INTERNATIONELLA HANDELSHÖGSKOLAN
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Spillover effects of Multinational Enterprises on domestic firms productivity.

Master Thesis in Economics

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Jönköping

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Abstract

Since the 1990s and the Swedish membership in the European Union in 1995, the presence of Multinational Enterprises (MNEs) has increased radically in the Swedish economy. The objective with this study is to analyze MNEs effects in different regions within the Swedish manufacturing industry in terms of productivity. Is a region with more MNEs, more productive than a region with a lower share of MNEs? The theory claims that productivity spillovers of MNEs occurs through three channels namely, via R&D, increased competition and transmission of technology. By observing 81 regions which consists of all 290 municipals in Sweden and taking the average value of productivity and the explanatory variables trough 1997-2004, a cross-sectional analysis is conducted. The results evidently showed signs of productivity spillovers of MNEs on local firms in the manufacturing industry. Findings suggest that (1) a regions with higher share of MNEs did face a higher regional productivity. However the spillovers was not successfully absorbed by regions with a industry structure that was not dominated by a the manufacturing industry. (2) Larger regions, in terms of population, tend to show a lower productivity level compared to the average levels of the rest of the regions, since their structure was dominated by the service sector. (3) Regions with small technological difference compared to the MNEs, tends to hold the skills and knowledge needed to efficiently exploit the productivity spillovers, hence MNEs influence on regional productivity was greater in these regions than regions with a lower level of technical capability.

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Sammanfattning

Ända sedan 1990-talet och Sveriges medlemskap i Europeiska Unionen 1995, har andelen multinationella företag ökat drastiskt inom den svenska tillverkningsindustrin. Syftet med denna uppsats är att analysera hur dessa utländska företag påverkar tillverkningsindustrins produktivitet på regional nivå. Är en region med större andelar utländska företag mer produktiva än regioner som har lägre andelar utländska företag? Teorin hävdar att utländska företag påverka den inhemska produktiviteten på tre sätt, via forskning och utveckling (FoU), ökad konkurens samt genom den teknologiska överföringen från utländska till inhemska företag. Med data för 81 LA-regioner samt det genomsnittliga värdet på produktvitet och olika förklaring variabler mellan åren 1997och 2004, så analyseras forsknings frågan med tvärsnitts analys. Resultaten visar tecken på produktivitet "spillovers" från utländska företag till den inhemska tillverkningsindustrin. Därmed så indikerar resultaten (1) att en region med större andelar utländska företag är mer produktiva än regioner med lägre andelar utländska företag. (2) Det visade sig även att regioner där industri strukturen inte domineras av tillverkningsindustrin, inte kunde absorbera produktiviteten lika bra som regioner med en industri struktur som karaktäriseras av tillverkningsindustrin. Stora regioner, som Stockholm, Malmö, och Göteborg visade tecken på en lägre produktvitets nivå jämfört med den genomslitliga nivån hos de resterade regionerna i Sverige. Anledningen visades sig vara av att dessa regioners struktur överskuggades av service sektorn. (3) Regioner med stora teknologisk skillnader jämfört med de utländska företagen visade sig kunna hantera den nya kunskapen och teknologin genretad från de utländska företagen, därmed så är även den utländska närvaron positiv i dessa regioner. Men så är inte fallet i regioner med stora teknologiska skillnader, eftersom dessa regioner inte kan på ett effektivt sätt dra nytta av dessa så kallade "spillovers".

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1. Introduction

Since the 1990s the Swedish government has been trying to catch the attention of foreign direct investments (FDI) and multinational enterprises (MNEs) by imposing liberal reforms such as tax regulation, financial support and by deregulating the market. In addition with the membership in the European Union in 1995, the presence of MNEs has increased radically during the last two decades.

The opinion about FDI and MNEs differs in the literature, some claims that MNEs spillovers has a positive effect on the host country and some states the opposite. As Kokko, Tansini and Zejan (1996) points out, various studies have shown that the productivity of local firms increases as foreign firms enters the domestic market. Since foreign firms make new technology and knowledge available for the local firms to absorb and thereby improve their productivity. Furthermore, the presence of MNEs also increases the competitiveness in the domestic market and hence the local firms are forced to adopt new technology, generated trough the spillovers of MNEs.

A concrete example is the study made by Blomström and Wolff (1994) which argued that the productivity in the Mexican manufacturing industry increased due spillovers. The productivity in the industry even converged to the US levels during the early 70's. Nadiri (1991) did conclude similar results, when analyzing the effects generated by United States FDI in the manufacturing industry in France, Japan, Germany and the UK.

However, some cases shows that spillovers are not always important and that positive spillover do not always occur in all industries. Aitken and Harrison (1991) points out that there is no clear evidence of positive technology spillovers in the manufacturing industry in Venezuela during 1976-1989. Cantwell (1989) observed the effects of US MNEs and the effects in the European markets and claims that all industries did not gain from productivity spillovers. Only regions where the local firms where relatively strong did gain from FDI, meanwhile the weaker firms was pushed out of the market or was forced to be satisfied with a smaller part of the business. Hence, all countries and regions within, do not gain productivity by having MNEs in the market. Sweden is a relative small economy thus the presences of MNEs could have a large influence, despite this fact previous studies about regional productivity in Sweden has not focused on MNEs as a variable.

The objective with this study is to analyze MNEs effect in different region within the Swedish manufacturing industry in terms of productivity. Is a region with more MNEs more productive than a region with a lower presence of MNEs? Furthermore, is it possible to observe any potential spillovers from MNEs in the regions that influence the productivity in a certain region and compare it with another region?

The paper is organized in the fallowing way in section 2, a brief background on MNEs and FDI in Sweden is presented, section 3 deals with the previous research and theory considering productivity spillovers of MNEs on local firms. The method and data to answer the research question are presented in section 4 while the results and analysis are shown in section 5.

