Impact of Foreign Direct Investment on Productivity of the Firms
Evidence from Lithuania

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Abstract

Developing and transition countries strive to attract foreign direct investment (FDI) by liberating FDI related policies and offering incentives to foreign companies. It is expected that knowledge and technology will spillover to the domestic firms and thus increase productivity of the domestic industries. This thesis investigates the existence of horizontal productivity spillovers from FDI to domestic companies in Lithuania. Six manufacturing industries are analysed during the period of 2006-2010. Using unique firm-level panel data containing financial and ownership information it is investigated whether foreign share increases the productivity of recipient firms and whether there is spillover effect from FDI to domestic firms within the same industry. Although Lithuania is seen as likely location for productivity spillovers due to its high endowment of skilled labour, also FDI levels have been growing steadily in Lithuania during the past decade until the financial crisis and foreign companies on average possess higher productivity compared to domestic companies, estimated results suggest that there are no spillover effects within six manufacturing industries in Lithuania. Foreign share enhances productivity of recipient companies only until it is controlled for reverse causality effect. Then the effects become small and insignificant indicating that foreign firms may be investing in more productive firms already, thus FDI does not have significant influence on their productivity. Furthermore, there is no evidence of positive effects from foreign presence on other domestic firms in the industry and an increase of foreign presence has even negative effects on other foreign firms in the industry. Such findings suggest that the negative competition effects may offset positive spillover effects from the foreign direct investment. This is supported by the fact that firms’ productivity is negatively affected by the increase in competition within the industry. Results are robust across various different estimation model specifications.

Keywords: Foreign direct investment, horizontal spillovers, labour productivity, Lithuania, manufacturing industries
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List of abbreviations
FDI – Foreign Direct Investment
CEECs – Central and Eastern European countries
MNEs – Multinational Enterprises
HI – Herfindahl Index
EU – European Union
1. Introduction

One of the remarkable consequences of the ongoing globalisation of the world economies process is steady rise of foreign direct investment (thereafter FDI) during past decades. According to UNCTAD (2010), the ratio of world FDI to world gross domestic product has increased from 6% in year 1980 to 30% in year 2010. Such increase is mainly influenced by the shift in perception of FDI, as most of the countries are now more open, favour FDI and even offer some kind of incentives in order to attract more foreign companies (Haskel and Slaughter, 2002; Javorcik, 2004). Also, World Investment Report by UNCTAD (2010) states that current investment policy trends continue to liberalize and are more favourable towards FDI. Countries make effort to increase their attractiveness for foreign investors as it is expected that FDI will enhance growth through knowledge transfer and by generating additional capital (de Mello, 1999).

Particularly, in transition countries foreign capital can be seen as crucial during economy restructuring process in order to speed up transformation from centrally planned to market oriented economies and important nowadays in order to enhance economic and technological development, stimulate catching up with developed countries and boost recipient countries’ competitiveness. In 2009, the share of developing and transition economies in global FDI inflows increased to 50% (UNCTAD 2010). The reason for this may be the growing engagement in attracting FDI by these countries and their increasing attractiveness due to offered incentives. Policies which favour FDI and incentives like lower income taxes, tax holidays, import duty exemptions or subsidiaries for foreign companies have to be justified. They are based on general belief that multinational firms are more productive, therefore, their existence in the industry will lead to higher overall productivity because of knowledge and technology transfer for domestic firms (Aiken and Harrison, 1999).

Due to the importance for the policy considerations, FDI and its links to the productivity of firms have attracted much of the researchers’ attention recently. While the theoretical argument in favour of FDI is widely accepted, the empirical studies investigating FDI effects on productivity do not reach consensus in their findings. Although some studies are able to find significant positive relationship between FDI and productivity (see: Keller and Yeaple, 2009; Haskel, and Slaughter, 2002; Suyanto, and Bloch, 2009), other studies find insignificant or even negative effects of FDI on productivity of domestic firms (see:
Javorcik, 2004; Djankov and Hoekman, 2000). The mixed evidence implies that there is no agreed relationship between FDI and productivity and further research is needed within this field in order to be able to generalize the relationship between FDI and productivity.

1.1 Problem statement

The aim of this paper is to investigate the relationship between the FDI and productivity. The primary interest is inward FDI and its generated productivity spillovers to domestic firms. Therefore, the main focus of this thesis is to investigate whether inward FDI has spillover effects on the productivity of the firms in six manufacturing industries of Lithuania within the years 2006-2010.

In order to better understand and answer the problem statement more specific research questions can be characterised:

1. Can foreign equity participation be associated with higher firm’s productivity?
2. Is there any evidence of productivity spillovers from FDI to domestic firms?

In order to answer research questions firstly the relevant theories are investigated and theoretical foundation for the empirical analysis is built. Next unique firm level data of six Lithuanian industries is collected from the database which includes the ownership, employment and financial information. In order to analyse the dataset and obtain the results, empirical model is estimated and regressed using statistical software. Various estimation issues are addressed and corrections are applied if possible. In order to obtain reliable results and investigate model specifications several robustness checks are performed.

1.2 Motivation

Firstly, the motivation to investigate FDI and productivity relationship arose from the fact that attracting FDI is one of the most important exercises in policy makers’ agendas, however unambiguous and ground evidence of its effectiveness is lacking. Therefore, it is interesting to investigate particular country and try to find any supporting evidence of existence of FDI effects on productivity. What is more, Lithuania is chosen as the country of interest, because it is seen as likely location for productivity spillovers due to high endowment of skilled labour (Javorcik, 2004). Also, it is characterised as transition
country, therefore it had to undergo complex change and to restructure the whole economy from closed central to open market oriented. As mentioned above for these changes FDI is seen as crucial, despite this Lithuania did not rush into attracting FDI and pursued conservative policies. Only recently, mainly after joining EU in 2004 the levels of FDI has increased remarkably. Therefore, it is interesting to investigate whether such policies can be justified.

1.3 Delimitation

This thesis is limited to investigation of one country, particularly Lithuania. Moreover, six manufacturing industries are selected and analysed within five years period, in order to reduce the sample size and ease data manipulation.

What is more, the small companies are excluded from the sample because most of them lack the data and they were seen as the least valuable when investigating FDI effects on companies’ productivity. However, it is important to take into account this limitation when generalising findings of this paper.

The paper analyses horizontal productivity spillovers from inward FDI as investigation of vertical spillovers through backward and forward linkages requires more sophisticated dataset.

Definitions and concepts

Transition countries – countries of Central, Eastern and South Eastern Europe as well as the ones of the ex-Soviet Union, which after collapse of Soviet Union, in late 1980s and early 1990s started political, economic and social reconstruction in order to transform from communist, centrally planned systems to democratic, market oriented ones (Sinani, 2004).

1.4 Structure of the paper

The paper is divided into eight parts and is structured in the following order. Second section will present the background information about Lithuania and FDI in order to provide general knowledge about the country of interest. Then theoretical framework and literature review will follow. These sections will provide theoretical foundation for the thesis. The next section will indentify particular hypotheses which will be tested in the analysis part. Methodology part will provide relevant information about the dataset and
methods which will be used in order to answer the research questions. The main findings
will be presented in the analysis part. The last section is conclusion which will summarise
the results and provide guidelines for the future research.

2. An overview of FDI inflows and manufacturing sector in Lithuania

In order to get acquainted with the context of Lithuania some background information
about the FDI development in Lithuania and in manufacturing sector in particular will be
provided. The first section presents evolution of foreign direct investment in Lithuania.
Following section compares the FDI inflows of Lithuania with other Europe countries in
order to find out the extent of the FDI compared to other countries. The next section then
provides information about FDI inflows into six manufacturing industries.

2.1 Evolution of FDI in Lithuania

Lithuania was occupied by Soviet Union for more than fifty years and restored its
sovereignty by declaring independence in 1990. The primary task and the biggest
challenge for the re-established country was to transform its economy from the ineffective
centrally planned system to the market oriented. The key components of economic
transformation are characterised by Sinani (2004) as macroeconomic stabilisation, trade
liberalisation, privatisation and institution building. The country until separation from
Soviet Union was virtually closed, therefore the date of independence can be seen as the
start date for FDI inflows into this country.

The FDI has been highly acknowledged as important source of the necessary financing in
this particular stage. Also, it is expected to transfer knowledge and technology, which is
crucial in order to speed up transformation from state sector to private sector (Kogut,
1996). While there had not been any doubts about the need to switch from state to private
owners among post Soviet countries, the different kinds of ownership has been favoured,
which can be divided into insider and outsider ownership, (Blanchard and Aghion, 1996).
Some countries from the beginning tried to attract foreign investors due to expectations
that they will be able to accomplish transformation faster. On the other hand, several
countries and Lithuania among them tended to promote insider ownership. The first stage
of privatisation from 1991 to 1997 offered only limited opportunities to foreign investors
and such policy was the reason why the FDI inflows remained at the low level during first
half of the 90s (Javorcik, 2004). In the second stage privatisation was made available to foreign investors, therefore from the figure 2.1 it can be seen that from 1997 FDI inflows started to rise. While the increases in the FDI are present in all years, until 2004 growth rates are modest and in 2003 were less than 4 billion Euros.

**Figure 2.1 Net FDI inflows into Lithuania in 1997-2010**

![Bar chart showing FDI inflows into Lithuania from 1997 to 2010, with EU and non-EU inflows separated.](image)

Source: Statistics Lithuania, own computation.

Lithuania’s entrance to the European Union in 2004 is another significant event, which stimulated FDI inflows. Joining the union increased Lithuania’s attractiveness as FDI recipient country due to the reduced trade barriers among member states. The figure 2.1 shows that FDI inflows were growing steadily in the period 1997-2004, while in 2005 - one year after entering European Union - there is a sharp increase in the inflows. This growth continues in the following years and peaks in the year 2007, when net FDI inflows exceed 9 billion Euros, what can be described as extensive growth, because it more than twice exceeds inflows in year 2004. What is more, the increase is mainly generated by the EU countries as the rates of FDI from the rest of the world demonstrates only moderate growth in the whole 1997-2010 period and the gap between EU and non-EU countries’ investments volume especially increases after accession to European Union. To continue with, the period of intense growth is discontinued in 2008 as due to the global financial crisis caused recession over the world inflow levels decreased. Despite the severity of the crisis, the rates have already started recovering next year and the FDI inflows exhibit growth in the period 2009-2010. It is expected that the rates will reach pre-crisis levels in 2011 (UNCTAD, 2010).
In conclusion, although during the first privatisation stage Lithuania has not attracted much FDI, the of level inflows started to grow in 1997 and increased significantly after the accession to European Union. What is more, due to the financial crisis there is a drop in FDI inflows in 2008, but they started to recover already in 2009.

### 2.2 Comparison of FDI in Europe and transition economies

The FDI inflow numbers of particular country alone does not provide much general knowledge about the situation, therefore it is useful to compare Lithuania with other countries in order to obtain the general view in the bigger context. Figure 2.2 exhibits FDI inflows in millions of US dollars in year 2010 into 27 European Union member states. From this graph it can be seen that Lithuania has outperformed only Latvia and Malta and is 25th on the list or third from the end. It is obvious that country despite the rapid growth in recent years has still attracted only modest amount of FDI compared to other member states. Likewise, other two Baltic states do not appear any higher as Estonia is 23rd and Latvia is 26th. Not surprisingly leading positions in attracting FDI are occupied by the most developed members of EU - United Kingdom and France. In case of counties which are classified as transition economies the highest level of FDI is attracted by Poland, then Czech Republic and Hungary.

