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**Foreign direct investments and productivity spillovers in the Swedish  
manufacturing industry**

Master Thesis: NEKN01 (15 credits ECTS)

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August 2013

## **Abstract**

Foreign direct investments (FDI) have considerably increased during the last twenty years throughout the world. Theory suggests that FDI affects host economies in a positive way through the advanced technologies they bring with them and which could spill over the domestic companies. Therefore, more and more research aims to assess the impact of foreign direct investments on the host economies. This paper focuses on analyzing the productivity spillover effect of FDI in the Swedish manufacturing industry over 1995-2007. Ordinary least squares (OLS), random effects (RE) and fixed effects (FE) estimation methods have been used along with different specifications of the model. As previously shown in the literature, the results show no productivity spillovers of FDI in the Swedish manufacturing industry in the period being analyzed.

**Keywords:** *FDI, productivity, spillovers, Swedish manufacturing industry*

## **Acknowledgements**

*First of all, I would like to thank my supervisor, Karin Olofsdotter, for her time and good advice.*

*I would also like to thank Katrin Humal, Cristian Muresan and also my husband, Bogdan Onigas, for all support.*

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## 1. Introduction

Foreign direct investments have considerably increased during the last twenty years throughout the world and that resulted in more and more research aiming to assess the impact of foreign direct investments (FDI) on the host economies. FDI is considered a vital tool that stimulates the development of a country and challenges nations to adopt different policies in order to attract more FDI and gain access to modern technologies. For the first time in history, in 2012, developing countries received more FDI than developed countries and nine developing countries were among the twenty largest FDI recipients in the world (World Investment Report, 2013).

There is a multitude of studies that try to evaluate the effects of FDI on productivity, economic growth, exports or capital formation. As more recent analyses tend to focus on the effects of FDI in developed countries, the aim of this paper is to try to answer the question: has the productivity of domestic companies in the Swedish manufacturing industry been increased by the presence of foreign companies?

Sweden has been chosen because it is one of the small developed countries which also faced increasing FDI throughout the years, mostly as a consequence of the 1990's liberalization reform between OECD member countries. Sweden was ranked third in the world as FDI recipient in 1999 (according to the World Investment Report, 2000). In 2012, Sweden obtained the twentieth spot on the top twenty FDI host economies (World Investment Report, 2013).<sup>1</sup>

In order to answer the question, a panel dataset with 17 manufacturing industries for years 1995-2007 has been used. An econometric model has been constructed considering labour productivity as the dependent variable and then regressed it on measures of foreign presence, capital intensity and human capital (while controlling for technology gap, year and industry specific effects). The estimation methods used are ordinary least squares (OLS), random effects (RE) and fixed effects (FE). As previously shown in the literature (Braconier *et al.*, 2001), the final results do not show any spillovers of FDI on productivity for the manufacturing industry in Sweden.

However, there are also some potential problems deriving from limited data availability and therefore, these should be taken into account when the final results are interpreted. As can be

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<sup>1</sup> Figure A in the Appendix illustrates the FDI inflows for Sweden for the 1990-2012 period

seen later on, there are cases in the related literature when the conclusions drawn from studies are different and do not always confirm what is expected from the theory. Their results are highly dependent on the data, measurement and methods that were used.

This paper is organized as follows: section 2 presents earlier findings in the related literature, mainly international and then for Sweden in particular. Section 3 provides a theoretical background concerning FDI and its effects. The specification of the model, variable descriptions and data are illustrated in chapter 4 along with potential problems deriving from the analysis. The estimation results are presented and explained in chapter 5. A robustness check has been performed and the results are also presented in this chapter. Finally, chapter 6 concludes.

## 2. Literature review

### 2.1. International evidence

Assessing the impact of productivity spillovers is an extremely important tool when designing national policies concerning inward FDI. There are a large number of empirical studies that try to measure the magnitude of FDI spillovers, especially in the case of developing countries. However, more recent studies began to analyze the spillover effects in developed countries. The conclusions of these studies are quite varied, but in general they tend to show similar results when the same estimation methods are used.

The first econometric analyses using cross-sectional data showed a positive impact of FDI on the productivity of domestic firms. Caves (1974) carried out his econometric analysis using data for Australia from 22 industries at a 2-digit level, initially for year 1962 and then 1966. He based his analysis on the production function and the results for both years showed that the coefficient of foreign presence was both positive and significant, concluding that FDI has a positive effect on labour productivity in the industry.