2. MNEs and FDI in Sweden

During the five last decades FDI flows has fluctuated intensely. In the 1960s inward and outward FDI was balanced in Sweden, however throughout the 1970s and 1980s outward FDI dominated the Swedish economy (Lundmark & Malmberg, 2000). In the 1990s the inward FDI levels sky rocked, one explanation is the European membership in 1995 which resulted to an extreme increase of outgoing FDI into the European countries. On the other hand Sweden opened up for inward FDI as well, hence foreign ownership increased during the last decades mostly through mergers and acquisitions of Swedish companies. The foreign ownership doubled in the 1980s compared to the previous decade. According to Lundmark and Malmberg (2000) 750 Swedish companies collectively with 63 000 employees, become foreign owned during the 1980s. Throughout the early years of the 1990s, 2500 companies was foreign owned and in the late 1990s this number increased to almost 4000. Consequently employment in MNEs increased to about 336 000 in 1998 compared to roughly 200 000 in the early 1990s, as can be seen in table 1. Hence, during the 1990s the FDI in- and outflows became balanced and at the same time the proportions flows heavily increased.

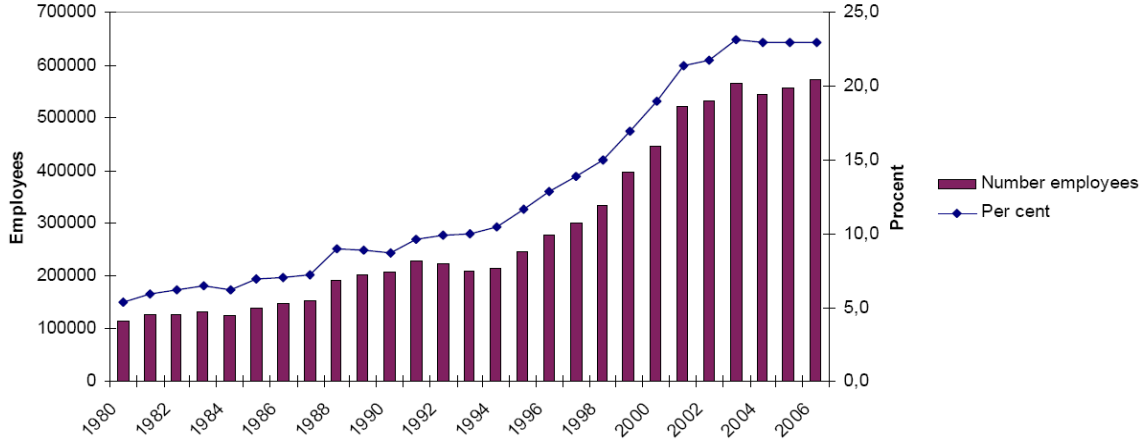
Table 1. Number of MNEs owns companies and corresponding employments in Sweden.

Year	1990	1994	1998	Relative change (%)	
				1990-1994	1994-1998
Nr. of MNEs	2 567	3088	3959	20.3	28.2
Employment in MNEs	206 886	213 829	336 068	3.4	57.2

Source: (Lundmark & Malmberg, 2000).

Thus, the Swedish economy has become extremely multinational and it has lead to a controversial topic, some experts claims that MNEs is a threat to the Swedish economy as the ownership becomes foreign owned thereby the economy becomes dependent on unsafe and less reliable foreign employers. In the same time MNEs could increase the number of new start-ups, which results to new job opportunities. The share of MNEs has increased remarkably since the membership in EU and especially since the millennium shift, as can be supported by the survey (figure 1) made by the Swedish Institute for Growth Policy Studies (ITPS) and the National Rural Development Agency, in 2006.

Figuare 1 Number of employees in MNEs and their share of employees in Sweden 1980-2006.



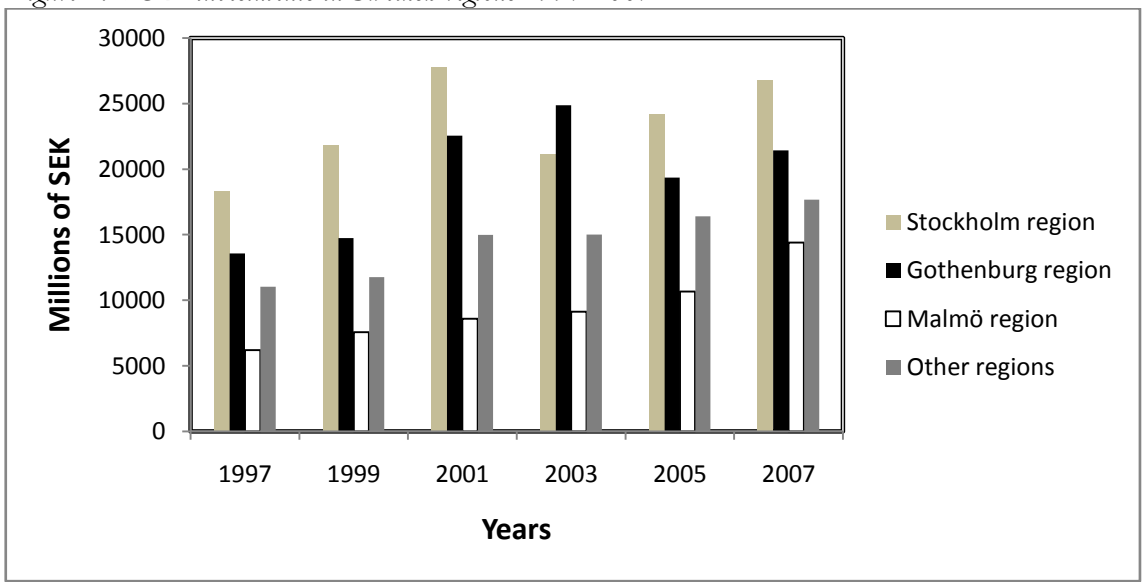
Source: Swedish Institute for Growth Policy Studies (2009).

Once again the increasing share of MNEs in the manufacturing industry is shown in figure 1 in the appendix, which reflects the share of employment in MNEs at a regional level in the years 1990 and 1998. However the figure also highlights another important aspect, namely the location of MNEs. The regions with a relative high share of MNEs are not the largest region and cities, such as Stockholm, Malmö and Göteborg. Instead the high shares of MNEs are concentrated in industrial regions such as Ludvika, Hagfors, Filipstad Avesta and Bengtfors. Thus it could be interesting to observe how the productivity in these regions differs from the rest of the regions in Sweden when considering MNEs as a explanatory variable.