**Figure 2.2 FDI inflows into EU countries in 2010**

Source: UNCTAD database, own computation. Note: FDI inflows are expressed in millions of US dollars.
While it is interesting to look at aggregate numbers of FDI which indicate the clear leaders in EU\(^1\), it is suggested to use population as adjustment factor when comparing FDI levels between countries (Garibaldi et al, 2002). In this way size differences of the countries are eliminated and more comparable results are attained. Figure 2.3 presents FDI inflows expressed in US dollars per capita into Central and Eastern Europe countries (CEECs) which are classified as transition economies. Year 2007 is chosen in order to reflect the FDI inflows before crisis, while 2010 indicates after crisis inflows. From the figure it can be seen that none of the countries except Albania have outperformed pre-crisis levels and most of the countries have experienced sharp decline in 2010 compared to 2007.

**Figure 2.3 FDI inflows in US dollars per capita into Transition economies in 2007 and 2010**

In figure 2.3 countries are arranged based on year 2007, because 2010 FDI rates reflects current situation which is highly affected by financial crisis, while 2007 can be seen as reflecting longer term trend of increasing FDI flows during past decade. When looking at FDI inflows in term of per capita Lithuania also demonstrates moderate levels of inflows. Based on 2007 rates Lithuania is 9\(^{th}\) between 12 transition countries and has the lowest FDI per capita among three Baltic States. Interestingly, three countries Bulgaria, Croatia and Latvia which were leading in FDI inflows in 2007 are having difficulties in recovering pre-crisis levels as the large difference between 2007 and 2010 numbers can be seen. Estonia has been leading during both years and was less affected by the crisis than any other

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\(^1\) See Appendix 1 tables A.1.1 and A.1.2 for FDI inflows into EU countries expressed in US dollars per capita and as percentage of country’s GDP in years 2007 and 2010.
country. The success in attracting large amounts of FDI despite small size of country’s economy can be explained by trade and investment liberalization immediately after regaining independence in 1991 and efforts to attract foreign investors in early stages of privatisation process as well as continued adjustment of policies and regulations according to EU law (UNCTAD, 2011b). This is contrary to Lithuania which as mentioned before made privatisation process open to foreign investors only in later stages, therefore due to the late start it remained at the end of the list of CEECs (Javorcik, 2004).

2.3 Manufacturing sector characteristics

In 2010 manufacturing accounted for 29% of inward FDI, although it decreased from 40% in 2005 (UNCTAD, 2011a). Even though services sectors attract increasing amounts of FDI, manufacturing can still be seen as significant part of FDI inflows. Six industries chosen for the analysis account for 25.7% of total FDI in 2010 (see table 2.1). Table 2.1 presents FDI inflows into six industries expressed in millions of Euros as well as a percentage of total FDI in period 2008-2010. The remarkable share of 17.6% or more than 1.8 billion Euros of FDI inflows in 2010 was achieved by chemicals et al industry. High tech rapidly developing chemicals, rubber, plastic and non-metallic products industry managed to attract increasing number of the FDI and its share grew in this period from 9.4% to 17.6%. In contrast all other 5 industries possessed steady or decreasing ratios. The highest decrease during the 3 year period was experienced by food, beverages and tobacco industry, where ratios fell from 4.9% to 3.9%. The inflows into metals and metal products industry also contracted from 1.7 billion Euros to 1.04 billion Euros in this period. Such contractions can be due to the global financial crisis, as well as switched interest by investors from manufacturing sector to rising services sector.

Table 2.1 FDI inflows into six manufacturing industries in 2008-2010

<table>
<thead>
<tr>
<th>Industry</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chemicals, rubber, plastic</td>
<td>868</td>
<td>1.460</td>
<td>1.814</td>
<td>9.4%</td>
<td>15.3%</td>
<td>17.6%</td>
</tr>
<tr>
<td>2. Food, beverages, tabacco</td>
<td>450</td>
<td>439</td>
<td>397</td>
<td>4.9%</td>
<td>4.6%</td>
<td>3.9%</td>
</tr>
<tr>
<td>3. Wood, cork, paper</td>
<td>164</td>
<td>191</td>
<td>183</td>
<td>1.8%</td>
<td>2.0%</td>
<td>1.8%</td>
</tr>
<tr>
<td>4. Textiles, wearing app., leather</td>
<td>117</td>
<td>115</td>
<td>104</td>
<td>1.3%</td>
<td>1.2%</td>
<td>1.0%</td>
</tr>
<tr>
<td>5. Metals and metal products</td>
<td>170</td>
<td>101</td>
<td>102</td>
<td>1.8%</td>
<td>1.1%</td>
<td>1.0%</td>
</tr>
<tr>
<td>6. Machinery, equipment, recycling</td>
<td>58</td>
<td>56</td>
<td>45</td>
<td>0.6%</td>
<td>0.6%</td>
<td>0.4%</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>1.827</strong></td>
<td><strong>2.361</strong></td>
<td><strong>2.646</strong></td>
<td><strong>19.9%</strong></td>
<td><strong>24.7%</strong></td>
<td><strong>25.7%</strong></td>
</tr>
</tbody>
</table>

Source: Statistics Lithuania, own calculations. Note: FDI inflows in first part of the table are expressed in millions of Euros. In second part of the table FDI inflows into six industries are expressed as percentage of total FDI that year.
In conclusion, Lithuania has experienced steady growth in FDI inflows during the period of 1997-2010. This growth was discontinued in 2008 due to the financial crisis. Crisis can also be seen as a partial explanation to the decreasing ratios within five manufacturing industries, while chemicals et al industry managed to sustain high growth during the period 2008-2010. Moreover, compared to other EU member states as well as CEECs classified as transition economies Lithuania possesses low levels of FDI and one of the reasons can be late start in promoting FDI favouring policies.

3. Theoretical framework

This section presents most relevant theories related to the FDI and firms productivity. The first section will provide working definitions of foreign direct investment as well as productivity. In literature various different definitions can be found, therefore this section will identify particular definitions which will be used as benchmarks through the whole paper. Next 3.2 section will introduce theories, which explain foreign direct investment effects on the hosting country. The specification between direct and indirect effects of FDI will be made. These theories act as a foundation for rising particular hypotheses, which will be tested in the analysis part.

3.1 Definitions of FDI and productivity

Foreign direct investment

According to OECD, foreign direct investment can be defined as the objective of obtaining lasting interest meaning long-term relationship by the resident entity (“direct investor”) in one economy in an enterprise (“direct investment enterprise”) which is located in a country different than one of the investor. According to OECD, a foreign direct investor can be an individual, an incorporated or unincorporated public or private enterprise, a government, a group of related individuals, or a group of related incorporated and/or unincorporated enterprises which has a direct investment enterprise. Direct investment enterprise should be defined as enterprise in which foreign investors own 10 percent or more of the ordinary shares or voting power, as it is assumed that at least 10 percent is needed in order for investor to be able to influence or participate in the management of the enterprise (OECD, 1996).
Productivity

Productivity’s concept by Syverson (2011) is defined as efficiency in production. It is an input-output ratio which shows how much of the output can be produced with particular number of inputs. When for same set of inputs different level of output is obtained there is the variation in productivity. There are many different approaches in productivity measurement and calculation. Objectives of measuring productivity vary from tracking technological change to evaluating living standards; in this case this measure is used to measure firms’ productivity in order to identify the change due to foreign direct investment. From the perspective of number of inputs used to calculate productivity two main classifications can be defined: single factor productivity and multifactor productivity (Ibid). Labour productivity is the most common between single factor productivity measures and it is employed in this paper.

3.2 FDI effects on host economy

FDI is welcomed by the countries especially by transition and developing countries due to expectations that additional foreign capital and more advanced technologies will raise productivity in domestic industries. It can be achieved by either direct or indirect effects of FDI or both. When it is observed that foreign owned firms are more productive than domestic ones, positive direct effect of foreign ownership is present. Indirect or spillover effect occurs when domestic firms in the same sector as foreign enterprises benefit from the existence of FDI (Ruane and Udur, 2002). The gains will appear if beneficial knowledge like marketing and management techniques, specific know-how, employee training as well as technology is transferred from foreign companies to domestic counterparts. Exports effect is another channel through which particular benefits can be obtained by host country from FDI. What is more, the foreign presence may stimulate competition in this way either forcing less productive counterparts to leave the market or enhancing productivity catch-up by local firms.

3.2.1 Direct effects

In order to identify the direct effects of FDI firstly it is useful to overview the characteristics of multinational enterprises (MNEs). When analysing MNEs from the foreign direct investment perspective the question naturally arises: why enterprises engage into international activities. A lot of researches were dedicated to investigate this issue.
While internationalisation provides various benefits like availability of new market, resources or efficiency, the company also has to overcome such obstacles like local competitors with better information, lack of knowledge about suppliers, buyers, recourses, local business, culture, socio-economic systems or language (Dunning, 1988). Therefore, investing abroad should possess particular advantages, which would help to cope with these certain barriers and ensure foreign enterprise’s competitiveness in the local market.

**OLI paradigm**

In order to explain MNEs choice to go abroad Dunning’s (1988) eclectic paradigm (also known as OLI paradigm) can be seen as one of the most recognised theories used for this purpose. OLI paradigm is based on hypothesis that companies will engage in FDI when three conditions are satisfied. These conditions are: Ownership (O) advantage, Location (L) advantage and Internalisation (I) advantage. Each will be described in more detail below.

**Ownership advantage**

In OLI paradigm the decision of internationalisation is highly based on firm specific assets. In order to be able to compete in foreign market company must possess ownership advantages also called competitive or monopolistic advantages, which would be able to compensate for the additional costs, occurred due to setting up and operating abroad, which are not faced by domestic companies (Stoian and Filippaios, 2008). Local firms are naturally in better position compared to the foreign companies due to specific knowledge about local market, easier access to labour and capital markets. Therefore, the internationalisation would not be considered if company would not be able to overcome these costs. This can be achieved when company possesses some kind of exclusive advantage for at least some period of time. These can be access to markets or raw materials not available to competitors, economies of scale, property rights, advantages related to common governance, like wider opportunities and easier access to international markets, or exceptional intangible assets like trademarks, patents, brand name, managerial and marketing know-how or superior knowledge related to technology or business, which in turn lead to reaching higher level of technical or price efficiency and more market power (Dunning, 1977). Overall, company has to obtain net advantage in order to engage and benefit from FDI.
**Location advantage**

Another condition is that there should be certain location advantage for the foreign firm to engage into FDI rather than use exports. There has to be a solid reason for the location of activities abroad rather than in home country especially in the case when economies of scale can be achieved (Markusen, 1998). It can be said that international competitiveness is highly based on the firm specific factors. Also, the fact that it depends on the nationality of the company suggests that other factors like industrial structure, economic system, institutional and cultural endowments might also play a major role (Dunning, 1977). Factors specified as location advantages can be divided into three groups: (1) the availability and real cost of resources, which can only be used in locations where enterprise is placed, (2) unavoidable and non-transferable costs and benefits like taxes, subsidies, investment constraints, local labour requirements, etc. and (3) the costs of shipping products, from one country to another (Dunning, 1977).

What is more, Markusen (1998) suggests that the type of location advantages can be associated to the motives of internationalisation. Horizontal firms\(^2\) which seek the access to the new markets will prefer country where the demand is relatively high. Therefore, the size of the market may be important incentive to engage in FDI especially if export costs are high. On the other hand, the vertical companies\(^3\) are concerned about efficiency gains (vertical FDI) and will establish stages of production with different factor intensities in countries which have different factor endowments. For example, the skilled labour technology intense processes will be placed in skilled labour abundant countries, while low technology processes like assembly, will be placed in low cost unskilled labour abundant countries.

