropolitan growth patterns*

	<i>Hypothesis I: Creativity</i>	<i>Hypothesis II: Innovators</i>	<i>Hypothesis III: Human capital</i>
<i>Stockholm</i>	Not explained	<b>Explained</b>	Not explained
<i>Göteborg</i>	Not explained	<b>Explained</b>	Not explained
<i>Malmö-Lund</i>	Not explained	Not explained	<b>Explained</b>

## 7 Conclusion

The technological changes in the last decades have brought significant growth in the Swedish metropolitan cities. ICT, life sciences and advanced manufacturing have made the large cities success stories in terms of innovation. The theories of Florida, Moretti and Glaeser offers different perspectives on a very similar topic. The purpose of this thesis was to find which of these hypotheses offered the best explanation for the growth of Stockholm, Göteborg and Malmö-Lund.

- *What was the driving force of growth and innovation in Stockholm, Göteborg and Malmö-Lund?*

The results and the analysis suggests that the driving force of growth and innovation in Stockholm and Göteborg was the success of the large company dominating their innovative labor market. The ICT company Ericsson in Stockholm, and the advanced manufacturing company Volvo in Göteborg. Moretti's (2012) hypothesis that the innovative power of a successful company in the city will have spill-over effects that brings skilled people and jobs to the city fits the description of Stockholm and Göteborg well.

Malmö-Lund has had several successful companies, but the results and the analysis suggests that the driving force of growth and innovation was the diversity in local industries and its ties to the human capital through Lund University. This enabled the city to reinvent itself from the crisis in manufacturing. That means that Glaeser's hypothesis (Glaeser 2005a) fits the growth in innovation and growth indicators in Malmö-Lund.

Florida's hypothesis of creative people as the origin of innovation and growth is interesting, and correlates well with the growth of the cities, but offers very little in actual explanation of its mechanisms. The results in this thesis correspond to the findings in Borén and Young (2013), Wimark (2014) and Andersen with others (2010) that the small and homogenous Sweden is not suitable for the measure of creative cores and gays to effectively explain growth patterns.

An important finding in this thesis is the obvious difficulties of trying to explain complex processes with the type of indicators that Florida, Moretti, and Glaeser use in their large sample research, even with long term data. Since the growth in the indicators so often are following the same upward trend, comparing statistical significances between indicators such as creative core or human capital levels becomes difficult. Creative cores and human capital is obviously important for the growth of modern cities, but also rather difficult to evaluate, as the tests of highly correlated indicators are often inconclusive.

It is obvious that people who work as computer professionals, programmers, are connected to innovation in ICT, likewise, the number of highly educated engineers are of course related to innovation in ICT. However, the Swedish ICT wonder, and the success of advanced

manufacturing and life sciences cannot be fully explained as simply as a product of macro indicators, even on a regional level. This is why the case-like examples by Florida (2012:183-189, 345-349), Moretti (2012:85-91), and Glaeser (2005a) are the most effective in explaining the actual mechanisms of achieving urban growth and innovation.

This is also why Ericsson, Volvo, and the industrial diversity in Malmö-Lund are effective in explaining the growth of these cities, as all other variables and growth patterns are so similar. The results of this thesis adds a theoretical and narrative perspective contribution to the ever growing body of research on Swedish metropolitan growth (Henning et al. 2016; Johansson et al. 2008; Henning et al. 2010).

This topic is far from being exhausted, however, and more research is needed to fully understand the patterns of modern urban growth in a comprehensive way. A detailed analysis with greater detail and resources could perhaps trace specific events with changes in the variables and provide a more detailed view. This thesis has shown that there is good data available for further research with the same theoretical framework.

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