Although the issue of MNEs in Sweden are well debated in literature and in media, the aspect of spillovers generated by MNEs and how theses spillovers has influenced the domestic industries, needs more attention. Spillover effects are basically externalities of a economic activity. It is a firm-specific asset that is transferred between companies, industries, region and even countries. In this paper, MNEs and their corresponding spillovers to local firms productivity in a region are analysed. Spillovers between companies can come in many forms, however one of the most common productivity spillovers in a region are research and development (R&D) and know-how.

Since the mid 1970s investments in R&D increased with approximately 16,5 % in Sweden and investments in R&D is crucial for an industry to increase their productivity in a competitive market. Traditionally the Swedish industries has relied on their factor endowments, but during the two last decades R&D has increased its role in the Swedish sectors. Andersson (1992) points out that R&D is vital in highly technical regions and industries, especially industries within the electronics market. To get an overview of the investments in R&D during the last decade, figure 2 is presented below, where the three largest regions and the average value in the rest of the regions are compared.

Figure 2. R&D investments in Swedish regions 1997-2007



Source: Statistics Sweden (2009)

Advantage in technology and management know-how can also be transferred between companies and thereby increase a firms productivity. Competition is also a "side-effect" generated by the increased presences of MNEs, in section 3 some of theses spillovers and their influence on productivity are discussed.

Obviously MNEs are not the only factors that affects regional productivity, therefore other factors that influence the productivity in a region needs to be clarified. There are some factors that are considered to be internal factors that naturally affect productivity, such as capital intensity (Åberg 1973). However these internal factors are not directly discussed in this study, since the focus will merely be on the external factors, such as MNEs spillovers and the potential indirect effects on the internal factors.

Population density is considered to be one of these external factors that affects the regional productivity. The common idea of productivity is that in a region with a large population, the productivity is higher compared to a region with a smaller population. This relationship is not an exception for a certain period but is found to be stable from year to year in the Swedish manufacturing industry[1]. However, one may ask if the variation in productivity is caused by population density per se or if the disparity occurs due to other factors that happens to change with the size of the region. Factors such as the amount of educated people, the industrial structure in the region or the amount of employees in the public sector in the region. Thus some of these factors are taken into account when analysing the regional productivity.

To be able to understand why productivity in Sweden differs from one region to another, it is vital to indentify the different variables that affect the productivity in a region. How does MNEs work as a variable when it comes to efficiency in a region? Does MNE spillovers effect all regions in the same way or are the effects greater in one region compared to another?

3. Spillover effects of MNEs on domestic industry

Generally the standard theory of FDI states "for direct investment to thrive there must be some imperfection in markets for goods or factors, including among the latter technology, or some interference in competition by government or by firms, which separates markets" (Blomström 1986). When firms decide to invest in a foreign market firms usually possess firm specific assets that distinguish the firms from the other companies in the foreign market. These assets take commonly the form of knowledge of a public-good character, such as product, technology process and management. Furthermore these assets may be transmitted through so called spillovers, from a foreign firm to a local firm and thereby influence the domestic industrial structure in terms of productivity. Hence the first hypothesis in this paper; *the productivity level in local firms are higher in regions that have a higher share of MNEs* (hypothesis 1).

The expression "spillover" indicates the indirect effects generated by the presence of MNEs both in the industrial structure of the host country as well as in the performance of domestic firms. The literature regarding spillovers is well explored in different areas and features, the possibility of spillovers generally occurs when MNEs may find it hard to protect and control the leakage of their firm specific assets (Görg, Hijzen & Muraközy 2009). However with respect to spillovers the common aspect in the literature is that productivity

[1] Ibid.

in domestic firms are mainly influenced by three factors, the effects of R&D, increasing competition and the transmission of new technology. With reference to Imbriani and Reganati (1999) the gains from R&D to the local firm arises from the enhancing of human capital as the training of management and labour increases the productivity. This occurs when labour moves and takes the knowledge of the firm specific assets from MNEs to local firms. Kamien and Zang (1999) points out that when local and foreign firms cooperate in their R&D approaches the spillovers can easily be realized which results to an increase in productivity and reduced production cost. However competing firms have a propensity not to cooperate and as a result the R&D approach is a more firm-specific R&D, hence a lower level of productivity spillover is available to their rival. Other studies show that competing firms attempts to collaborate with other firms to increases the productivity. Wiethaus (2005) found that competing firms do choose identical R&D approaches, which strengthen the network between firms and thereby maximizing the local firms absorptive capacities.

Cohen and Levinthal (1989) discusses the dual role of R&D, not only does R&D generate new information to the local firm but it also generate the ability to understand and exploit the existing information. This ability is known as the absorptive capacity, where R&D not only develops new innovations but also the firm's ability to recognize , absorb and make use of the knowledge from the environment. Cohan and Levinthal (1990) continues to argue that the absorptive capacity also consist of the capability to use outside knowledge such as research findings which encourage new R&D to develop. Hence the absorptive capacity is an important part of firms ability to create new knowledge and products and that the capacity depends on the previous knowledge and expertise. This mean that already strong and establish firms with the appropriate knowledge is assumed to have a stronger absorptive capacity[2]. Thus this capacity differs from the conventional idea of learning -by -doing since it also promotes possibilities to create new and different knowledge, hence a higher productivity in firms.

Competition is the second factor that also has been discussed in the literature to a great extent, which is commonly related to the size of the market, thus a large region tends to have a higher level of competition and thereby higher productivity. Hence it is assumed that *MNEs influence on productivity, is greater in regions with a larger population compared to a smaller population* (hypothesis 2). The levels of MNEs penetration in the industry is likely to be superior where the entry barriers for new firms are high which results to improvements in the domestic industrial structure as the entry of MNEs increases competition (Imbriani & Reganati 1999). Domestic firms are forced to become more efficient, either by adopting new technologies or increase X-efficiency in order not to be pushed out of the market, as the more efficient MNEs are present (Kokko 1996).