**Internalisation advantage**

The third element of OLI paradigm is internalisation advantage. This advantage is based on idea that there should be benefits to undertake international production itself than use exports, licensing, franchising or sub-contracting as entry modes to foreign country. In other words, in order to prefer FDI against other entry modes there should be the advantage

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\(^2\) Horizontal firms can be defined as the ones which produce mainly the same product over several different locations (Markusen, 1998).

\(^3\) Vertical firms are the ones which geographically fragment their production based on process stages (Markusen, 1998).
of internalising the ownership advantage possessed by the company (Stoian and Filippaios, 2008). Companies tend to choose FDI in order to maintain the value of assets and avoid asset dispersion. For the company FDI may be more attractive option in cases when it possesses such advantages like avoidance of search, negotiation and property rights enforcing costs, avoidance of quality of intermediate of final goods protection and inspection, control of supplies and sale conditions or/and to avoid or exploit government intervention e.g. quotas, taxes, price controls, etc. (Dunning, 1977). What is more, it is the great interest by the company to protect that its superior knowledge would not be obtained by competitors and if there are no trustworthy potential partners or the costs of ensuring and preventing the dissipation of knowledge are high, then company will prefer FDI as the most convenient mode to enter foreign market.

**Characteristics of MNEs**

As mentioned in OLI paradigm the MNEs possess particular advantages against their competitors when engaging in FDI. In connection to these advantages the specific characteristics of MNEs can be attributed. According to Markusen (1998) MNEs are associated with high research and development relative to sales ratios (R&D). As a result, they are associated with new and technically complex products. Also, they possess high value intangible assets; employ large number of scientific, technical and other “white collar” workers as percentage of their workforce; are associated with product-differentiation variables such as advertising to sales ratios. Finally, MNEs are more likely to be older and more established firms.

All things considered, OLI paradigm identifies particular MNEs advantages they possess, which allow them to compete against domestic firms. Therefore this paradigm can be seen as theoretical foundation for direct effects of FDI spillovers. What is more, based on this paradigm and particular characteristics identified by Markusen (1998) it can be constituted, that foreign firms should be more productive than domestic firms. In order to be able to compete they have to possess some kind of advantage against the domestic firms with better knowledge and established linkages with local suppliers and customers. As mentioned above the company has to contain non-tangible productive assets like technology, know how, exports contracts, reputation, which are gained through experience and cannot be easily transferred. Otherwise, the company will not be willing to engage into international activities. Therefore, it is expected that due to the existence of such intangible
assets the foreign ownership will increase firm’s productivity (Aitken and Harrison, 1999). This is direct effect of the FDI on host economy.

**3.2.2 Spillover effect**

As mentioned above it is reasonable to expect that multinational firms are more productive than domestic firms due to comparative advantage which is necessary to overcome extra costs associated with FDI. What is more, it is expected that FDI benefits not only recipient firms, but other domestic firms in the industry as well. If foreign firms are not able to completely internalise their knowledge and technology, these may spill over to the local firms and in turn increase their productivity (Javorcik, 2004). Therefore FDI is often favoured in transition and developing countries, as it is expected that transfer of new technologies, marketing concepts and management skills will generate productivity gains in the industry and generate catch up and growth (Schoors and Tol, 2002). This is referred as indirect effect of FDI or spillover effect. While it is one of the greatest interests for multinationals to prevent the transition of the knowledge to the local competitors in literature there are several channels of spillovers identified. These channels can be classified as: (1) labour turnover, (2) imitation or demonstration effects and (3) forward/backward linkages (Djankov and Hoekman, 2000). What is more, other channels identified, through which host country can obtain benefits from FDI, are exports and competition effect. These channels now will be analysed in more detail.

**Labour turnover**

Labour turnover is considered one of the channels through which the spillover effect might occur. Technology superior firms need to train local employees in order to create highly skilled and appropriately trained employee base for the company (Eden et al, 1997). Multinationals are not able to retain all the trained and skilled employees and completely prevent labour turnover. The spillovers appear when worker previously employed by the international company transfers his/her obtained knowledge about superior technology and/or special know how about the business practices to the new workplace which might be local firm or his/hers own business (Crespo and Fontoura, 2007). As mentioned the foreign firms cannot avoid labour turnover but in order to reduce it, MNEs tend to pay higher wages to retain qualified employees (Fosfuri et al, 2001). Such higher wages are called pecuniary spillovers and if the difference between wages paid by domestic and
foreign companies is high it can be expected that there will be low spillovers through labour turnover. What is more, the possible negative effect from such pecuniary spillover may be that the multinationals by offering higher wages will attract the best workers from the domestic firms in this way worsening the situation of domestic companies (Crespo and Fontoura, 2007). Moreover, other factors which can restrict the knowledge spillovers through labour turnover might be restrictive laws of labour mobility as they may reduce the rates of the labour turnover between companies. More strict property rights protection might as well work as a barrier for leakage of valuable information (Fosfuri et al, 2001).

In conclusion, the spillovers through labour turnover may transfer valuable knowledge and technology to domestic firms but they are more likely to happen in countries where the gap between foreign and domestic firms’ wages is small and where less restrictive policies concerning labour mobility and property rights are practiced.

**Demonstration effect**

Demonstration also known as imitation effect is another spillover channel through which domestic firms might benefit from the presence of FDI in their sector. Due to reduced geographical and operational proximity there are better information flows among firms which improve learning possibilities for the domestic firms (Eden et al, 1997). Spillovers occur when domestic firms attempt to imitate the products or production technologies used by multinationals. Introduction of new technology into the production involves high level of uncertainty about its effectiveness and normally requires large investments which smaller local firms might not be willing to undertake due to risk involved. Lack of information in domestic market about the costs and benefits of the technology discourage existing firms from using it. If the technology is successfully used by the foreign firm it is likely that the domestic firms will be aware of that and encouraged to apply this technology (Crespo and Fontoura, 2007). The technology diffusion happens easiest and fastest when there are geographical and operational proximity among interest groups. Therefore, the domestic companies will adopt new technologies faster when the particular level of knowledge and expertise is obtained. What is more, the effectiveness of demonstration effect to technology spillover is highly related to the similarity of the products produced by MNEs and domestic firms (Crespo and Fontoura, 2007). Hence, the larger differences among products the less relevant for the domestic company it will be to invest into new technology. On the other hand, for such technologies like management and
marketing to spill over to domestic firms the similarity of the products is not necessary (Ibid).

All in all, demonstration effect occurs when companies imitate products or technologies of foreign companies but in order to be able to benefit from spillovers through demonstration effect domestic companies should possess at least some knowledge about the technologies and operational and geographical proximity should be present.

**Forward/backward linkages**

The third channel of spillovers can occur due to the interaction between foreign and local companies. Such interaction produces linkages which can be divided into (1) backward and (2) forward linkages. Linkages among firms encourage firms to adopt common routines, industry norms or acquisition standards in order to reduce costs of transactions (Eden et al, 1997).

1) Backward linkages in the domestic market arise from the relationship between multinational and its local suppliers (Javorcik, 2004). If the MNEs are switch to the local suppliers the host economy can benefit firstly by increasing demand of particular inputs therefore companies might attain economies of scale. What is more, multinationals in order to assure the certain level of quality will be willing to provide their suppliers with technical support, share their superior knowledge and introduce product innovations (Crespo and Fountura, 2007).

2) Forward linkages in the domestic market arise from the relationship between multinational and its local customers. Spillover effect from multinationals to upstream sectors exists due to supply of the inputs that previously where either unavailable or are more technologically advanced, better quality, less expensive or provided with supplementary services (Javorcik, 2004).

Although forward and backward linkages might be important channel of productivity spillovers to domestic firms and several research confirm that (see: Javorcik, 2004; Schoors and Tol, 2001), the unavailability of data needed to analyse this channel limits the analysis and only horizontal spillovers are investigated.
**Competition effect**

Another channel the host country is affected through is competition affect. It occurs when foreign companies enter domestic market and increase competition within the industry. The results of more intense competition are twofold: it can be positive or negative. In case of positive effects the increased competition and the fact, that MNEs are more productive than domestic competitors, puts pressure on domestic firms. Therefore in order to maintain the current market share these companies have to increase their productivity and this can be done by more efficiently using existing resources and technology or upgrade their production either by following the MNEs or implementing own established improvements (Eden et al, 1997).

On the other hand, the adverse effects of competition can be identified, particularly in the short run. In cases where companies face fixed costs the intention of companies is to increase the production and split these costs over higher volume of production. In such environment new foreign entrants which tend to be more productive will capture the demand from domestic firms. Decreasing market share will force local companies to cut the production and as a result the productivity will fall as the companies will have to spread fixed costs over the smaller number of production (Aitken and Harrison, 1999). Therefore, such competitive pressure may force less efficient local firms to leave the market.

**Figure 3.1 Output response of domestic firms to foreign entrance**

![Output response of domestic firms to foreign entrance](image)

Source: Aiken and Harrison 1997
The graphical presentation of two offsetting effects is shown in figure 3.1. Due to positive spillovers the domestic companies become more productive and average cost curve falls from AC\textsubscript{0} to AC\textsubscript{1}. However, the increased competition due to new foreign entrants forces to decrease the output from A to B and move up AC\textsubscript{1} resulting in higher costs per unit particularly in this situation. Overall the net effect of the FDI in the industry will depend on which effect dominates.

**Export effect**

Exports effect is another channel through which MNEs can affect host country. Firstly, the direct positive impact from FDI can be identified on the capacity of the exports due to existence of MNEs in the industry, as the exports of foreign companies increase overall exports of the host economy (Kokko and Tansini, 2001). Usually the exports and FDI are seen as interchangeable entry modes into foreign country and the explanation can be here why multinationals engage into exports can be that the foreign firms are more productive, therefore they are more capable to bear sunk costs associated with establishment of distribution networks, transport infrastructures and knowledge about customers’ preferences in the foreign country arising from exports (Crespo and Fountura, 2001). Moreover, by producing in the host economy they can still exploit benefits possessed by the FDI hosting country. As mentioned in 3.2.1 section vertical FDI is exercised in order to realise efficiency gains by placing different production stages in countries where particular benefits can be obtained. In this case, the exports of intermediate goods are proceeded and as a result the exports of the host economy increase (Greenaway & Kneller, 2007). What is more, export-platform FDI is when company produces in foreign country and exports part of or all production to the third country in order to benefit from the lower cost between host and third country compared to those incurred when exporting directly from the country of origin (Ibid). This type of FDI would also increase the volume of exports of the host country.

Moreover, FDI can indirectly affect exports of the host economy. The increase in competition due to entry of foreign companies in the industry is expected to force domestic firms produce more productively and in turn leads them to being more competitive globally and more capable to engage in exports (Kneller and Pisu, 2007). It can be seen as secondary effect aroused from the increase in productivity due to the presence of multinationals in the industry in the first place. Also, the presence of foreign firms can
encourage domestic firms to enter foreign markets. This is achieved by following the export processes of foreign companies by imitating them or in some cases even by collaborating with MNEs. Foreign companies may possess some knowledge about the foreign markets and have established networks thus resulting in lower export costs. If local companies are able to observe the knowledge and imitate the practices, they are able to reduce the costs of exports as well, therefore the exports will increase (Crespo and Fountura, 2007).

To sum up, FDI may affect recipient economy through various channels. The direct and indirect effects can be identified. The host economy is directly affected if the foreign firms are more productive than domestic ones. Indirect effects known as productivity spillovers may occur through labour turnover, demonstration effect or linkages among multinational firms and their suppliers or customers. Also, MNEs may contribute to the increase of export levels in the host country directly or indirectly. The most ambiguous is competition effect which may increase the productivity of domestic firms by stimulating efficiency improvements or work as offsetting effect known as market-stealing effect. Therefore, the general outcome from FDI depends on which effect dominates.