Globerman (1979) performed a similar approach for the manufacturing industry in Canada, and the obtained results were in line with those of Caves (1974). When it comes to developing countries, the results were also confirmed by Blomström and Persson (1983) in the case of Mexico's manufacturing industry, by using 4-digit industry level data for 1970. However, the overall idea is that using cross-section industry-level data makes it impossible to control for firm heterogeneity and therefore the results should be carefully interpreted.

Recent studies have used panel data analysis, either industry-level data or firm-level data. Their final results are very mixed. Liu *et al.* (2000) studied the case of UK and used data from the manufacturing sector for 48 industries at 3-digit level in the 1991-1996 period. The results showed that increasing foreign presence has a significant and positive impact on the productivity of the UK firms. Haskel *et al.* (2002) used plant-level data for U.K. in the manufacturing sector covering 1973-1992 and found that a 10 percentage-point increase in foreign presence in the industry raises the total factor productivity of that industry by about 0.5 %. On the other hand, Girma *et al.* (2001) carried out an analysis based on firm-level data in the same period and found that there is no evidence of productivity spillovers, except in the case of firms from industries with highly imported skills.

Fontoura *et al.* (2000) analyses the impact of foreign investment on the productivity performance in Portugal for nine manufacturing sectors at the two-digit level in the period 1992-1995. They found a positive effect when the technological differences are taken into account. A more recent study on Portugal carried by Crespo *et al.* (2009) takes into account geographical proximity between multinational and domestic firms. They concluded that their hypothesis is confirmed, namely that geographical proximity is relevant to the occurrence of FDI spillovers.

Ruane and Ugur (2005) examined potential productivity spillovers from foreign companies to domestic ones in the Irish manufacturing sector, using plant-level data for all manufacturing firms in the 1991–1998 period. They conclude that, despite the intensive promotion of FDI in the last 40 years, there is weak evidence of productivity spillovers and moreover, the results depend in a significant manner on how the foreign presence variable is measured.

Haddad and Harrison (1993) used firm-level data in the Moroccan manufacturing industry and did not find any significant effect of FDI on the firms' productivity. Aitken and Harrison (1999) used data from Venezuela and concluded that increasing FDI in Venezuela leads to a lower productivity of the domestic firms in the same industry. A study on emerging economies (Bulgaria, Romania and Poland) was carried out by Konings (2000) on the basis that a large inflow of FDI was directed to these countries after the collapse of communism and transition to a market economy. The results showed no effect of FDI on productivity in Poland, the more advanced transition economy. However, for Bulgaria and Romania, there seem to be negative spillovers for domestic firms.

The studies presented above are only a few examples taken from a large body of literature, but the general idea is that the results are very mixed and depend considerably on the research design, the data used and the estimation methods. Görg and Stroble (2001) collected the results of studies that focused on FDI and productivity spillovers and carried out a meta-analysis. They argue that the results of productivity spillover studies show that it is important whether the data used are cross-sectional or panel data and are not influenced by the industry- or firm-level data.

On the other hand, Görg and Greenaway (2001) followed the pattern of results and concluded that cross-sectional studies show mainly positive spillovers, while firm-level panel data tends to issue negative spillovers or no impact of foreign presence on productivity. Aitken and Harrison (1999) and Konings (2001) explain these negative results as a consequence of the

competition effect: the productivity of the domestic firm is affected by the foreign owned company that has lower marginal costs and gains market share, resulting in decreased production for the domestic company in the short run.<sup>2</sup>

## 2.2. Studies about Sweden

Braconier *et al.* (2001) empirically analyzed whether inward and outward FDI could be a channel for international R&D spillovers using data for Swedish manufacturing both at the industry- and firm level. Their results did not show any evidence of FDI-related R&D spillovers in Sweden at the industry- or firm-level, and found that inward or outward FDI does not have any significant effect on productivity in Swedish manufacturing industries.<sup>3</sup>

Karpaty and Lundberg (2004) studied FDI spillovers in Sweden using data for all manufacturing firms with at least 50 employees for the years 1990-2000. They used fixed effects estimation and first differences. Their results showed strong evidence of productivity spillovers to domestic firms. Another finding is that the volume of FDI is determined by the nationality of the foreign company and the absorptive capacity measured by R&D.

A later study on the productivity effects of foreign acquisitions in Sweden carried out by Karpaty (2007) used a more modern estimation strategy, namely combining the Difference-in-Differences estimator (DiD)<sup>4</sup> with the matching estimator based on propensity scores on data for Swedish manufacturing firms with at least 50 employees during the period 1986–2002. The results show a positive and significant effect of foreign acquisitions on domestic productivity, even though the process is not immediate and the difference can be seen from one to five years after the acquisition. The productivity might have an increase of 3% up to 11%, depending on the estimation method used.