There is also literature concerning industry clusters and their relation to spillovers. Due to proximity, competing firms tends to push each other to the best-practicing firms. Johansson (2004) argues that proximity effects transactions and information spillovers, where an efficiency externality results to differences in productivity. Furthermore, innovation externalities effects the industry in form of new routines, products and increased product diversity. According to Johansson (2004) these externalities arises through two channels, one is the via prices charged by suppliers and firms and the other is derived outside the market. The mechanisms for spillovers arises as transaction cost are lower due to proximity and higher concentration of clusters. In clusters, diversity of inputs are more likely to exists, hence it improves the efficiency of a firm and with a larger local market firms can more efficiently exploit scale of economies. In clusters networks between suppliers and input-

[2] Ibid.

buying firms reduces the transaction costs, increases knowledge spillovers and promotes innovations, hence productivity. Furthermore the communication externalities in clusters are important since the spillovers are assumed to be more concentrated within a region and thereby effect the innovation process this would result to an increase in productivity.

Competition as a spillover on the domestic firms has been tested in different countries, Globerman (1979) for Canada, Haddad and Harrison (1993) for Morocco, Aslanoglu (1998) for Turkey. Blomström (1986), tested for the Mexcian manufacturing industry and pointed out that MNEs increases efficiency in the industry through competitive pressure and that foreign investment per se does not generate more productivity spillovers. In Mexico, where industries are dominated by MNEs tends to more efficient since the average firms have a propensity to converge to the best-practice firm. The productivity efficiency of the industrial structure is positive correlated to the Herfindahl index[3] and negatively correlated to the technical progress. Furthermore, Kokko (1996) highlights that earlier studies may have failed to understand the importance of competition as a result of spillovers, since competition is not proportional to the presence of MNEs rather to investments strategies made in both the local and foreign firm. Additionally Kokko (1996) recognize that the promotion of competition and local technological capability should complement polices that endorse inflows of FDI. (Mowery & Oxley 1995) concluded that countries in East Asia and Japan which benefited the most by spillovers, where nations that concentrated on promoting national innovation systems and thereby increasing the absorptive capacity. A capacity that can be obtained by investments in R&D, technical training and policies that encourage competition, thus the actual channels for inward technological transfer and level of trade restrictions are only of secondary importance. However Görg, Hijzen & Muraközy (2009) claims that competition also could have a negative effect on productivity as an increases in competition could drive down the market share of local firms. Hence the local firms may not gain from economics of scale as their productivity declines.

The third spillover is the flow of new technology that may occur for several reasons, as local firms consume or supply inputs to MNEs and thereby experiencing the advanced technology used in MNEs. Technology spillover is probably the most controversial issue in the literature more or less there are two arguments that concern the link between MNEs spillovers and the technology gap (the difference in technology level between domestic and foreign firms). One argument is supported by Wang & Blomstrsöm (1992) and Wang (1990) that productivity spillovers are positively related to the technology gap. On the other hand the vice versa is argued by Kokko. Tansini and Zejan (1996), local plants facing foreign competition and with a small technological gap between domestic firms and MNEs, gains more from productivity spillovers then local plants with a large technology gap. Hence it assumed that *MNE spillovers have a positive and larger impact on productivity in regions with a smaller technology gap then a region with a large technology gap* (hypothesis 3). Furthermore, if the technology gap is extreme, policies to promote FDI are simply not sufficient, if an industry desires to gain from spillovers. The alternative support is to improve the domestic firms capability to absorb modern technologies, which could be a more effective tool to obtain productivity spillovers. Additionally, (Kokko, Tansini, and Zejan (1996) emphasizes on the fact that there are only positive spillovers in firms with a reasonable technology gap.

[3] Herfindahl index is a measure of industry concentration. The value of the index is the sum of the squares of the market shares of all firms in an industry. Higher values indicate greater concentration (Organisation for Economic Co-operation and Development 2009).

3.1 Why does a regional dimension matter?

As stated above, previous research has not focused on MNEs and their effects on the productivity, instead other issues has been the main variable, such as population density. Åberg (1973) found that the population density had a significant influence on regional productivity in the Swedish industry, however no test has been made on regional differences in MNEs spillovers in the Swedish manufacturing industry. Studies also shows that there is a vital difference in comparing spillovers at a national level in contrast to a regional level whereas Cantwell and Iammarino (1998) found that technology performance of MNEs tends to be strongly concentrated at a sub- or regional level.

Furthermore inter-firms networks between the domestic firms and the MNEs, may increase the advantages of geographical concentration when it comes to technological development. Thus MNEs tend to concentrate in different regions and thereby the productivity and market activity is assumed to become unevenly distributed a cross a nation. Additionally MNE networks for innovation tend to locate accordingly to a hierarchy of various regional centers, i.e. the technological specialization of MNEs locations depends on the position of the regional system in the hierarchy (Cantwell & Iammarino 1998).

Hence it is vital to consider the regional aspects and the potential differences to better understand the process of technology activities and MNEs spillovers that occurs, but more importantly to be able to interpret the benefits and cost of these spillovers more cautiously (Imbriani & Reganati 1999). In the presence of globalization and the differences of economic activity in the European Union, not only at a national level but also at sub-national level, EU policy makers must take regional differences into account to be able to tackle the issue of uneven distribution of economic activity within the nations.

4. Statistical model and data

In this section the method used to answer the research question, the collected data as well as the author expectations are presented.