The next section will analyse existing literature within the study area and will present the most influential findings of the FDI effects on the host economy.

4. Literature review

The previous section presented theoretical foundations for the FDI effects on the host economy. While the theoretical models of FDI suggest that there should be positive effects from FDI (Djankov and Hoekman, 2000), various empirical studies in this field present ambiguous results. Some researches provide the evidence of the positive effects on the host country while other scholars fail to find significant effects or even obtain negative effects from FDI in recipient economy. This part of the paper is used to analyse empirical research and to highlight most influential findings. The discussion of the literature is divided by classification of the countries: developed, developing and transition countries. It is not only easier to follow in such way grouped overview but also it can be observed whether the level of development of the country has any effects on the results attained. Table 4.1 is constructed to provide brief summary of the empirical studies analysed in this section.
4.1 Developed countries

One of the first attempts to investigate the effects of FDI on host economies was made by Caves (1974) and Globerman (1979) can be identified. Both researchers used industry level data and investigated Canada and Australia and Canada alone respectively. Caves analysed knowledge and technology spillovers and obtained positive results for Australia and, in contrast, negative but not significant results for Canada of spillover effects from FDI presence in the industry. On the other hand, Globerman found positive effects of FDI in case of Canada using industry level data for year 1972. Early research and use of industry level data are criticised due to unclear causal meaning of correlation. According to Haskel and Slaughter (2002) it may be that FDI increases productivity via spillovers or by forcing to leave less productive firms or by obtaining higher market share and increase productivity because on average are more productive.

The increased availability of firm level data during the last years has created possibility to use micro-level data when analysing FDI effects and overcome identified shortcomings arising from using industry level data. More recent study by Ruane and Udur (2002) has investigated spillover effects in Ireland manufacturing industry in years 1991-1998. Authors indicate that due to consistent promotion of FDI in manufacturing sector during last 40 years Ireland managed to attract substantial number of foreign direct investment. Moreover, policies fostering connections between MNEs and local companies as well as favouring labour turnover and imitation between companies were applied. However, despite all the promotion programmes no spillovers effects were identified and only after measurement adjustment weak, but still insignificant positive effects are found.

On the other hand, works by Keller and Yenalpe (2009) and Haskel and Slaughter (2002) which investigate productivity spillovers in United States and United Kingdom respectively using firm-level data, conclude that FDI leads to significant productivity gains for domestic firms from the presence of foreign companies in the industry. What is more, both papers indicate that the companies with lower productivity tend to benefit more from the FDI then more productive ones. Therefore, it is concluded that less developed countries, where higher number of less productive companies is present, should benefit from FDI to the higher extent.
In conclusion, while this overview of literature is far from being conclusive particular pattern that more researches support the existence of productivity spillovers in developed countries can be observed. It is likely that developed countries are more able to benefit from FDI due to the lower technology gap in this way easing the technology and knowledge transfer from MNEs to domestic firms.

4.2 Developing countries

The literature analysing productivity spillovers in developing countries has not reached consensus in the findings either. Highly influential work by Aitken and Harrison (1999) investigated spillover effects in Venezuela using plant level data. The research found that the foreign presence in the sectors has positive effects on the recipient firms but negatively affects domestic firms. Thus it was concluded that there is no evidence of spillovers from FDI to domestic firms. Negative effects are also obtained in the study by Hale and Long (2011) investigating Chinese manufacturing sector. As the main reasons for lack of spillovers of FDI in China institutional factors like lack of human capital in state owned companies and lack of capital in private owned companies are identified.

The study of Indian manufacturing sector by Iyers (2009) using firm level data provides mixed results. Author of the research investigates horizontal, forward and backward spillovers and obtains both positive and negative spillover effects depending on the industry leading to conclusion about the need for industry-specific policies, which should take into account particular strengths and weaknesses of each industry. To continue with, study by Suyanto and Bloch (2009) provides the evidence of positive spillover effects using panel firm-level data from Indonesian chemicals and pharmaceutical industry. What is more, research finds positive competition effect. Another important implication is that companies with R&D benefit more from FDI presence than those without. This supports idea that the companies with lower technological gap are able to benefit more from FDI existence in the sector.

In conclusion, the research regarding developing countries is far from conclusive. The effects highly depends on specific factors within countries and in some cases even industries.
4.3 Transition economies

Recently, more attention by researchers was brought to transition economies. The interesting aspect in the analysis of transition economies is that these countries had to overpass complex transition process in the early 90s and until then they were almost virtually closed to foreign direct investment. Thus, it should be noted that these countries had only moderate levels of FDI inflows during the early stages of transition. One of the earliest works regarding transition countries was done by Djankov and Hoekman (2000) using firm level data from Czech Republic. While this country is among the most successful countries in attracting substantial amounts of FDI among transition economies, the researchers found that FDI in fact has negative spillover effects on domestic firms and positive effects can be obtained only when all the companies - foreign and domestic - are included in the sample. Another study by Konings (2001) found negative spillover effects for domestic companies in Romania and Bulgaria as well as no spillover effects in Poland. Author indicated that competition effect outweighs positive spillover effects.

Interestingly, more recent study by Nicolini and Resmini (2010), based on the same countries only more recent years, has obtained quite different findings. There were positive spillover effects found in Romania and Bulgaria, but not spillover effects in Poland. The explanation for such findings could be that the technological gap in Poland is smaller than in other two countries and FDI generates negative competition effect instead of positive technology spillover effect. What is more, the authors come up with the differentiation which states that MNEs operating in low-tech manufacturing sectors generate intra-sectoral spillovers, while foreign firms operating in high-tech foreign firms generate inter-sectoral spillovers.

Evidence of positive spillover effect is also obtained by Schoors and Tol (2002) in their study of Hungary firm level data from 1997 to 1999. According to this study openness of the sector plays major role in ability to benefit from FDI. Another contribution to transition countries studies was made by Sinani (2004). Author investigated technology spillovers from FDI to domestic firms in case of Estonia using panel data sample from the years 1994-1999. Study indentified that the extent of spillover depends on the number of things like firm size, trade orientation, ownership structure to name a few. Also, the distinction was made among companies which benefit from the FDI presence. State and outsider owned firms experience positive spillover effects while insider owned companies are
affected negatively. Javorcik (2004) made thorough analysis of spillover effects using firm level panel data from Lithuania in years 1996-2000. Research focuses on spillovers across industries rather than within industries. The study states that through backward linkages the positive spillovers are generated, only from the partially owned firms due to the larger sourcing activities undertaken by such type of firms. Finally, evidence of intra-sectoral spillovers as well as spillovers through forward linkages was not found.

Table 4.1 Summary of empirical studies investigating spillovers from FDI

<table>
<thead>
<tr>
<th>Authors</th>
<th>Countries</th>
<th>Period</th>
<th>Aggregation level</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Developed countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- (NS)</td>
</tr>
<tr>
<td>2. Globerman (1979)</td>
<td>Canada</td>
<td>1972</td>
<td>Industry</td>
<td>+</td>
</tr>
<tr>
<td>2) Developing countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Transition economies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: own construction. Note: NS is abbreviation for Not Significant.

In conclusion, empirical literature provides diverse results from the research on FDI effects on the host economy. No generalisation is possible after categorising countries according
to their development level either. In all subcategories there are studies with evidence of positive, negative or no spillover effects. Various reasons can be identified in order to explain such ambiguity of the results. Findings can differ due to the different development of the host economies, different type of data used or different measures of foreign presence in the sector (Gorg and Strobl, 2000). Even countries in the same category like transition economies may have different level of capability to benefit from FDI due to different policies, industry development, and level of FDI in the country. Also, data sets and estimation issues play major role in results obtained.

5. Hypotheses

After overview of the theories and existing empirical literature this section provides hypotheses which will be tested in the analysis part. Research questions highlight particular aspects of interests within the field of FDI and productivity and what exactly should be analysed. Based on them and using theory as background hypotheses are formulated in order to emphasise analysis in particular direction. This is necessary due to the fact that FDI effects on productivity can be investigated from a lot of different perspectives. Based on the hypotheses most suitable estimation methods can be chosen. Two research questions are stated in the introduction part and each will be reflected in the hypotheses.

First research question specifies particular interest in investigating whether foreign owned firms are more productive than domestic firms. Theories provided above indicate that MNEs, due to comparative advantage, should be more productive than domestic firms. Therefore first Hypothesis can be formulated as:

**H1:** Foreign equity presence increases productivity of the recipient firms in six manufacturing sectors in Lithuania.

The second research question highlights the interest in investigating spillover effects on domestic firms from the presence of FDI in the sector. Particularly the horizontal spillovers are the interest of this study. Theoretical section specified various channels through which positive spillovers can be generated and in general domestic companies should benefit from existence of foreign firms in the sector unless the competition effect is dominating.
Although the empirical literature does not provide the unambiguous results (see to table 4.1) based on the theoretical arguments the second hypothesis is:

**H2:** There are positive productivity spillovers from FDI to domestic firms within six manufacturing sectors in Lithuania

### 6. Methodology

This part of the thesis presents the baseline for the analysis: the data and methods used in order to test the hypotheses, specified in previous section. Firstly, in the 6.1 section the dataset collection and construction issues will be introduced. Further on, 6.2 section will characterize the method of estimation, which will be used in the analysis part to obtain the results. Also, estimation issues will be identified and possible solutions will be offered and based on the final estimation model will be developed.

#### 6.1 Data description

Based on the research questions and hypotheses the particular dataset has to be constructed in order to perform the analysis. Data is obtained from Orbis database, which contains comprehensive financial and ownership information about the companies worldwide. Therefore, using this database unique firm level panel data sample can be constructed. As mentioned before the country of interest is Lithuania. Five years are chosen for investigation, more precisely it is period from 2006 to 2010. Such time period can be seen as sufficient for the analysis as most researchers choose it (see: table 4.1), mainly due to limited availability of data for longer periods. This particular period was chosen because these are the most recent available years and they possess the most comprehensive data, as for earlier or later years the data availability decreases considerably in the Orbis database for this country. Unbalanced panel data sample is constructed from the six manufacturing industries companies. When deciding on the structure of data sample the unbalanced sample was chosen in order to avoid survivorship bias (Greene, 2008). As if only companies which have data for all five years where selected, the ones which entered later or went bankrupt during selected 5 years period would be excluded from the dataset. In order to avoid such bias all the companies with at least one value of revenue and employment in five years period were included in the sample. When such sample was constructed, it was checked and companies with missing values were deleted.
Panel dataset can be defined as the set consisting of a time series for each member in the dataset (Wooldridge, 2009). This means that the same companies were observed during the five years period. According to Baltagi (2005), panel data sample can be seen as providing more informative data, more variability, less collinearity among the variables and more efficiency. From this follows that more informative data will produce more reliable parameter estimates.

In the following subsections the data selection and final dataset construction will be described in more detail.

### 6.1.1 Data selection

As mentioned above the financial and ownership data was obtained from Orbis and table 6.1 provides the steps undertaken in the database in order to obtain the sample of companies for the analysis. After performing first five steps the overall sample of companies meeting size requirements\(^4\) including information about their industry type, turnover and employment was obtained. Six industries were chosen in order to reduce sample size. All companies were classified by two digit major sectors and from 19 sectors 6 were chosen which contained 1653 companies. Furthermore, in order to distinguish foreign and domestic companies 6\(^{th}\) step (table 6.1) was specified.