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<sup>2</sup> The competition effect can also be a channel for positive spillovers transmission, as it will be presented in the next chapter.

<sup>3</sup> In their study, Braconier *et al.* (2001) used observations for years 1978, 1986, 1990 and 1994.

<sup>4</sup> DiD estimation method is a version of fixed effects strategy when using aggregate data.

### 3. Theoretical background

Foreign direct investment (FDI) is defined as an investment that implies a long-term relationship, lasting interest and control by an investor or parent enterprise in another enterprise resident in an economy other than that of the foreign direct investor (FDI enterprise or foreign affiliate) (UNCTAD, 2007).<sup>5</sup>

The most common forms of FDI are greenfield investments and mergers and acquisitions (M&As), but most of the FDI transfer occurs via M&As. In the case of greenfield investments, a company will enter a market by building a new company, and set up its own facilities from the ground up. This strategy is considered to produce a more visible effect on the host economy.

The literature discerns between direct and indirect effects of foreign direct investments. The direct effects consist in higher employment, trade development and capital formation, which are particularly important for developing countries.

Blomström and Kokko (1998) state though that in fact countries are interested in acquiring more FDI because they want to benefit from modern technology; that is considered an indirect effect. Moreover, it is also argued that the investment that multinational companies make might improve the productivity of domestic firms through productivity spillovers. Multinational companies transfer knowledge to their foreign affiliates and this can indirectly “spill over” to domestic companies as a consequence of the interactions between firms. Through greenfield-investments, the technology transfer takes place straightaway, while through M&As the technology transfer occurs gradually, and it might take time for the potential spillover effects to be observed (Braconier *et al.*, 2001).

Görg and Greenaway (2004) try to answer the question on how spillovers can occur by explaining four potential spillover channels identified in the literature: imitation, competition, skills acquisition and exports.

The process of *imitation* consists of observing and copying technologies used by foreign companies on the local market, especially regarding new production methods or managerial and organizational innovations. Even if the domestic companies cannot imitate the multinational companies, they can face a competition effect.

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<sup>5</sup> This general definition of FDI is based on OECD, Detailed Benchmark Definition of Foreign Direct Investment, third edition (OECD, 1996) and International Monetary Fund, Balance of Payments Manual, fifth edition (IMF, 1993).

The *competition effect* is another important channel for productivity spillovers, which occurs when the multinational company enters the local market. Beside the negative effect of competition that has been presented in the previous chapter, there might be also a positive effect, as domestic companies are forced to use their resources more efficiently or to even search for new technologies. Greater competition leads to productivity gains (Blomström and Kokko, 1998).

The third potential channel for productivity spillovers is *skills acquisition*. In general, multinational companies invest in training programs and demand high-skilled labour. Hiring workers that were previously employed and trained in multinational companies is a way through which domestic firms can improve their productivity. Haacker (1999) argues that the specific knowledge that workers come with is the most important channel for spillovers.

Domestic companies could also *learn to export* from the multinational companies that already have the knowledge regarding regulations, distribution networks or consumers' tastes. There is more and more work done trying to find the link between exports and productivity. One hypothesis is that exporting is strongly correlated with firms' size and productivity and therefore, firms export as they have higher productivities, better technologies, more employees, a higher volume of sales and can cover the sunk-costs of exporting. On the other hand, companies can choose to become exporters because they believe that this action would result in increased productivity (Girma, Greenaway and Kneller, 2004).<sup>6</sup> Therefore, domestic companies have the possibility to decrease their sunk costs and learn how to start or increase their exports (Kneller and Pisu, 2010).

The spillovers' magnitude might be influenced by some characteristics of the host country. Kokko (1994) suggests the technology gap (the difference in labour productivity between foreign and domestic companies) which also indicates the absorptive capacity of host country's companies.<sup>7</sup> The technology gap between domestic and foreign companies could be diminished through competition and as a consequence, potential productivity spillovers could occur. However, multinational companies might try to prevent technology spillovers from occurring by offering higher wages or choosing to locate in countries or industries where it is not as straightforward for domestic firms to imitate (Javorcik, 2004).

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<sup>6</sup> The authors use a large panel of UK manufacturing firms, applying matching techniques. Contrary to other evidence (see Bernard and Jensen, 1999), they found that exporters are more productive and that there is self-selection when becoming an exporter.

<sup>7</sup> It shows companies' ability of using the knowledge transfer that has spilled over.