To observe the productivity in a region, the calculation method previously used by (Åberg 1973) with some modifications is being used in this study, the data was collected from Statistics Sweden (2009). The sample consists of 81 regions in Sweden and the average values between the years 1997-2004. Furthermore a region consists of municipal blocks of which there are 290 municipals in Sweden. The relationship between the different factors is examined by cross-sectional data with the use of regression techniques. The authors recognize the importance of using capital intensity as a variable to estimate the model however the data was not available at foreign and local level within a region separately. The production relationship in each region is given by the following equation:

$$\boldsymbol{PROD = C^{\alpha} EDU^{\alpha_1} SER^{\alpha_2} SIZE^{\alpha_3} MNE^{\alpha_4} PRO^{\alpha_5} Metro^{\alpha_6} Industry^{\alpha_7}} \quad (1)$$

Where **PROD** represents productivity in non-MNE firms within a region, in this study productivity is in terms of the value added per employee. Since the productivity is measure in terms of value added per employee in current prices, it is assumed that product prices must not systematically vary between the regions and time. **EDU** correspond to the share of high level educated labor force in the non-MNE firms. Since productivity is measured in

value terms, the cost of production is assumed to have an impact on productivity. Thereby the level of education has some influence on PROD since a more qualified and educated worker is assumed to be more efficient and thus a lower production cost. **SER** stands for the regional share of employment within the service sector or more exactly within information, communication, financial and insurance activities, so the industrial structure in the region can be identified. Thus a region with a high share of employment in the service sectors may imply a low regional manufacturing productivity. More importantly the service sector tend to be relatively larger in the large regions such as Stockholm, Göteborg and Malmö. However, the service sector could also assist smaller firms to reduce costs, by hiring cheaper labour and hence small local firms can become more efficient.

Additionally **SIZE** is the size of the region in terms of total number employed in the region. The variable is included since a larger region tends to indicate a higher level of competition thereby effects the productivity in the region (Åberg 1973). **PRO** is the share of production in a region and it is derived by dividing the total production with total number employed in the region.

The most important factor for this study is **MNE**, which corresponds to the amount of MNEs in the region, which has been calculated as the share of employment in MNEs within a region. MNE is included to observe any signs of spillovers that are related to the to the regions exposure to MNEs, thus if this variable is positive and significant spillovers are assumed to exist. Moreover, α indicate the change in productivity PROD for each change in the explanatorily variables respectively.

Furthermore, to analyse the three largest regions in Sweden namely Stockholm, Göteborg and Malmö and compare their productivity with the rest of the regions, the dummy variable **Metro** included to reflects these three large region. Additionally the dummy variable **Industry** corresponds to 5 industry regions, Ludvika, Hagfors, Filipstad, Avesta and Bengtfors, which reflects the regions with a the largest share of MNE (figure 1 in appendix). Where the coefficients in both the dummy variables reflects how much the productivity PROD in the regions differs from the average level in the rest of regions. By taking the logarithms of productivity (PROD)and the regional size (SIZE) in equation (1) the term can now be analyzed by using a common regression technique, the estimated model is given by equation 2:

$$\boldsymbol{Log(PROD)=\alpha C + \alpha_1 EDU + \alpha_2 SER + \alpha_3 Log(SIZE) + \alpha_4 MNE + \alpha_5 PRO + \alpha_6 Metro + \alpha_7 Industry + \varepsilon} \quad (2)$$

4.1 Expectations

In Table 2 the expectations of the outcome are presented. The expectations are based on the previous research and qualified assumptions.

Table 2. Expectations

Variable	Expectations	Expected sign
EDU	Educations is expected to have a significant impact on productivity since a more trained and educated management and labour force are assumed to be more efficient, than a less educated labour force.	+
SER	Regions that possess a large share of SER is reasonably expected to have a lower regional productivity within the manufacturing industry. On the contrary the service sector could have a positive effect on small firms as they can hire labour which could be assumed to be less costly and hence increase their productivity.	+/-
SIZE	The size of the region, in terms of employees is expected to also have a significant impact, since a large region is assumed to indicate a large market as a result it attracts more firms and increase competition, thus a positive impact on productivity is expected	+
MNE	MNE are expected to have a positive and significant influence on PROD. Furthermore in regions with a small productivity gaps, MNEs are expected to have greater effect then in regions with large gaps, as discussed in section 3.	+
PRO	A high productions share is assumed indicate a high productivity in a region thus PRO is expected to have a positive impact on regional productivity.	+
Industry dummy	As can be observed in (figure 1 in appendix), these regions possess large shares of MNE, thus it is expected that the productivity level is large in these regions compare to the rest of the regions.	+
Metro dummy	The larger regions which include the largest cities in Sweden, consist of a large market and thereby hold a high competition thus higher productivity is expected. However, these regions do not share high levels of the manufacturing industry in their industry structure, thus the productivity level in these regions could show a relatively low rate.	+/-

5. Empirical Findings and Analysis

In this section the results from the regressions are presented and it is concluded with a analysis of the regression outcome.

In table 3 the regression results of equation (2.1) shows the average spillover between the years 1997-2004 for the 81 regions in Sweden. As the author expected the variables, SIZE with a 1% significant level and MNE with a 1% significant level, both seems to have a positive impact on the regional labour productivity in the sample of 81 regions. However the variable SER which indicates the industry structure in a region has a negative impact on regional productivity, which is an interesting notation to make. Furthermore the education level in non-MNEs (EDU) and the share of production per employees (PRO) are both in-significant. Despite the fact that all the variables are not significant the results still implies a relative high "goodness of fit" in the model with a R^2 value of 0,43. Furthermore by observing the Durbin-Watson value and the correlation matrix (Table 1 & 4 in appendix) there is no signs of autocorrelation or multicollinearity in model.

Table 3 Regression results: Regional labour productivity in domestic-owned manufacturing plants (Average value 1997-2004). Dependent variable labour productivity (PROD)

Variable \ Equation	81 regions (2.1)	Small gap (2.2)	Large gap (2.3)
C	2.489	2.45	2.442
(t-stats)	**(61.58814)*** **	**(57.044)*** **	**(36.582)*** **
EDU	0.115	0.074	0.678
(t-stats)	(0.439)	(0.310811)	**(1.954)***
SER	-0.348	-0.858	0.177
(t-stats)	**(-1.685)***	**(-3.566)** **	(-0.529)
Log(SIZE)	0.026	0.046	0.014
(t-stats)	**(2.344)** **	**(3.704)*** **	(1.025)
MNE	0.061	0.056	0.054
(t-stats)	**(2.490)** **	**(2.718)** **	(1.536)
PRO	-0.001	-0.0004	0.108
(t-stats)	(-0.034)	(0.008)	(1.278)
Industrydummy	0.061		
(t-stats)	**(6.1015)*** **		
Metrodummy	-0.049		
(t-stats)	**(-2.3906)** **		
R^2	0.430	0.541	0.274
Number of obs.	81	41	40

*Sig. at a 10% level, **Sig. at a 5% level and ***Sig. at a 1% level.