Unfortunately, ownership information in Orbis was available only for year 2010. For other four years it was impossible to extract information directly. In order to obtain the ownership information for the earlier years the Zephyr and Orbis databases were used. The ownership information from Orbis was obtained by taking each company specified as foreign in 2010 and checking its ownership information during the selected period. If such information was unavailable, the Zephyr database was used. Here comprehensive information about deals related to companies’ acquisitions is provided. Therefore, the dates of deals related to foreign companies were investigated. If neither database could provide ownership information, the company was deleted from the sample due to missing data necessary for the analysis. Another issue regarding ownership data is that for domestic companies there was assumption made that their ownership have not changed during 5 years. This is done due to limitations of data attainability and the fact that disinvestment is

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\(^4\) Small companies where excluded. The companies were classified as small which meet such criteria: \(\leq 10\) employees or \(\leq 1000\) Euros operating turnover
not the interest of this study. The particular shares possessed by the foreign owners are not specified, therefore company is either domestic or foreign in the sample.

Table 6.1 Search strategy in Orbis database

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Search steps in Orbis</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>World region/Country/Region in country: Lithuania</td>
<td>Selecting country of interest: Lithuania</td>
</tr>
<tr>
<td>3.</td>
<td>Category of companies: Very large, Large and Medium sized companies</td>
<td>Step used to create size criteria in order to exclude small companies from the sample</td>
</tr>
<tr>
<td>4.</td>
<td>Operating revenue (Turnover): All companies with a known value, 2006-2010 for at least one of the selected periods</td>
<td>Specifying type of financial data needed. Revenues are expressed in Euros</td>
</tr>
<tr>
<td>5.</td>
<td>Number of employees: All companies with a known value, 2006-2010 for at least one of the selected periods</td>
<td>This step filters employment data</td>
</tr>
<tr>
<td>6.</td>
<td>Ultimate Owner or Shareh. (owning together 10%) located in another country (incl. shareh. with an unknown country)</td>
<td>Step used to differentiate between domestic and foreign owned companies.</td>
</tr>
</tbody>
</table>

Source: Own construction

When all the needed data was obtained several adjustments had to be made for the sample. Firstly, the turnovers obtained were in current prices and nominal turnover values reflected not only real increase but increases due to the price changes as well. In order to obtain comparable values over all years the turnovers were deflated using producer price index (PPI) obtained from the Statistics Lithuania database with the base year 2005. PPI values were obtained and applied for each particular industry.

Another issue, addressed by Frank and Goyal (2007) was to eliminate the outliers. Authors identify three common practices which can be applied in researches: rule of thumb truncations, removal of extreme values (0,5% of observations from both sides of distributions) and robust regressions. In this paper the second approach was applied and 0,5% of observations in each side of distribution were eliminated.
6.1.2 Final dataset

After checking the sample and deleting the companies with missing data as well as outliers, final dataset with 1149 companies was obtained. The number of companies varied from 1059 in 2006 to 1149 in 2010. There are 897 domestic companies and 252 foreign companies in 2010 in the sample, therefore foreign firms account for 22% of the overall sample. Both foreign and domestic companies have experienced steady growth in productivity levels until 2009, then the decline occurred in both categories due to global financial crisis. However, in the following year level of productivity has recovered and outperformed the pre-crisis levels. This indicates that there is year effect on productivity which should be taken into account when conducting analysis.

Table 6.2 Employment, output and labour productivity of sample companies

<table>
<thead>
<tr>
<th></th>
<th>Obs</th>
<th>Mean</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>5.604</td>
<td>112</td>
<td>173</td>
<td>1</td>
<td>2.707</td>
</tr>
<tr>
<td>Domestic</td>
<td>4.467</td>
<td>94</td>
<td>63</td>
<td>1</td>
<td>1.343</td>
</tr>
<tr>
<td>Foreign</td>
<td>1.137</td>
<td>182</td>
<td>88</td>
<td>2</td>
<td>2.707</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>5.588</td>
<td>5.868567</td>
<td>1.605269</td>
<td>1.594</td>
<td>414,000,000</td>
</tr>
<tr>
<td>Domestic</td>
<td>4.453</td>
<td>4.148151</td>
<td>1.267197</td>
<td>1.594</td>
<td>414,000,000</td>
</tr>
<tr>
<td>Foreign</td>
<td>1.135</td>
<td>12.618361</td>
<td>4.678088</td>
<td>6.323</td>
<td>172,000,000</td>
</tr>
<tr>
<td><strong>Labour productivity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>5.588</td>
<td>46.254</td>
<td>27.015</td>
<td>199</td>
<td>998,367</td>
</tr>
<tr>
<td>Domestic</td>
<td>4.453</td>
<td>38.557</td>
<td>23.873</td>
<td>199</td>
<td>998,367</td>
</tr>
<tr>
<td>Foreign</td>
<td>1.388</td>
<td>76.453</td>
<td>48.991</td>
<td>790</td>
<td>803,741</td>
</tr>
</tbody>
</table>

Source: Own computation from Orbis database. Note: Obs means observations; output expressed in Euros.

Table 6.2 provides information about the employment, output and labour productivity of all, domestic and foreign companies included in the final sample. From this table it can be seen that foreign companies on average hire more employees with the maximum value 2707, therefore these firms on average are larger than domestic companies. What is more, these firms possess higher mean output than domestic firms, although the maximum value can be found among domestic companies. Finally, the table provides results on productivity in line with assumption that foreign firms are more productive than domestic ones. There it can be seen that on average the foreign companies are almost twice more

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5 See Appendix 2 table A.2.1 for companies’ information during years 2006-2010.
productive than domestic ones. Despite this, the maximum productivity was achieved among the group of domestic firms.

Table 6.3 contains information, specified for each industry. The largest industry in the sample among six sectors is S6 with 321 companies while the smallest is S5 with 122 firms\textsuperscript{6}. The highest share of foreign companies is in S2 sector which is 30\%, while the lowest share of foreign companies is possessed by S1 16,9\%. When looking at the foreign presence in the industry and average productivity it is hard to notice any pattern. While S2 sector has the highest share of foreign companies, the productivity level is one of the lowest. On the other hand the highest productivity is achieved by S4 sector while it is only third by share of foreign firms. In conclusion, descriptive statistics do not provide support that the foreign presence can be associated with higher productivity in the industry.

Table 6.3 Number of firms, employment, output and productivity data for six industries

<table>
<thead>
<tr>
<th>Sector</th>
<th>No. of Domestic firms</th>
<th>No. of Foreign firms</th>
<th>Share of foreign firms in sector</th>
<th>Mean Employment</th>
<th>Mean Output</th>
<th>Mean Labour productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>206</td>
<td>42</td>
<td>16,94%</td>
<td>145</td>
<td>9.295.723</td>
<td>49.734</td>
</tr>
<tr>
<td>S2</td>
<td>93</td>
<td>39</td>
<td>29,55%</td>
<td>134</td>
<td>3.356.873</td>
<td>35.811</td>
</tr>
<tr>
<td>S3</td>
<td>136</td>
<td>28</td>
<td>17,07%</td>
<td>75</td>
<td>3.673.040</td>
<td>42.609</td>
</tr>
<tr>
<td>S4</td>
<td>122</td>
<td>40</td>
<td>24,69%</td>
<td>99</td>
<td>8.190.038</td>
<td>63.063</td>
</tr>
<tr>
<td>S5</td>
<td>101</td>
<td>21</td>
<td>17,21%</td>
<td>73</td>
<td>2.869.141</td>
<td>33.682</td>
</tr>
<tr>
<td>S6</td>
<td>239</td>
<td>82</td>
<td>25,55%</td>
<td>118</td>
<td>5.326.124</td>
<td>46.118</td>
</tr>
</tbody>
</table>

Source: own computation using dataset from Orbis. Output is in Euros.

Several limitations should be noted in this dataset. Firstly, although labour productivity is widely applied in empirical research (Syverson, 2011) due to its assumption that all other factors are constant it does not reflect the effects of other inputs like capital. Therefore, multifactor productivity measures are more preferred by researchers. However, due to data limitations in this paper labour productivity measure is applied, because increasing the number of inputs would considerably decrease the number of observations. Also, another limitation is related to output measurement. As it is difficult to obtain the information about the particular level of outputs each plant produces, instead the revenues of a firms are used as it is standard approach when such limitation occurs (Ibid). Having these limitations mentioned and taken into account when making analysis, this dataset is seen as appropriate for the analysis.

\textsuperscript{6} See Appendix 2 table A.2.2 for abbreviations of industry names.
6.2 Estimation methods

In order to test the hypotheses presented, empirical model has to be developed and examined. What is more, empirical research has addressed number of issues arising from panel data usage in the analysis. These issues have to be taken into account when estimating final model.

6.2.1 Baseline model

In order to obtain solid results from analysis reliable and robust model has to be developed. The baseline model for this thesis is based on the Aitken and Harrison (1999) offered log-linear production function estimated at the plant level. Several adjustments to the original model are made in order to adapt it to the current dataset specifications. Firstly, the dependent variable is labour productivity not output, therefore inputs variable is excluded from the regression. The advantage of this model is that both hypotheses about direct and spillover effects can be tested in the same equation. It can be specified as:

\[
Y/L_{ijt} = C + \beta_1 * FDI_{Plant} + \beta_2 * FDI_{Sector} + \beta_3 * FDI_{Plant} * FDI_{Sector} + \\
+ \beta_4 * Time + \beta_5 * Sector + \epsilon_{ijt}
\]  

(1)

There \( Y/L \) is output divided by employment, thus labour productivity in the \( i \) firm, which is in \( j \) sector at a \( t \) year. \( FDI_{Plant} \) is a dummy variable which defines the ownership of a company, 1 being foreign company and 0 being domestic company. This variable is available directly from the constructed dataset and if this variable obtains positive coefficient it shows that foreign ownership increases productivity of the recipient firm. \( FDI_{Sector} \) is variable which measures the FDI in the industry. This variable has a positive coefficient if presence of FDI in the sector increases firms’ productivity in that sector. In order to obtain this measure some further calculations have to be made. Based on Aitken and Harrison (1999) definition \( FDI_{Sector} \) is foreign equity participation averaged over all firms in that sector and weighted by each firms’ share in sectoral employment. Alternatively this measure can be calculated by weighting it by the output of the foreign firms like in estimation by Javorcik (2004) but in this paper was chosen to follow the method applied by Aitken and Harrison (1999) and alternative method will be applied as a robustness check. At sectoral level foreign investment can be calculated using formula:
Another variable specified in equation $FDI_{Plant} * FDI_{Sector}$ is used to identify if the effects of foreign presence in the sector differs for domestic firms and foreign owned companies. This variable is obtained by multiplying foreign share in plant level and foreign share in sector level. The negative coefficient for this variable is obtained if foreign companies are negatively affected by the presence of other foreign companies. Finally, time and industry dummy variables as well as error term $\epsilon$ are introduced in equation order to control for unobservables that may drive the changes in, for example attractiveness of particular industry (Javorcik, 2004).

### 6.2.2 Estimation issues

There are several econometric issues related to panel estimation, which should be noted before applying model in the analysis part. According to Sinani (2004) these problems may result in biased and insufficient estimates and can be characterised as: heteroskedasticity, omitted variables bias, sample self-selection bias and endogeneity. These issues will be presented in the following subsections in greater detail and possible solutions for these problems will be discussed.