## 4. Methodology

### 4.1. Model specification, variables and data

#### *Model specification and variable description*

The aim of this paper is to try to find if the increasing presence of foreign companies might improve the productivity of the domestic firms. The most general approach used in other studies is based on the production function. Industry-level studies generally use labour productivity as the dependent variable, mainly because of data limitations.<sup>8</sup> This paper follows the approach of Liu *et al.* (2000) and Ruane and Ugur (2005) by considering labour productivity expressed as a function of foreign presence, capital intensity and human capital:

$$labprod_{it} = c + a_1 fo_{it} + a_2 capint_{it} + a_3 humcap_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (1)$$

where  $i$  represents industry ( $i = 1, 2, \dots, 17$ ) and  $t$  represents year ( $t = 1, \dots, 13$ ). Each variable used in both equation (1) and (2) below are explained in Table 1.

As it will be presented later on, the technology gap variable seems to play an important role for the results when estimating our final model. In our final specification we regress labour productivity on foreign presence, capital intensity and human capital while controlling for technology gap, year and industry specific effects.<sup>9</sup> Considering the above function, the second specification of the model can be derived:

$$labprod_{it} = c + a_1 fo_{it} + a_2 capint_{it} + a_3 humcap_{it} + a_4 gap_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (2)$$

**Table 1.** Variable descriptions

Variable name	Variable description
<b><i>labprod</i></b>	(log of) labour productivity in domestic companies
<b><i>fo</i></b>	(log of) foreign presence
<b><i>capint</i></b>	(log of) capital intensity
<b><i>humcap</i></b>	(log of) human capital, average wages
<b><i>gap</i></b>	(log of) technology gap
$\gamma_i$	Industry effects
$\lambda_t$	Year effects
$\epsilon_{it}$	Error term

\*log of represents the natural logarithms of the variables

<sup>8</sup> Firm-level studies compute a measure of total factor productivity for each domestic company and year and then regress that on the presence of foreign owned firms, controlling at the same time for firm and industry characteristics that could influence productivity (Karpaty and Lundberg, 2004).

<sup>9</sup> A model specification without controlling for technology gap is also presented in the Appendix, Table A.

We measure *labour productivity* in domestic companies as the ratio of value added to employment for each industry. Value added and employment in domestic industries was obtained by subtracting the values for foreign companies from the total.

The explanatory variable that is of the greatest interest, *foreign presence*, is measured by the share of employment in foreign-owned companies in total employment in the industry.<sup>10</sup> Labour productivity in the industry is also influenced by the *capital intensity* measured by the ratio of total capital stock to total employment. A standard proxy for the *human capital* variable is average wages. As average wages could not be appropriately assessed for each of the industries included in our sample, it has been measured by the ratio of total wages and salaries to total employment.

A variable measuring the impact of the *technology gap* has also been included as a control. It has been assessed by the ratio of labour productivity in foreign owned companies to labour productivity in domestic companies. Blomström, Globerman and Kokko (1999) argue that a smaller technology gap between foreign and domestic firms could result in larger spillovers. This hypothesis was empirically confirmed by Girma *et al.* (2001) for UK or Hale and Long (2007) for China.

All the variables are in logs and therefore the coefficient of every explanatory variable represents the elasticity coefficient of the dependent variable with respect to every explanatory variable. The error term captures the effects of unknown factors. However, there are some potential problems associated with the way our variables have been measured; they will be presented after the following section that presents the data used.

The capital intensity and human capital variables are expected to have a positive impact on domestic productivity. With respect to the coefficient of the foreign presence variable, it is interesting to see if there are any positive productivity spillovers from foreign to domestic companies in the manufacturing sector, considering that previous studies for Sweden reported both positive and no productivity spillovers.

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<sup>10</sup> Another possible option would be to proxy it by the share of capital stock in foreign-owned firms in the total capital stock in the industry (Liu *et al.*, 2000). The only reason for choosing share of employment instead of share of capital stock (and value added instead of output for labour productivity) was data availability.

## Data

This study is using a panel data set that covers 17 manufacturing industries over 1995-2007 in Sweden, with a total number of 221 observations. The data comes from OECDstat, STAN Database for Structural Analysis and Inward Activity of Multinationals at the ISIC Rev. 3 aggregation level.<sup>11</sup> Even though the initial data set was larger, a number of industries have been dropped mainly because of missing data for certain variables. Table 2 below presents the descriptive statistics for each variable. For example, the foreign share varies quite much, being between 5% and 76%. However, foreign share represents on average 29.42%. A variable that is more stable is the human capital variable.