In addition, the dummy variables shows a high statical reliance and the industry dummy also shows a positive coefficient however the dummy variables for the three largest region shows a negative coefficient. To analyse the relation between spillovers and productivity gaps, equation (2.2) and (2.3) was conducted. Follwed by Kokko (1996) the productivity gap has been measured by the ratio of value added per employee in foreign firms to the value added per employee in domestically owned firms. The median value on this measure has been then used to divide the entire manufacturing sector into two sub-samples. These two equations reflects the sub-samples of the 81 regions which are characterise by their levels in the productivity gap. Thus equation (2.2) consists of 41 regions, these regions are characterised with a relatively small technology gap hence the labour productivity do not significantly differs from productivity in the MNEs. Meanwhile in equation (2.3) is the vice versa, the 40 regions with the largest technology gap are included. As can be observed in table 3 the MNE variable is significant and positive in the sample of regions with small technology gaps however is not significant when the gap is large. The industry structure SER and the regional size SIZE influence the labour productivity significantly however in only the regions with small gaps and not in regions with large gaps. However the share of high level educated labour force seems to have a significant and positive effect on productivity in regions with large gaps.

Furthermore to avoid any problems in the model with heteroskedasticity, the regression was conducted with the robust standard error procedure. One of the classical assumptions in a model like equation (2) is that the disturbance appearing in the population regression function should be homoscedastic, in other words they all have the same variance. On the contrary if the variance in the model are not constant the issue of heteroskedasticity arises. In a cross-sectional data the issue of heteroskedasticity is generally more common to detect. Furthermore if the model have problems with heteroskedasticity, it implies that the confidence intervals, t-,F- and R^2-values are not reliable, as a result the estimation is likely to provide misleading and inaccurate results (Gjurati 2003). Thus an significant coefficient level could actually be insignificant or vice versa. However by using the robust standard error procedure, the author can put a higher statistical reliance on the results and values generated from equation (2).

By observing the results in table 3 the variables EDU and PRO, which where both statistically insignificantly implies that these factor in this model do not have a vital impact on productivity in a region. Since MNE has a positive and highly significant impact, the results implies that MNEs have a substantial influence on regional productivity thus there are signs of productivity spillover. Therefore *hypothesis 1* cannot be rejected, as it stated that the productivity levels are higher in regions that possess a higher share of MNEs.

As stated above, the industry-dummy variable indicated a positive significant difference in productivity compared to the rest of the regions. The regions are characterised by the high share of MNEs thus the regions Ludvika, Hagfors, Filipstad Avesta and Bengtfors have a higher productivity level compared to the average productivity level in the rest of the regions. A plausible explanation may be that these regions exists in a cluster of manufactured industry and along with the high shares of MNEs, the spillover of know-how, R&D and technology is well absorbed by the firms in the region. Since the firms in these regions are producing relatively similar products it becomes easier to achieve the most efficient way to exploit technology spillovers and know-how from MNEs. Consequently these results also supports *hypothesis 1*; productivity is higher in regions with superior shares of MNEs.

Conversely the metro-dummy, which reflects the productivity in the three largest regions in terms of population, shows a significant and a negative coefficient which implies that the manufacturing industry in these regions are facing a lower productivity level compared to

the average level in the rest of the regions. Thus *hypothesis 2* is rejected, since it stated that MNEs influence on productivity, is greater in regions with a large population compared to a smaller population. However the only variables that affects the regional productivity which are both positive and significant are the shares of MNE (MNE) and the size of the region in terms of total employment in the region (SIZE). With that fact in mind, the statement that MNEs do not have a significant impact on productivity in regions with a large population compared to a small population, may sound contradictable. An explanation to this paradox is that MNE and SIZE affects the regional productivity in different ways. The regional size effects the productivity in terms of higher demand, larger market and thus increase in competition which results in a increase in regional productivity. However, as the theory clearly states, the share of MNEs in the manufacturing industry influence the regional productivity by spillovers in terms of R&D, know-how, transmission of technology and competition. Although these spillovers are only absorbed efficiently by the firms in regions that possess a industry structure that is dominated or at least have a large share of manufacturing industry. As stated above, the industry structure in the largest regions Stockholm, Göteborg and Malmö is dominated by the service sector and not the manufacturing industry, hence the negative influences on regional manufacturing productivity is generate by the share of employment in the service sector, SER. According to NUTEK (2008) the services sector has increased rapidly in these large region since 1996. Some of the reason for the increase is that with a large population, it results in a increase of highly educated people which ends up working in the service sector and a overall increase in demand of services, which seems to be the case in these large cities. However the largest contribution to overall regional productivity is the manufacturing sector, hence the difference in regional productivity levels in Swedish regions.

Additionally the results from equation (2.2) and (2.3) implies that there are signs of spillovers in regions with a relative small technology gap whereas the regions that are behind or far ahead in technology compared to the MNEs are not significantly affected by spillovers. Hence *hypothesis 3* is accepted since it claims that that MNE spillovers have a greater positive impact on productivity in regions with a smaller technology gap than a region with a large technology gap. The results are supported through the findings made by both Kokko Tansini and Zejan (1996) and Imbriani and Reganati (1999) which suggest that there is a significant difference between the two sub-samples.