**Heteroskedasticity**

Heteroskedasticity may arise from the different firm and industry characteristics (Sinani, 2004). Therefore, when the regressions are performed on the micro units, but aggregated data (industry level variables) is also included this may result in underestimated standard errors when applying ordinary least squares (OLS) method and as addressed by Moulton (see: Javorcik, 2004) this may lead to downward bias of estimated errors resulting in inaccurate findings of statistical significance for the aggregate variable of interest. Since in this study the firm level as well as industry level variables are used it is necessary to note this issue. There are several methods identified which help to overcome this possible bias. Sinani (2004) applies Generalised Least Squares (GLS) method, Javorcik (2004) uses clustered standard errors and Wooldridge (2009) proposes Weighted Least Squares (WLS) estimation or heteroskedasticity-robust standard errors (usually referred robust standard errors) attributed to White (1980).
Omitted variable bias

Omitted variable bias can occur due to correlation between firm productivity and foreign presence that is affected by firm, time or industry specific factors which may be known to the firm, but not to the researcher, therefore not observed or cannot be measured and included in the regression (Javorcik, 2004). For example, industry may experience productivity shocks which increase both sales growth in domestic firms and FDI inflows. In such case the positive relationship can be observed between productivity and FDI but it is not generated by spillover effects but rather by some outside factors. In order to account for such bias Sinani (2004) includes into estimation time and industry dummies. What is more, Haskel and Pereira (2002) avoid this bias by using first-differencing method. It is already discussed that in baseline model (1) these dummies are included in order to avoid such bias.

Selection bias

Sample self-selection bias may arise if the dependent variable is not observed for all firms over entire period. This can be due to the bankruptcy, merger or missing data (Sinani, 2004). It is clearly the case when using unbalanced data sample as it is almost impossible to produce a sample where all the values would be present unless the balanced sample is chosen by deleting the companies with missing data, but this would lead even higher bias due to the fact that only most productive companies are included in the sample. While Sinani (2004) has applied Heckman two-step procedure in order to control for this bias, the author is aware that only few researchers have applied these techniques and have chosen not to correct for selection bias due to dataset constraints and leave this issue to the research in the future.

Endogeneity

According to Sinani (2004) two sources of endogeneity can be identified. Firstly, reverse causality can be an issue when investigating productivity and FDI due to the fact that the foreign firms may invest to the more productive industries and firms. Therefore, this is defined as reverse causality due to the fact that not only FDI can generate productivity increases, but higher productivity might as well generate increase in FDI levels. The bias will occur and the coefficient of FDI variable will not reflect the net effect of FDI on productivity. In order to control for reverse causality the first-differencing method can be
applied (Konings, 2000; Aitken and Harrison, 1999) as well as lagged values (Haskel and Pereira, 2000). Second, the firms choose their inputs based on their productivity, which in turn is affected by these inputs. Not taking into account input endogeneity may lead to biased results (Javorcik, 2004). This being said, the input endogeneity issue is not addressed in this analysis, as approaches to address this problem like offered by Olley and Pakes require much more sophisticated data than used in this paper.

### 6.2.3 Final model characteristics

Previous section provided particular estimation issues which have been identified by most researchers in their empirical work as well as particular solutions for these problems. In order to obtain reliable results these issues should be taken into consideration when constructing the final model.

The main estimation method in the analysis part was chosen first-differencing model due to its ability to solve multiple estimation issues when applying OLS. When panel data is used, unobserved factors, which affect dependent variable, can be classified into two types: those that are constant over time and those that vary over time. In theory the model with single observed explanatory variable and with time constant unobserved factors reflecting variable \( a_i \) and error \( u_{it} \), which represents unobserved factors, which change over time is written as follows:

\[
y_{it} = \beta_0 + \delta_0 d_{2t} + \beta_1 x_{it} + a_i + u_{it}
\]

Where \( y \) denotes dependent variable, \( i \) is cross-sectional unit, \( t \) is time period, \( x \) is independent variable and \( d_2 \) is time dummy (Wooldridge, 2009). First-differenced equation can be obtained in order to differentiate away the unobserved time fixed effects in the following way (Ibid):

\[
(y_{i2} - y_{i1}) = \delta_0 + \beta_1 (x_{i2} - x_{i1}) + (a_{i2} - a_{i1}) + (u_{i2} - u_{i1})
\]

This will result in such equation:

\[
\Delta y_i = \delta_0 + \beta_1 \Delta x_i + \Delta u_i
\]

Such equation is just like single cross-sectional equation but each variable is differenced over time (Wooldridge, 2009).
Based on this theoretical elaboration the previously presented equation (1) can be differenced over time and, as mentioned in previous section, such method allows to get rid of omitted variable bias as well as reverse causality. Such effects like unobserved firm fixed effects as well as the reverse relationship between productivity and FDI, which may bias the results, are excluded. What is more, time and sector dummies allow controlling for time and sector unobserved effects. Therefore, more precise results can be obtained, when the equation is regressed.

Final model can be specified as:

$$\Delta Y/L_{ijt} = C + \beta_1 \Delta FDI_{Plant_{ijt}} + \beta_2 \Delta FDI_{Sector_{ijt}} +$$

$$+ \beta_3 \Delta (FDI_{Plant_{ijt}} \ast FDI_{Sector_{ijt}}) +$$

$$+ \beta_4 \text{Time}_t + \beta_5 \text{Sector}_j + \epsilon_{ijt} \quad (2)$$

In order to account heteroskedasticity, another issue mentioned above, heteroskedasticity-robust standard errors instead of standard errors are applied in order to control for within group disturbance, due to the fact that the firm level and industry level values are used in estimation. According to Wooldridge (2009) the use of robust standard errors are justified when the sample size is big, which is the case in this research. It is common to apply the robust standard errors on the big sample without checking for heteroskedasticity (Ibid), therefore no test for heteroskedasticity prior to applying this method will be taken in this analysis either.

In order to test the validity of the findings several robustness checks are undertaken. This is done by differentiating between model specification and estimation techniques, like using different calculation technique for variable, including additional variable in equation and applying different estimation techniques.

In conclusion, this section provided thorough presentation of data selection and final dataset construction procedure and methods, which will be applied in the analysis part in order to test particular hypotheses. Also, several estimation issues are highlighted and possible solutions for them are discussed and where possible these are corrected in the final estimation model. In order to overcome the estimation issues related to panel data first-differencing method will be applied as well as some other adjustments. Results of estimation are presented in the following section.
7. Analysis

This section is the core of the paper and presents the empirical analysis, which investigates how FDI affects productivity of the firms. Firstly, the rough estimates will be calculated using OLS method and results will be presented to get overall idea of the potential effects of FDI on domestic firms. Further on, the next section will present the main method of analysis – the (2) equation will be regressed using first and second differencing. Obtained results will be the basis for hypotheses testing and making conclusions. In order to check, whether it can be summarised that the findings are valid, several robustness checks will be performed.

7.1 Primary estimations

In order to provide general overview of possible effects from FDI on labour productivity of the firms, the equation (1) is estimated using OLS method with different model specifications. Table 7.1 provides results from these estimations. Different included variables and sample size provides better insight how particular specifications may influence obtained results. First column is calculated without industry dummies, third column is estimated including only domestic companies into the sample and the second column is estimation for the whole sample with time and industry dummies. As mentioned in the methodology all three columns were calculated using robust standard errors in order to correct for heteroskedasticity. $R^2$ is relatively low compared to the ones obtained in empirical researches, but this can be explained by the fact that this model does not include input variables and thus much smaller values are obtained. $R^2$ notably increases when in the model industry dummy variables are included (see columns 1 and 2).

When looking at the results of the columns 1 and 2 in the table 7.1 it can be seen that the positive effects on the FDI_Plant are large and statistically significant indicating that foreign ownership within the company can be associated with the increase in labour productivity. On the other hand, there is no evidence that domestic firms or other foreign firms benefit from the presence of foreign firms in the sector. Both values for FDI_sector and FDI_Plant*FDI_Sector are insignificant and while in first column they are positive in second column both variables obtain negative values (still insignificant). As noted by Aitken and Harrison (1999) such difference obtained when including industry dummy is important to observe as it indicates that failing to control for the fact that FDI is attracted to
more productive sectors may lead to positive spillover effects where they actually do not exist. To continue with, results of no spillover effect to domestic firms do not change much when model is estimated using sample including only domestic companies. The value for sector variable is still negative and insignificant indicating that there is no effect on domestic firms from foreign presence. While, based on this model first hypothesis holds as there is significant impact on productivity of recipient firms, the second hypothesis should be rejected as there is no significant evidence of productivity spillovers to domestic firms.

Table 7.1 Impact of foreign ownership on labour productivity

<table>
<thead>
<tr>
<th></th>
<th>OLS without industry dummies</th>
<th>OLS with industry dummies</th>
<th>OLS for domestic firms only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>FDI_Plant</td>
<td>0,653***</td>
<td>0,689***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0,072)</td>
<td>(0,068)</td>
<td></td>
</tr>
<tr>
<td>FDI_Sector</td>
<td>0,021</td>
<td>-0,004</td>
<td>-0,005</td>
</tr>
<tr>
<td></td>
<td>(0,034)</td>
<td>(0,024)</td>
<td>(0,219)</td>
</tr>
<tr>
<td>FDI_Plant*FDI_sector</td>
<td>0,012</td>
<td>-0,016</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0,092)</td>
<td>(0,091)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>10,053***</td>
<td>10,134***</td>
<td>10,073***</td>
</tr>
<tr>
<td></td>
<td>(0,031)</td>
<td>(0,054)</td>
<td>(0,057)</td>
</tr>
<tr>
<td>Time dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry dummies</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R²</td>
<td>0,089</td>
<td>0,136</td>
<td>0,072</td>
</tr>
<tr>
<td>Number of firms</td>
<td>1149</td>
<td>1149</td>
<td>929</td>
</tr>
<tr>
<td>Number of observations</td>
<td>5588</td>
<td>5588</td>
<td>4453</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors are presented in parentheses. Dependent variable is log firm labour productivity regressed using FDI_Plant, FDI_Sector, FDI_Plant*FDI_Sector, time and industry dummies, unless otherwise is stated.

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

This paper’s estimation model was based on the one used by Aitken and Harrison (1999) in their research of Venezuela’s plants therefore it is reasonable to use this paper as a benchmark for comparison in order to put the results in broader perspective. When comparing OLS estimation results it can be seen that here obtained significant positive results for FDI_plant variable are in line with the findings in their research. However, Aitken and Harrison (1999) obtain significant negative results for domestic firms, while here negative values are not significant. Javorcik (2004) analysed Lithuania’s
manufacturing sector thus it is interesting to compare results obtained in this research although it used quite differenced estimation technique as backward and forward linkages were included in the equation. This research obtained positive and significant results from OLS estimation for foreign owned firms and domestic firms. What is more, Javorcik (2004) also calculated lagged values for OLS estimation in order to see whether extent of the spillover effect changes if there is time effect as spillovers may need some time to manifest themselves. She found that lagged values reduced the significance of horizontal spillover effect for domestic and all firms’ samples. In order to see if it is the case in this analysis as well as to account for possible reverse causality issue lagged values have been estimated and obtained values are presented in table 7.2.