**Table 2.** Descriptive statistics

Descriptive statistics for final sample				
Variable name	Obs	Mean	Min	Max
Labour productivity (SEK)	221	567118	216378	1336079
Capital intensity (SEK)	221	749168	164383	1482315
Human capital (SEK)	221	270163	155723	422234
Foreign share (%)	221	29.42	5.10	76.03
Technology gap (%)	221	1.26	0.46	3.92

### 4.2. Potential problems

There are a number of potential problems associated with this analysis. They are mainly caused by limited data availability. First of all, labour productivity has been used instead of total factor productivity (TFP) as the dependent variable due to lack of data on the capital stock variable.

Secondly, foreign companies have not been excluded when computing the proxies for capital intensity and human capital, as it was not possible to find data for these variables that could discern between domestic and foreign companies. This approach is however quite common in the studies that use aggregate data. Hale and Long (2007) argue that the estimates of spillover effects obtained from aggregate regressions are subject to an upward aggregation bias, but at the same time, excluding foreign companies from the aggregates and estimating the model

<sup>11</sup> International Standard Industrial Classification of All Economic Activities, Rev.3

using only domestic companies could cause selection bias because of the possibility of non-random selection.

The best solution to avoid this problem would be to use firm-level data, but this was not possible to achieve in this case. However, we could find data for the dependent variable, and therefore labour productivity was measured for domestic firms in each industry. This might attenuate the exaggerated positive effect of FDI on domestic companies' productivity that could appear from the assumption that foreign companies are more productive than domestic companies.<sup>12</sup>

Endogeneity is also a problem that might affect the results as foreign companies are likely to invest into sectors that already have higher productivity. In this case, the explanatory variable might be correlated with the error term (unknown factors) and the OLS results would show only a correlation instead of a causal effect. The optimal solution would be to use other techniques, such as instrumental variables (IV). As it is quite difficult to find a good instrument for the foreign presence variable, we estimate the model using FE and RE, which should also help attenuate the potential bias.

Another issue is the measurement of the human capital or human quality variable. A standard proxy for it used in the literature is average wages or the ratio of skilled workers to unskilled workers. As there is no reliable measure of human capital at the industry level and, moreover, for each of the industries included in our sample, it has been measured as total wages and salaries per total employment in each industry.

According to Liu *et al.* (2000), there might also be shortcomings resulting from the measurement of technology gap. They argue that foreign companies may serve the premium segments of the market and domestic firms are focused on standard segments. This could result in larger technology gaps that might affect the results' reliability and therefore, further investigation would be recommended when large technology gaps appear.

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<sup>12</sup> This pattern has been also confirmed by the data here.

## 5. Results

### 5.1. Empirical results

Both equation (1) and (2) have been estimated, using Ordinary Least Squares (OLS), Random Effects (RE) and Fixed Effects (FE) methods on a balanced panel with 221 observations.<sup>13</sup> The baseline specification (1) does not include the technology gap as a control and the results we get are surprisingly different from what is expected from theory. They show that none of the foreign presence, capital intensity or human capital variables has any significant impact on labour productivity.<sup>14</sup> Hence, as previously suggested in the literature, the results confirm that the technology gap has a significant impact on productivity. The results of the final specification are presented in Table 3 below.

**Table 3.** Estimation results for the final model

Dependent variable: labour productivity			
VARIABLES	(1) OLS	(2) RE	(3) FE
Infoshare	0.081*** (0.029)	<b>0.060</b> <b>(0.044)</b>	0.051 (0.039)
Incapint	0.128*** (0.030)	<b>0.113**</b> <b>(0.058)</b>	0.036 (0.126)
Inhum	0.860*** (0.073)	<b>0.797***</b> <b>(0.094)</b>	0.510 (0.542)
Ingap	-0.446*** (0.044)	<b>-0.543***</b> <b>(0.097)</b>	-0.550*** (0.090)
Constant	0.563 (0.803)	<b>1.641</b> <b>(1.074)</b>	6.235 (5.852)
Year dummies	-	<b>Yes</b>	Yes
Industry dummies	-	<b>Yes</b>	-
Observations	221	<b>221</b>	221
R-squared	0.695	<b>0.746</b>	0.764
Number of industries	17	<b>17</b>	17

Robust standard errors are reported in parentheses. R-squared represents the within R-squared for RE and FE. \*\*\*, \*\* and \* note statistical significance on the 1%, 5% and 10% level, respectively.

<sup>13</sup> All estimations in this paper were made in Data Analysis and Statistical Software for Professionals (STATA).

<sup>14</sup> The estimation results for the baseline model are presented in the Appendix. Further tests showed that the most appropriate specification model is the one estimated by FE.