Regions with small technology gaps appears to be more efficient when it comes to exploiting the technology spillover of MNEs as the firms in these regions possess the education and skills to apply or learn from the MNE technologies. However regions with large gaps seems to indicate that technologies from MNEs are not relevant in terms of the local productivity. Probably because the manufactured products produced by the MNEs differs from the local firms output to that extend that firms with high gaps cannot make use of the know-how and technology that is available from MNEs. Hence the local firms in the regions do not have anything to learn from MNEs or it could imply that the absorbity capacity in regions with large gaps are to weak to efficiently use the technology generated from MNEs. More however the size of the region (SIZE) has positive and has a highly statistically significant influence on productivity which implies that the number of employed in a region is an important determinant of productivity in regions with small gaps however not in regions with large gaps

These results clearly indicates an uneven distribution of regional shares of MNEs and thereby the Swedish economy faces an disproportionate distribution of regional productivity. If policymakers objective is to diminish the unequal productive, they must consider the role and location of MNEs in the Swedish manufacturing industry, by trying to attract the foreign firms to location where the share of MNEs are lower. Instead of letting foreign

plants end up in some regional industry cluster, policymakers should emphasize on distributing MNEs more equally across different regions, which would perhaps increase the efficiency and economic activities in regions with a relatively lower productivity. This could be done by promoting polices and systems that results in a stronger and a more attractive regional environment for the MNEs to operate in. To achieve this environment (NUTEK 2009) recognize the need of policies that reinforce the links between MNEs and their sub-suppliers and especially the link to small and medium size local firms. By making these links stronger and with investments that promotes advanced technology in the regional industries, so the gaps becomes smaller, the spillovers of MNEs can be absorbed more efficiently. Furthermore an increase in the number of MNEs also increases level of competition, which may also facilitate the smaller and economically weaker regions to increase their productivity. Thereby the weaker regions can more successfully exploit the idea of economic of scale and gradually converge to the productivity levels in the more efficient and stronger regions.

6. Conclusion

The purpose of this study was to analyze if regions with a higher share of Multinational Enterprises possessed a higher productivity level than regions with a low presence of MNEs. This was done by observing the productivity spillovers of MNEs on local firms productivity in the Swedish manufacturing industry. The general theory of spillovers of MNEs on local firms productivity, claims that spillover are mainly transmitted through three channels namely, via R&D, increased competition and the flow of technology. The results clearly showed that productivity spillovers on local firms do occur, hence a large regional productivity was observed, however MNE did not have the same significant impact on all regions.

The first hypothesis stated that the regional productivity was superior in regions with a larger share of MNEs. In the model used, the empirical results indicated that two variables where the main factors to higher regional productivity, the size of the region and the share of MNEs meanwhile the share of the service sector in the regional economy had a negative impact on the manufacturing productivity. Consequently hypothesis 1 could not be rejected, since the influence of foreign firms was interpreted as signs of productivity spillovers of MNEs on the regional productivity. The results also implied that MNEs tends to locate their foreign plants in regions with high levels of manufacturing industry in their industrial structure. In these clusters the flow of productivity spillovers in terms of technology and R&D was easier to attract and more successfully absorbed by firms in these regions, which results to higher competition thus higher regional productivity.

MNEs did affect larger regions more than regions with a smaller population, which was the second hypothesis in this study. The outcome showed that regions with a larger population actually had a lower value of manufacturing productivity compared to the average productivity level in the rest the of the regions, hence hypothesis 2 was rejected. The size of the population reasonably affected the productivity in terms of higher demand, larger market and thus increase in competition which results to an increase in regional productivity. The share of MNEs in the manufacturing industry did influence the regional productivity however these spillovers was only absorbed efficiently by the firms in regions that possess a industry structure that had a large share of manufacturing industry. Since the larger regions was dominated by the service sector and not the manufacturing industry, the results showed a lower level of productivity in these large regions.

The difference in technology between MNEs and local firms indicate that spillover only occurred in regions with small productivity gap not in regions with large differences. Hence hypothesis 3 was accepted, which stated that MNEs influence was greater in regions with small technology gaps. Regions with large gaps appeared to be economically weaker or were unable to exploit the spillovers efficiently. One explanation could be that these regions did not produce similar products as the MNEs, hence the spillovers was to no use. However regions with small gaps, did hold the skills to control and adapt the technology spillovers and thereby ending up with a higher regional productivity.

Policymakers in Sweden needs to consider MNEs as an important factor when dealing with issues such as uneven distributions of economic activities between regions in Sweden. By promoting polices and systems which supports MNEs to locate themselves in region which economically smaller, the nationwide distribution of economic activity becomes more equal which perhaps results to a strong and a more stable economic growth in Sweden.

7. Suggestions for Further Research

Since there was some limitations in this study due to lack of data some topics and issues was not included. It cloud be interesting to see how spillovers of local firms affects the MNEs, or does the flow of spillover only go one way?

Furthermore, some of governments in the developing world tends to shut out the MNEs from their market due to protect themself from exploitations of factor endowments and human labour in these regions. Hence it would be interesting to observe how MNEs actually effects these low developed countries where the productivity gaps are extremely large.

Additionally, how can the local firms absorptive capacity of spillovers increase? Does firms in developing countries absorb in the same way as firms in developed countries?

Another interesting topic would be to analyze which spillover has the largest impact on regional productivity and why?

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Appendix

Table 1 Regression Appendix : All regions (81 regions)

Dependent Variable: PROD
Method: Least Squares
Date: 06/09/09 Time: 18:05
Sample: 1 81
Included observations: 81
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.489462	0.040421	61.58814	0.0000
EDU	0.115423	0.262813	0.439184	0.6618
SER	-0.348153	0.206537	-1.685670	0.0961
SIZE	0.026070	0.011119	2.344554	0.0218
MNE	0.060726	0.024384	2.490359	0.0150
PRO	-0.001487	0.043710	-0.034023	0.9730
INDUSTRYDUMMY	0.060957	0.009990	6.101589	0.0000
METRODUMMY	-0.049677	0.020780	-2.390685	0.0194

R-squared	0.430572	Mean dependent var	2.605903
Adjusted R-squared	0.375969	S.D. dependent var	0.043709
S.E. of regression	0.034528	Akaike info criterion	-3.800530
Sum squared resid	0.087031	Schwarz criterion	-3.564041
Log likelihood	161.9215	F-statistic	7.885545
Durbin-Watson stat	1.815755	Prob(F-statistic)	0.000000

Table 2 Regression Appendix: Regions with small technology gaps (41 regions)

Dependent Variable: PROD
Method: Least Squares
Date: 06/09/09 Time: 18:10
Sample: 1 41
Included observations: 41
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.451211	0.042970	57.04455	0.0000
EDU	0.073580	0.236735	0.310811	0.7578
SER	-0.858258	0.240630	-3.566718	0.0011
SIZE	0.046166	0.012463	3.704151	0.0007
MNE	0.055643	0.020470	2.718243	0.0101
PRO	-0.000400	0.049088	-0.008151	0.9935