Table 7.2 Impact of foreign ownership on labour productivity estimated with OLS with lagged values

<table>
<thead>
<tr>
<th></th>
<th>OLS lagged by -1</th>
<th>OLS lagged by -2</th>
<th>OLS lagged by -3</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI_Plant lagged</td>
<td>0.647***</td>
<td>0.634***</td>
<td>0.667***</td>
</tr>
<tr>
<td></td>
<td>(0.068)</td>
<td>(0.073)</td>
<td>(0.079)</td>
</tr>
<tr>
<td>FDI_Sector lagged</td>
<td>-0.004</td>
<td>-0.028*</td>
<td>-0.029</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.022)</td>
<td>(0.029)</td>
</tr>
<tr>
<td>FDI_Plant*FDI_sector lagged</td>
<td>0.113</td>
<td>0.186*</td>
<td>0.152</td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td>(0.099)</td>
<td>(0.115)</td>
</tr>
<tr>
<td>Intercept</td>
<td>10.261***</td>
<td>10.331***</td>
<td>10.198***</td>
</tr>
<tr>
<td></td>
<td>(0.056)</td>
<td>(0.057)</td>
<td>(0.058)</td>
</tr>
<tr>
<td>Time dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R²</td>
<td>0.15</td>
<td>0.15</td>
<td>0.16</td>
</tr>
<tr>
<td>Number of firms</td>
<td>1145</td>
<td>1125</td>
<td>1110</td>
</tr>
<tr>
<td>Number of observations</td>
<td>4440</td>
<td>3295</td>
<td>2170</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors are presented in parentheses. Dependent variable is log firm labour productivity regressed using FDI_Plant, FDI_Sector, FDI_Plant*FDI_Sector, time and industry dummy variables.

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

There are no significant changes in the results when values are lagged by one period as indicated in column 1. When values are lagged by two periods the results indicate that there is weakly significant negative effect on domestic firms and positive effects on other foreign companies in the industry. Such results suggest that when foreign share in the sector increase by 10 percent the productivity would decrease by 2.8% for domestic
companies and would increase by 1.9% for other foreign companies in the industry. Nevertheless, the significance disappears when values are lagged by 3 periods for both variables. Although, it can be expected that if productivity spillovers are not present in contemporaneous values, should appear after some time, here results from the estimation using lagged values do not support such idea. What is more, there is little change in the magnitude of foreign firms’ variable FDI_Plant as in all three columns it is significant at 1 percent level and possesses large values indicating that 10 percent increase in foreign equity within the company would result in around 6 percent increase in productivity.

7.2 Final model estimation

In order to test the hypotheses developed in the fifth section, final model is estimated using equation 2 from methodology part. This equation is estimated by transforming data into first differences in this way controlling for fixed effects at the company level. In order to check for the robustness of the findings second differences are also calculated. Both columns are estimated with robust standard errors. Results from these estimations are presented in table 7.3. OLS estimation is presented in the first column in order to be able to compare and observe differences if any.

<p>| Table 7.3 FDI impact on labour productivity estimated in first and second differences |
|---------------------------------|-----------------|-------------------|</p>
<table>
<thead>
<tr>
<th>OLS</th>
<th>First differences</th>
<th>Second differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI_Plant</td>
<td>0.689***</td>
<td>0.116</td>
</tr>
<tr>
<td></td>
<td>(0.068)</td>
<td>(0.148)</td>
</tr>
<tr>
<td>FDI_Sector</td>
<td>-0.004</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>FDI_Plant*FDI_sector</td>
<td>-0.016</td>
<td>-0.061*</td>
</tr>
<tr>
<td></td>
<td>(0.091)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Intercept</td>
<td>10.134***</td>
<td>0.115***</td>
</tr>
<tr>
<td></td>
<td>(0.054)</td>
<td>(0.018)</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors are presented in parentheses. Dependent variable is log firm labour productivity regressed using FDI_Plant, FDI_Sector, FDI_Plant*FDI_Sector, time and industry dummy variables.

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level
Column 2 in the table presents the results of first differencing estimation. The most visible change in results compared to the ones obtained in 1 column is that FDI_Plant variable now has much smaller value and is not significant any more. This can be explained by the earlier referred endogeneity bias which arises from the fact that foreign companies tend to invest into more productive companies. Thus, such apparent shift in obtained results confirms the reverse causality existence, which states that the FDI does not necessarily increase productivity of recipient companies, but positive effects may arise due to “cherry-picking” nature of FDI. Foreign companies tend to choose most productive enterprises (Hale and Long, 2011) and therefore there is need to control for such bias. Second differencing also possesses insignificant value for foreign share variable supporting lack of positive effects from foreign ownership. Such findings are in line with the results obtained by Aitken and Harrison (1999) and Javorcik (2004) as in both researches, after applying first and second differencing methods, the significance of variable defining foreign ownership disappears. Both studies support the idea that foreign firms may be investing in the most productive companies.

Recall the first hypothesis:

**H1:** Foreign equity presence increases productivity of the recipient firms in six manufacturing sectors in Lithuania.

Results from the table 7.3, which contains insignificant values for the variable FDI_Plant indicates that there is no evidence of the positive effects of the foreign ownership to recipient companies. Therefore, null hypothesis that there is no difference among foreign owned and domestic companies cannot be rejected and H1, which states that foreign equity presence does increase the productivity of recipient firms in Lithuania’s six manufacturing industries cannot be accepted.

To continue with, FDI_sector variable after first differencing obtains positive value, but is still statistically insignificant. After second differencing, the value is even lower and also insignificant. Moreover, there is no evidence of positive spillovers from the OLS estimation either. Possible explanation for the lacking intra-industry spillover effects can be large technological gap between foreign and domestic firms, low labour turnover, moderate levels of FDI in the country (recall from table 2.3 that Lithuania is only 9th between 13 transition countries based on FDI per capita) or possibly negative competition
effect outweighs positive spillover effects. Aitken and Harrison (1999) obtain significant negative effects on domestic firms from presence of FDI. What is more, the magnitude of negative effects does not fall but rise over time. Such difference in the findings can be explained by difference of development level of analysed countries (Venezuela and Lithuania) as well as different data samples and measurement techniques as Aitken and Harrison (1999) use plant level data and total factor productivity while in this paper firm level data and labour productivity is used. On the other hand, Javorcik (2004) also obtains insignificant results for horizontal spillovers after regressing equation with first and second differences.

Recall second hypothesis:

**H2:** There are positive productivity spillovers from FDI to domestic firms within six manufacturing sectors in Lithuania.

After examination of the results in table 7.3 it can be stated that the null hypothesis cannot be rejected. There is no evidence that positive productivity spillovers exist from FDI to domestic firms within six manufacturing sectors in Lithuania. All estimations have obtained insignificant values for the variable the FDI_Sector. Thus the H2 hypothesis is rejected.

Additionally, table 7.3 also indicates results for interaction variable which indicates the effects of FDI on other foreign firms in the industry. Interestingly this variable possess significant at 10 percent level negative value indicating that other MNEs are affected negatively by presence of foreign counterparts. Such result should be treated with caution as the significance is quite weak and it disappears when second differencing is estimated. This quite differs from the findings by Aitken and Harrison (1999) as they obtain positive and significant effects for other foreign companies. Possible explanation for such effect could be that negative effects are obtained due to negative competition effect as foreign companies may be quite similar, thus there is lack of spillover effect among them.

### 7.3 Robustness checks

Previous section provided results from the main model estimation and in order to test their validity several robustness checks will be applied by using alternative model estimations. Firstly, the alternative weight will be applied for the variable FDI_sector to measure
foreign share in the industry, also different measurement techniques will be applied to account for heteroskedasticity and finally additional variable will be included in the model to test its explanatory magnitude.

7.3.1 Alternative variable estimation

There are several ways in which the variable FDI_Sector can be calculated. The method used in the main model was based on the one used by Aitken and Harrison (1999). It was noted that using for example capital would lead to the much higher foreign share as MNEs tend to be more capital intensive. As foreign companies have much higher average output levels it can be expected that the same results would be as when using capital. Nevertheless, such alternative measure is good way to test the validity of the results. Thus, FDI_Sector variable was calculated using output instead of employment. The formula can be simply rewritten as:

$$FS_{jt} = \frac{\sum_i FSI_{ijt} \times Output_{ijt}}{\sum_i Output_{ijt}}$$

Table 7.4 presents results after applying this measure for foreign presence in the industry. The results are estimated using OLS, first and second differences and robust standard errors. The first column of OLS estimation results do not contain many significant differences from the ones, obtained by using employment as measure. Here FDI_Plant variable is insignificant and has much lower value, while sector and interaction variables possess quite similar values. Interestingly, the first differences estimation has opposite value for FDI_Plant*FDI_Sector variable as in previous estimation it was significant and negative while here it is significant and positive. However, significance is weak and after estimating model in second differences like in the first case the significance is not present any more. Also, sector variable possesses higher value nevertheless is still insignificant. Second differences do not have any significant changes comparing with the primary model.

In conclusion, alternative estimation technique may be the reason for different observed values at some extent and in this case the values of interaction variable possesses weak difference. Thus its results should be treated with some level of caution. Also, such estimation has decreased the value of foreign share variable and it become not significant. In all other cases there is no significant changes compared with the original model.
Table 7.4 FDI impact on productivity measuring sector variable by output

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>First Differences</th>
<th>Second differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>FDI_Plant</td>
<td>0.26</td>
<td>-0.298</td>
<td>-0.463</td>
</tr>
<tr>
<td></td>
<td>(0.281)</td>
<td>(0.239)</td>
<td>(0.283)</td>
</tr>
<tr>
<td>FDI_Sector</td>
<td>-0.407</td>
<td>0.288</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td>(0.259)</td>
<td>(0.354)</td>
<td>(0.389)</td>
</tr>
<tr>
<td>FDI_Plant*FDI_sector</td>
<td>0.943</td>
<td>0.861*</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>(0.636)</td>
<td>(0.471)</td>
<td>(0.631)</td>
</tr>
<tr>
<td>Intercept</td>
<td>10.319***</td>
<td>0.132***</td>
<td>-0.094***</td>
</tr>
<tr>
<td></td>
<td>(0.129)</td>
<td>(0.021)</td>
<td>(0.028)</td>
</tr>
</tbody>
</table>

Time dummies: Yes | Yes | Yes
Industry dummies: Yes | Yes | Yes
R²: 0.13 | 0.054 | 0.07
Number of firms: 1149 | 1145 | 1125
Number of observations: 5588 | 4439 | 3294

Notes: Robust standard errors are presented in parentheses. Dependent variable is log firm labour productivity regressed using FDI_Plant, FDI_Sector, FDI_Plant*FDI_Sector, time and industry dummies. FDI_Sector is calculated using output as weight for foreign presence in the industry instead of employment.

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

7.3.2 Error measurement

There are several different methods to control for heteroskedasticity and in methodology part the particular choice for this estimation was explained. In order to validate the results obtained with chosen technique two others, offered in literature, are used to estimate the equations: clustered standard errors (Javorcik, 2004) and weighted least squares (Wooldridge, 2009). Table 7.5 contains the results from different estimation techniques. First and third columns reproduce first differences and OLS with robust standard errors to provide the baseline for comparisons. Second column provides first differences estimation using clustered standard errors. There are no significant differences between two columns. Error terms contain different values, but none has changed as much that would generate different significance levels. What is more, third column contains results from weighted least squares estimation, where the weight is logarithm of employment. In this way the higher weight is given for the companies with higher employment. Thus, if there would be differences between smaller and bigger companies, different results should be obtained. There is no significant differences between the OLS and WLS estimations as well as
between columns 1 and 2, therefore it can be concluded that estimates with robust standard errors produce valid results.