There are many advantages of using a panel dataset, but the most important one is that it can be used to deal with the heterogeneity, i.e. units are all different from each other in fundamental unmeasured ways. As omitting some variables would cause biased estimations, it is claimed that this is the main advantage of using panel data (Kennedy, 2008).

As can be seen from Table 3, the results using OLS are in line with what it is expected from theory. All the variables, including foreign presence have a positive and significant effect on labour productivity, as expected. However, it needs to be carefully tested if the model fulfills the required assumptions when using OLS. Therefore, before interpreting the results, different diagnostic tests have been performed. We have followed Kennedy's (2008) approach in order to choose the most appropriate estimator.

First of all, it is recommended to test for evidence of significant differences across industries. If there are no significant differences across industries, the OLS estimator on pooled data is the optimal choice. A Lagrange Multiplier test (LM) developed by Breusch and Pagan was used and the result showed that in fact there are significant differences across industries. Consequently, the random effects estimator is more appropriate.

Regarding RE versus FE, the RE estimation method is more efficient than the FE model as it does not exclude the explanatory variables that are time-invariant. Despite the advantage, the RE estimator does not control for a different intercept as the FE estimator does and this can generate bias because of the correlation between the error term and the explanatory variables.

In order to choose between the FE and the RE estimator, it has to be tested whether the results generated by RE are biased, i.e. if the error term is correlated with the explanatory variables. The Hausman test is used to test if the difference in the coefficients issued by RE and FE are systematic.<sup>15</sup> The results show that the coefficients are not significantly different from one another which indicate that the RE estimator is the most appropriate one.<sup>16</sup>

The coefficient for the variable of particular interest - foreign share - is positive, but not significant in the RE model. This means that there is no evidence of productivity spillovers being transmitted by foreign direct investment at the industry-level. This result is in line with a previous study for Sweden performed by Braconier *et al.* (2001), who argues that this result can be explained by the fact that most of the foreign direct investments in Sweden come

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<sup>15</sup> The FE estimator is unbiased as it includes dummies for different intercepts (Kennedy, 2008).

<sup>16</sup> The Hausman Test reports  $\chi^2(4) = 6.98$  and a p-value of **0.1370**. We do not reject the null that the difference in coefficients issued by RE and FE is not systematic.

through mergers and acquisitions. Contrarily to the greenfield investments, the knowledge transfer occurs gradually and during longer periods of time.

The capital intensity and human capital coefficients are both positive and significant, as expected. This means that they have an effect on domestic productivity in the manufacturing industry in Sweden. If human capital increases by 1%, productivity of domestic firms goes up by 0.797%.

The technology gap coefficient is negative and highly significant and plays a major role for the final results. It means that an increase in the technology gap between foreign and domestic companies by 1% decreases the productivity of the domestic firms by 0.543%. However, the hypothesis that larger spillovers might occur when the technology gap is small could not be tested for our data since we have not found any significant effect of the foreign presence on productivity.

## **5.2. Robustness check**

As the effects could occur with certain delays, a number of specifications that included lags of the foreign presence variable have also been estimated. However, the results did not show any significant positive spillovers generated by FDI. The approach of Castellani and Zanfei (2003) has been followed as a robustness check. They argue that the absolute levels of employment in foreign companies (`lnempl_fo`), rather than shares, might have an important effect that cannot be observed if employment levels experience the same increasing rate both in domestic and foreign companies.<sup>17</sup> Castellani and Zanfei (2003) also suggest including domestic employment (`lnempl_do`) as a control variable in order to avoid biased estimates because of the sector size effect.

The estimation results with the foreign presence variable measured in absolute values are presented in Table 4 below. The same estimation methods have been used, namely OLS, RE, and FE, and using domestic employment as a control variable. Then domestic employment has been excluded from the regressions (4) – (6) and the results appear to be very similar to the previous ones.

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<sup>17</sup> Equal changes of foreign and domestic employment levels have no effect on domestic productivity and can cause a downward bias in the results.

Tests have been used again with the same approach as before to choose between models and the conclusion is that the most appropriate one is again the RE model.<sup>18</sup>

Even though the foreign presence variable has a positive coefficient no matter if we control for domestic employment or not, it is not significant. The capital intensity and human capital coefficients are both positive and significant at the 5% and 1% level, respectively, in both RE specifications (2) and (5). Regarding the technology gap, it can be seen once again that the coefficient is negative and highly significant, meaning that an increase in the technology gap by 1% decreases the domestic productivity by 0.548%.