R-squared	0.541699	Mean dependent var	2.601305
Adjusted R-squared	0.476228	S.D. dependent var	0.039551
S.E. of regression	0.028624	Akaike info criterion	-4.134694
Sum squared resid	0.028676	Schwarz criterion	-3.883927
Log likelihood	90.76123	F-statistic	8.273817
Durbin-Watson stat	2.049427	Prob(F-statistic)	0.000031

Table 3 Regression Appendix: Regions with large technology gaps (40 regions)

Dependent Variable: PROD
Method: Least Squares
Date: 06/09/09 Time: 18:08
Sample: 1 40
Included observations: 40
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.442422	0.066763	36.58329	0.0000
EDU	0.678498	0.347191	1.954252	0.0589
SER	0.177820	0.280092	0.634865	0.5298
SIZE	0.014179	0.013830	1.025185	0.3125
MNE	0.054409	0.035413	1.536407	0.1337
PRO	0.108798	0.085077	1.278817	0.2096

R-squared	0.274274	Mean dependent var	2.610615
Adjusted R-squared	0.167549	S.D. dependent var	0.047640
S.E. of regression	0.043466	Akaike info criterion	-3.296180
Sum squared resid	0.064237	Schwarz criterion	-3.042848
Log likelihood	71.92361	F-statistic	2.569922
Durbin-Watson stat	2.176375	Prob(F-statistic)	0.044693

Table 4 Correlation matrix: Correlation between all the 8 variables.

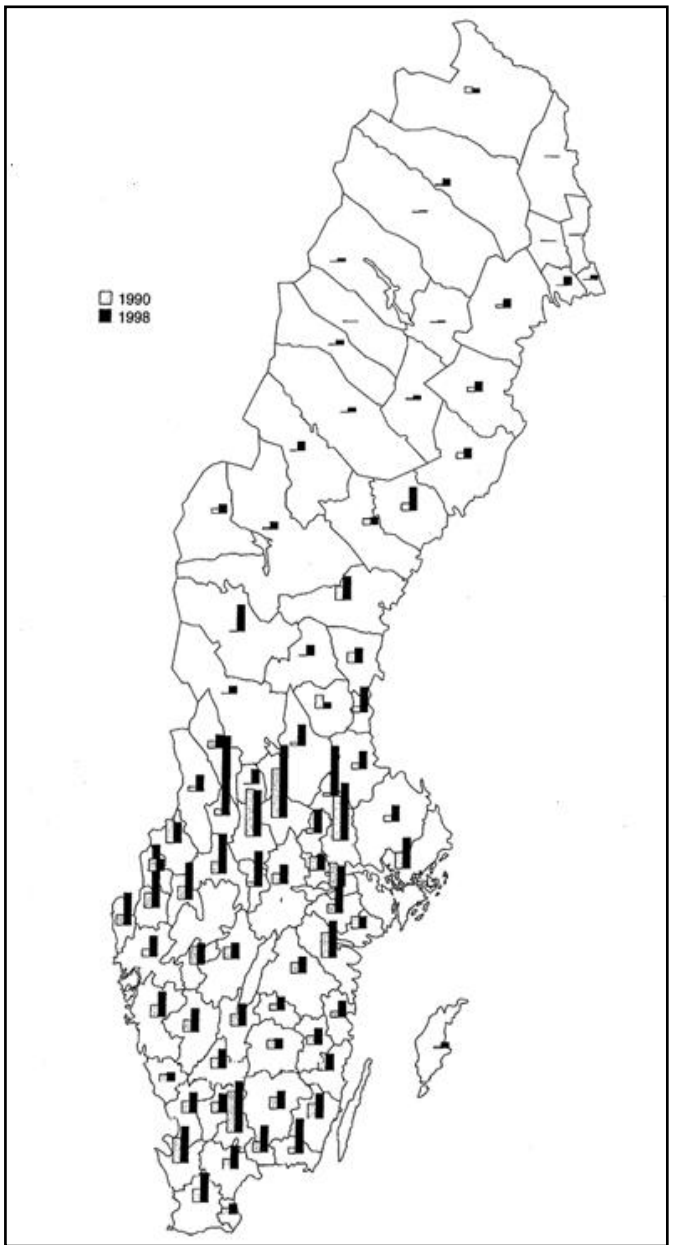
Correlations

		PROD	EDU	SNI	SIZE	PRO	MNE	Industrydummy	Metrodummy
PROD	Pearson Correlation	1,000							
	Sig. (2-tailed)								
	N	81							
EDU	Pearson Correlation	,190	1,000						
	Sig. (2-tailed)	,089							
	N	81	81						
SNI	Pearson Correlation	,006	,334**	1,000					
	Sig. (2-tailed)	,955	,002						
	N	81	81	81					
SIZE	Pearson Correlation	,391**	,326**	,565**	1,000				
	Sig. (2-tailed)	,000	,003	,000					
	N	81	81	81	81				
PRO	Pearson Correlation	,189	-,069	-,409**	-,086	1,000			
	Sig. (2-tailed)	,091	,539	,000	,445				
	N	81	81	81	81	81			
MNE	Pearson Correlation	,437**	,240*	,124	,489**	,205	1,000		
	Sig. (2-tailed)	,000	,031	,270	,000	,067			
	N	81	81	81	81	81	81		
Industrydummy	Pearson Correlation	,354**	,035	-,117	,027	,283*	,121	1,000	
	Sig. (2-tailed)	,001	,756	,299	,813	,010	,281		
	N	81	81	81	81	81	81	81	
Metrodummy	Pearson Correlation	-,203	-,086	-,045	,033	,025	,218	-,050	1,000
	Sig. (2-tailed)	,069	,444	,689	,772	,827	,051	,656	
	N	81	81	81	81	81	81	81	81

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 1: Share of employment in MNEs within the manufacturing industry in 1990 and 1998.



Source: Swedish Agency for Economic and Regional Growth (2009).