### Table 7.5 Impact of FDI on productivity: different error measurements

<table>
<thead>
<tr>
<th></th>
<th>First differences with robust s. e.</th>
<th>First differences with clustered s. e.</th>
<th>OLS</th>
<th>Weighted least squares weight= log(emp)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>FDI_Plant</td>
<td>0.116</td>
<td>0.116</td>
<td>0.689***</td>
<td>0.62***</td>
</tr>
<tr>
<td></td>
<td>(0.148)</td>
<td>(0.085)</td>
<td>(0.068)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>FDI_Sector</td>
<td>0.011</td>
<td>0.011</td>
<td>-0.004</td>
<td>-0.014</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.015)</td>
<td>(0.024)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>FDI_Plant*FDI_sector</td>
<td>-0.061*</td>
<td>-0.061*</td>
<td>-0.016</td>
<td>-0.028</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.056)</td>
<td>(0.091)</td>
<td>(0.077)</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.115***</td>
<td>0.015***</td>
<td>10.134***</td>
<td>10.283***</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.035)</td>
<td>(0.054)</td>
<td>(0.036)</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors are presented in parentheses unless otherwise is stated. Dependent variable is log firm labour productivity regressed using FDI_Plant, FDI_Sector, FDI_Plant*FDI_Sector, time and industry dummy variables.

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

#### 7.3.3 HI variable

Another way to check the strength of the estimated model is to add another variable and see how this changes the results obtained. It was chosen use Herfindahl index (HI) to measure the level of industry competition. Such variable was used by Javorcik (2004) as well as Sinani (2004) but later has further differentiated between domestic and foreign companies concentration. Here Javorcik (2004) method will be followed as this paper is more interesting to compare to due to the same country of analysis.

HI is calculated by summing the squared market shares of four largest producers in a given sector and its value may range from 0 to 10.000 (Javorcik, 2004). This measure is the same for each company in an industry in a given year, but it varies among industries and among
years. It measures how the change in the industry concentration changes the productivity of the firms.

Table 7.6 Impact of FDI on productivity when HI index included

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>First Differences</th>
<th>Second Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>FDI_Plant</td>
<td>0.69***</td>
<td>0.121</td>
<td>-0.052</td>
</tr>
<tr>
<td></td>
<td>(0.068)</td>
<td>(0.148)</td>
<td>(0.071)</td>
</tr>
<tr>
<td>FDI_Sector</td>
<td>-0.001</td>
<td>0.014</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.019)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>FDI_Plant*FDI_sector</td>
<td>-0.016</td>
<td>-0.061</td>
<td>-0.059</td>
</tr>
<tr>
<td></td>
<td>(0.091)</td>
<td>(0.041)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>HI</td>
<td>-0.143***</td>
<td>-0.073***</td>
<td>-0.062**</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.028)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Intercept</td>
<td>11.056***</td>
<td>0.099***</td>
<td>-0.073***</td>
</tr>
<tr>
<td></td>
<td>(0.206)</td>
<td>(0.019)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>Time dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.137</td>
<td>0.073</td>
<td>0.074</td>
</tr>
<tr>
<td>Number of firms</td>
<td>1149</td>
<td>1145</td>
<td>1125</td>
</tr>
<tr>
<td>Number of observations</td>
<td>5588</td>
<td>4439</td>
<td>3294</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors are presented in parentheses. Dependent variable is log firm labour productivity regressed using FDI_Plant, FDI_Sector, FDI_Plant*FDI_Sector, time and industry dummy variables.

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

Table 7.6 presents the results from estimations when Herfindahl Index (in table HI) is included into the equation. Results from estimations using OLS, first and second differencing methods are presented. In the first column it can be seen that no significant changes were obtained. The negative effect from FDI for FDI_Sector variable has decreased from -0.004 to -0.001, but result remained insignificant. In the second column, where first differencing findings are presented, changes are minor as well. Sector variable obtained higher value by 0.003, but no significant changes have occurred. This is the case in second differencing results as well.

What is more, all three columns contain significant negative value for HI variable. This indicates that the companies are affected negatively as increased competition in the industry lowers productivity of these firms. This can be explained by the fact that this variable captures negative competition effects as increased competition decreases the
output of the companies and they are not able to exploit economies of scales at the full extent. These results differ from the ones obtained by Javorcik (2004) as she obtained insignificant results for HI variable. Author refers to Nickell (1996) which indicates that the ambiguous results for competition effect are predicted by theoretical literature, therefore HI index may contain either value.

In conclusion, the HI index inclusion in the model does not differ significantly from the results obtained by estimating main model. Nevertheless, this index provides useful insight on the competition effect and in this case negative effects from increased competition are obtained.

7.4 Discussion and summary of results

Analysis part presented the results from empirical model estimation which was used to test the hypotheses. What is more, robustness checks were conducted in order to test the validity obtained by the constructed model. What is more, the findings obtained in the analysis part were compared to the two papers which influenced the methods chosen for this analysis. In general it can be stated that robustness checks have mainly not obtained different results from the ones presented in the main analysis part. Thus, results and conclusions drawn from them can be perceived as valid and acceptable. Based on the results provided in the table 7.4 both hypotheses were rejected and concluded that there is no evidence of positive spillover effects in case of foreign equity participation in the company as well as in the industry. Insignificant results were obtained for foreign share variable as well as for sector variable indicating in spillover effects. Moreover, variable indicating foreign presence effects on other foreign firms in the industry possessed negative value. Therefore, it can be concluded that the large foreign share in the industry lowers the productivity of other MNEs. This could be explained by more severe competition between foreign companies with each other. However, it should be noted that such effect has low significance and disappeared when the second differences were applied. Comparison of results with the ones obtained by Aitken and Harrison (1999) and Javorcik (2004) provided interesting insights. Although, it should be noted, that no particular conclusions can be brought from these comparisons due to different dataset characteristics and particular methods of analysis and they should be seen as illustrative to give the broader view of the topic. What is more, it should be mentioned that when evaluating the results obtained, several limitations should be taken into account. Due to
limitations of the data only labour was used as an input to calculate productivity, small companies were excluded from the sample and particular six industries were chosen for the analysis. Nevertheless, despite these limitations it is believed that results obtained are valid and bring particular understanding to the topic.

8. Conclusion

FDI impact on the host economy has received a lot of attention by researchers lately. Liberalisation of the FDI related policies over past decades induced the question, whether countries benefit from FDI. Interestingly, while theoretical argument favours FDI, empirical research within this field has not reached the consensus in their findings. While it can be argued that different findings are reached due to the different methodological techniques applied. Though, most of recent research analysed firm level panel data but diversity of results has not reduced. Such ambiguity in the findings suggests that more research is needed in order to generalise the impact of FDI on host economy.

This thesis is an attempt to contribute to the recent literature by analysing the impact of FDI on the Lithuanian firms in manufacturing sector. The effects of FDI on companies can be divided into direct and indirect effects and thus two research questions were developed in order to address each effect. Based on these research questions and theoretical elaboration two hypotheses were defined to provide clear direction for analysis part. In order to test these hypotheses and provide reliable results, estimation issues were discussed and particular methods were chosen to overcome these problems highlighted by previous research.

Despite the fact that theory suggested that FDI presence should bring positive effects which also were hypothesised, the empirical analysis part produced quite different findings. No evidence of spillover effects were found neither through direct nor indirect channels. Although companies with foreign share contained much higher average productivity levels and primary model estimation also supported that they are more productive than domestic companies, after controlling for reverse causality bias, such positive effects disappeared and became insignificant. Same results were obtained by Aitken and Harrison (1999) and Javorcik (2004). Possible explanation for such contradictory results could be that the foreign affiliates tend to choose the most productive companies. Thus, the hypothesis that the foreign ownership increases productivity of the
firms was rejected and the answer for the first research question is that there is no evidence that foreign presence in the company can be associated with higher productivity as it is likely, that company was already more productive before it was acquired.

In order to answer second research question the existence of productivity spillovers from FDI to domestic firms was investigated. The insignificant results of sector variable suggested that there is no evidence of productivity spillovers to domestic firms from foreign presence in the industry. While it was hypothesised that FDI should generate positive productivity spillovers through such channels like labour turnover, demonstration, export or competition effects, all different model estimations provided insignificant results (except in case of lagged values by two periods when significant negative effect was obtained) suggesting that FDI does not increase productivity of domestic firms. Therefore, the second hypothesis was rejected as well. Possible explanation for such findings could be that negative competition effect outweighs positive spillover effects. However, when the model was expanded in order to observe the competition effect, generally the same results were obtained which indicated no productivity spillovers. Estimation for other foreign companies in the industry does not provide any evidence of productivity spillovers either. What is more, robustness checks which were done in order to test the validity of results generally have not provided any significant differences.

Further research should try to overcome limitations related to the data. Firstly, the ownership variable could be improved by including the amount of the shares owned by foreigners not just differentiating between foreign and domestic firms. Current dataset is not able to account for the changes in the foreign ownership from 10 to 100 percent and does not capture related effects on the companies due to the changes in the amount of owned shares. Also, more input factors such as materials and capital could be included when estimating the model in order to increase the explanatory power of it. Such improvements would increase the validity of the results. What is more, the backward and forward linkages could be included in the model to test the hypothesis that intersectoral spillovers are more likely to happen due to the fact that companies attempt to internalise their knowledge from the competitors in the same industry.
**References**


**Databases:**

Orbis database  

Zephyr database  

Statistics Lithuania  
(http://www.stat.gov.lt/en/?PHPSESSID=8b0943913f7228464df0079aba8ee70a)

UNCTAD database  
(http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx)
Appendix 1

Table A.1.1 FDI inflows in US dollars per capita into EU countries in 2007 and 2010

Source: UNCTAD database, own computation

Table A.1.2 FDI inflows into EU countries in 2007 and 2010 as percentage of GDP

Source: UNCTAD database, own computation
Appendix 2

Table A.2.1 Firm information during years 2006-2010

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domestic firms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>856</td>
<td>895</td>
<td>899</td>
<td>909</td>
<td>897</td>
</tr>
<tr>
<td>mean employment</td>
<td>105</td>
<td>104</td>
<td>94</td>
<td>84</td>
<td>84</td>
</tr>
<tr>
<td>mean productivity</td>
<td>33.614</td>
<td>39.491</td>
<td>39.867</td>
<td>35.449</td>
<td>44.163</td>
</tr>
<tr>
<td><strong>Foreign firms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>206</td>
<td>215</td>
<td>226</td>
<td>236</td>
<td>252</td>
</tr>
<tr>
<td>mean employment</td>
<td>196</td>
<td>197</td>
<td>184</td>
<td>168</td>
<td>170</td>
</tr>
<tr>
<td>mean productivity</td>
<td>69.085</td>
<td>74.214</td>
<td>79.646</td>
<td>74.196</td>
<td>83.636</td>
</tr>
<tr>
<td>Number of observations all firms</td>
<td>1.059</td>
<td>1.110</td>
<td>1.125</td>
<td>1.145</td>
<td>1.149</td>
</tr>
</tbody>
</table>

Source: Own computation using dataset obtained from Orbis.

Table A.1 provides information of number of observations, average employment, output and productivity of domestic and foreign firms during the five year period. Therefore the table reflects particular trends in the variables during the years of interest. It can be observed that the foreign firms possess higher average rates within all three measures. What is more, both groups have experienced decrease in labour productivity in year 2009, while until then it was steadily increasing. This can be explained by the fact that country was hit by financial crisis around this time, therefore, the rapid decrease in output can be observed.

Table A.2.2 Abbreviations for industries

<table>
<thead>
<tr>
<th>Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 - Food, beverages, tobacco</td>
</tr>
<tr>
<td>S2 - Textiles, wearing apparel, leather</td>
</tr>
<tr>
<td>S3 - Wood, cork, paper</td>
</tr>
<tr>
<td>S4 - Chemicals, rubber, plastics, non-metallic products</td>
</tr>
<tr>
<td>S5 - Metals and metal products</td>
</tr>
<tr>
<td>S6 - Machinery, equipment, recycling</td>
</tr>
</tbody>
</table>