**Table 4.** Robustness check – estimations results

VARIABLES	Dependent variable: labour productivity					
	(1) OLS	(2) RE	(3) FE	(4) OLS	(5) RE	(6) FE
lnempl_fo	0.067*** (0.023)	<b>0.040</b> <b>(0.035)</b>	0.060 (0.053)	0.023*** (0.007)	<b>0.030</b> <b>(0.025)</b>	0.042 (0.037)
lnacapint	0.126*** (0.029)	<b>0.120**</b> <b>(0.055)</b>	0.047 (0.117)	0.158*** (0.033)	<b>0.135**</b> <b>(0.063)</b>	0.042 (0.123)
lnhum	0.842*** (0.077)	<b>0.807***</b> <b>(0.094)</b>	0.609 (0.604)	0.926*** (0.059)	<b>0.828***</b> <b>(0.072)</b>	0.505 (0.547)
lngap	-0.457*** (0.046)	<b>-0.548***</b> <b>(0.101)</b>	-0.545*** (0.092)	-0.432*** (0.043)	<b>-0.544***</b> <b>(0.098)</b>	-0.552*** (0.090)
lnempl_do	-0.058** (0.025)	<b>-0.025</b> <b>(0.035)</b>	0.111 (0.201)	-	-	-
Constant	1.040 (0.940)	<b>1.481</b> <b>(1.211)</b>	3.298 (8.124)	-0.618 (0.615)	<b>0.872</b> <b>(0.649)</b>	5.990 (5.912)
Year dummies	-	<b>Yes</b>	Yes	-	<b>Yes</b>	Yes
Industry dummies	-	<b>Yes</b>	-	-	<b>Yes</b>	-
Observations	221	<b>221</b>	221	221	<b>221</b>	221
R-squared	0.700	<b>0.744</b>	0.765	0.689	<b>0.745</b>	0.763
Number of industries	17	<b>17</b>	17	17	<b>17</b>	17

Robust standard errors are reported in parentheses. R-squared represents the within R-squared for RE and FE. \*\*\*, \*\* and \* note statistical significance on the 1%, 5% and 10% level, respectively.

All in all, considering the data and potential problems of this analysis, it seems that there are no productivity spillovers of FDI in the Swedish manufacturing industry over 1995-2007.

<sup>18</sup> The Hausman Test reports  $\chi^2(4) = 9.31$  and a p-value = 0.097 for specifications (2) and (3);  $\chi^2(4) = 8.67$  and a p-value = 0.069 for specifications (5) and (6) in Table 4. The null that the difference in coefficients issued by RE and FE is not systematic, cannot be rejected in either case, so it is justified to use RE.

### 5.3. Discussion

Theory suggests that FDI have definitely an impact on the host country's economies, and this can be also seen in the countries' efforts and policies designed to attract more and more FDI. Empirical results on the other hand are very mixed and it seems difficult to find evidence of positive spillovers. However, even if we were not able to find a significant effect, this might be caused by some elements that could not be captured by this analysis.

First of all, it might be an effect that could not be identified because of the data used. Using micro-level data would help analyze in more detail and capture some effects that cannot be seen at an aggregate level. Additionally, micro-level data would help prevent the potential upward aggregation bias that might appear when using data at the industry-level (Hale and Long, 2007).

Secondly, the type of investments could also influence the final results. Braconier *et al.* (2001) argue that the lack of spillovers in the Swedish manufacturing industry can be explained by the large number of M&As compared to greenfield investments. Through M&As the technology transfer is weak and it occurs on a larger period of time. If this is the case, the data used should cover a very long time span in order to be able to find an effect.

Finally, foreign companies can focus on other segments of the market or they might manage to protect their assets in an efficient way and do not allow for any spillovers to occur. As foreign companies might produce for the premium market or for exports and domestic companies may serve the local standard market, larger technology gaps are expected. Hence, this might imply lower productivity spillovers (Liu *et al.*, 2000). Moreover, the absorptive capacity is an important factor that might determine the spillovers' magnitude. Further investigation on how it may influence the productivity spillovers would be useful (using micro-level data).

## 6. Conclusion

This paper focuses on analyzing the productivity spillover effect of FDI in the Swedish manufacturing industry over 1995-2007. Theory suggests that FDI affects host economies in a positive way through the advanced technologies they bring with them and that could “spill over” the domestic companies. Therefore, assessing the impact of productivity spillovers is a very important tool that helps design national policies concerning inward FDI. Despite this, empirical studies show both mixed and unclear results.

This empirical analysis shows that there seem to be no productivity spillovers of FDI in the Swedish manufacturing industry in the period being analyzed. It has also been found that the technology gap has a negative impact on labour productivity, namely that an increase in the technology gap between foreign and domestic companies by 1% decreases the productivity of the domestic firms by 0.543%. As expected, if human capital increases by 1%, the productivity of domestic firms goes up by 0.797%.

Different specifications of the model using the same three estimations methods have been estimated in order to check the robustness of the results. As it might take some time for the effects to occur, a number of specifications using time lags have also been estimated. In all cases, the issued results were very similar and no evidence of productivity spillovers could be found.

An explanation for these results might be that it takes more time for the productivity spillovers to occur, or, as Braconier *et al.* (2001) argue, there are more M&A in Sweden than greenfield investments and those incur weak technology transfer. Thus, knowledge transfer is not immediate and does not have the same magnitude. Moreover, FDI spillovers do not occur in an automatic way and depend in a great manner on the host economies' characteristics, such as the absorptive capacity and the technology gap.

On the other hand, as it has already been mentioned throughout the paper, the final results should be carefully interpreted. The model here might not fully capture the effects due to data limitations and its related problems. As a good understanding of the link between FDI and productivity is really important for policy makers, it would be of great interest to conduct a further analysis using more recent firm-level data in order to check the robustness of the results. Furthermore, also including the services sector in a similar analysis would be of great support when discussing national policies implications of FDI in Sweden.

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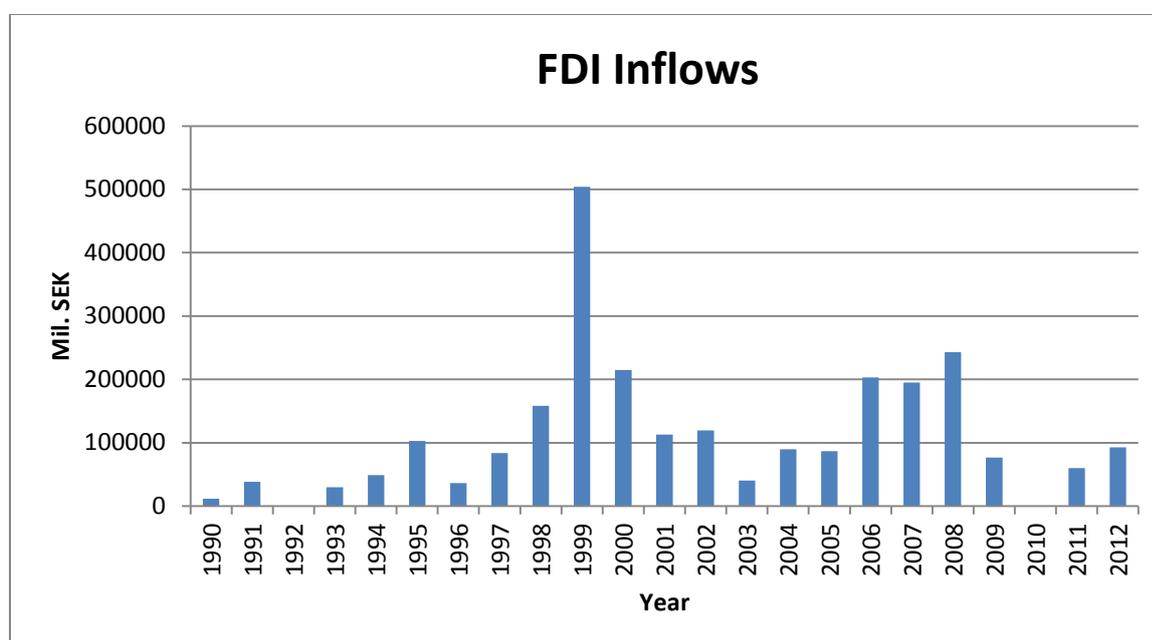
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## 8. Appendix

**Figure A.** FDI Inflows in Sweden



Source: UNCTADstat

**Table A.** Estimation results of the baseline specification

Dependent variable:labour productivity			
VARIABLES	(1) OLS	(2) RE	(3) FE
Infoshare	0.020 (0.034)	0.038 (0.061)	0.024 (0.039)
Incapint	0.093** (0.036)	0.059 (0.060)	-0.180 (0.211)
Inhum	0.891*** (0.100)	0.678*** (0.253)	-0.724 (1.494)
Constant	0.761 (1.195)	3.832 (3.040)	24.186 (20.180)
Year dummies	-	Yes	Yes
Industry dummies	-	Yes	-
Observations	221	221	221
R-squared	0.468	0.268	0.328
Number of industries	17	17	17

Robust standard errors are reported in parentheses. R-squared represents the within R-squared for RE and FE. \*\*\*, \*\* and \* note statistical significance on the 1%, 5% and 10% level, respectively.