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Foreign direct investment in Estonia:
A source of productivity spillovers and local industrial development?

Master's Thesis

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Any ideas or data taken from other authors or other sources have been fully referenced.

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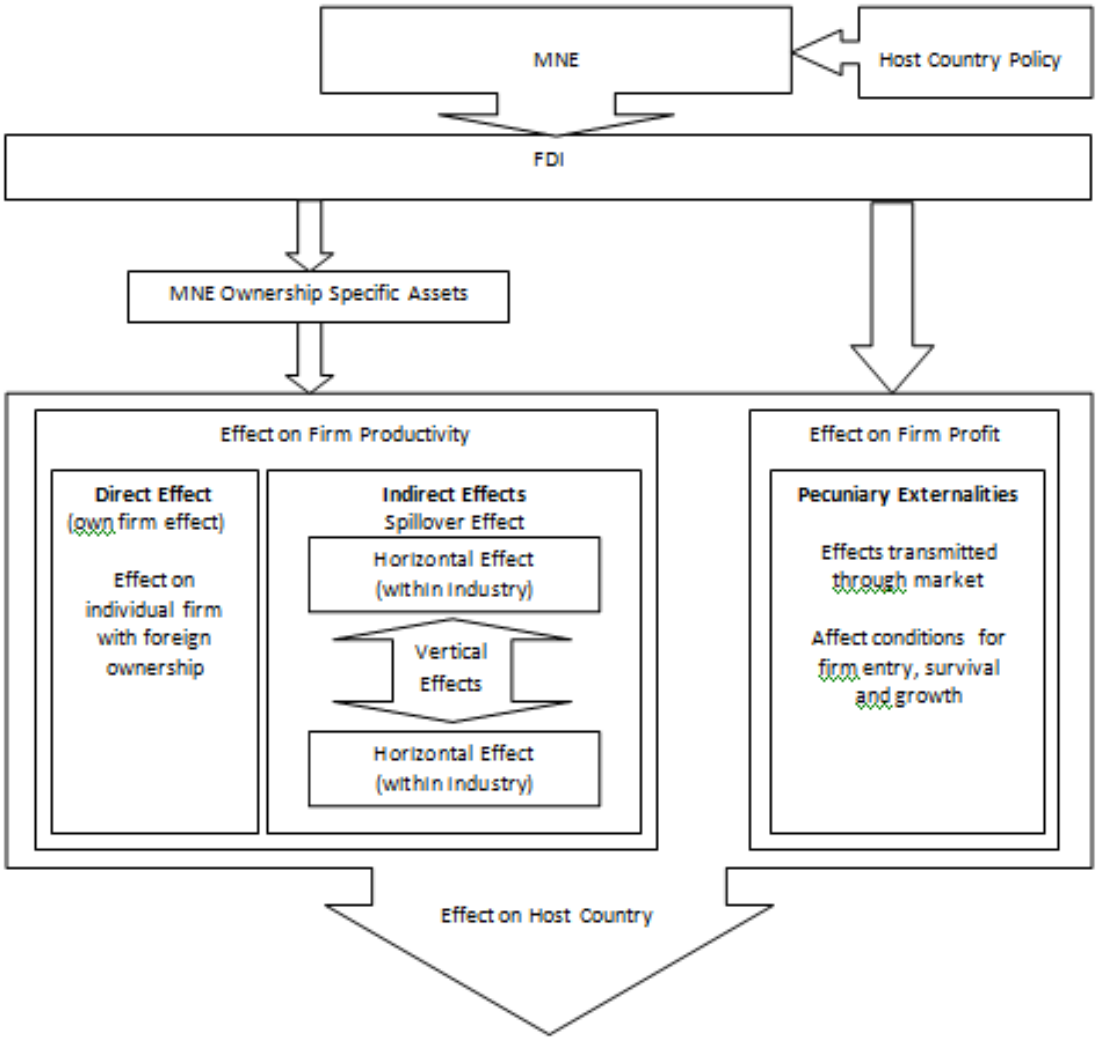
1. Introduction

This paper discusses the impact of foreign direct investment (FDI) on host country development. While the precise importance of FDI for local development is still under debate, two basic mechanisms for FDI effect on a host economy have been identified. These are productivity spillovers within and between companies and pecuniary externalities of foreign investment. While productivity spillovers are a result of knowledge transmission from the investor firm, pecuniary externalities affect the host economy through changes in the market structure. Both affect host country development, and the potential benefits have been the reason why governments in most countries are liberalizing their policies affecting FDI. We apply the theory of FDI host country benefits to Estonia, an advanced transition economy which has attracted significant foreign investment under a liberal policy regime.

This is broad overview of the structure of the concepts used in this paper. Next, we introduce these concepts in more detail and relate them to each other. Figure 1 presents these relationships. Finally, we situate this study in the wider academic and policy context and present the research framework.

Figure 1: Structure of the paper



Source: own schematization

Foreign direct investment is undertaken by a multinational enterprise (MNE) in order to gain ownership and control of a firm outside the MNE home country. At the global level, FDI has become increasingly important since the 1990s due to two different phenomena. These are its sheer volume and its effect on host country development. The volume of foreign direct investment has rapidly risen as a result of more liberal policy since the 1960s and particularly after 1990. For many countries, economic opening was motivated by attracting foreign investors in order to upgrade domestic knowledge and thereby ensure competitiveness through technological catch-up. MNEs typically possess superior knowledge compared to domestic

companies. The expectation of it partially being transferred to the domestic economy has made governments worldwide invest significant resources to attract it.

While naturally FDI affects a host economy in a multitude of ways, two principal mechanisms through which FDI effect on development emerge can be distinguished. These are spillover effects through knowledge transfer and pecuniary externalities through changes in market conditions. While spillover effects have been much researched, current knowledge on pecuniary externalities is very limited. Spillover effects are the transfer of knowledge to firms in the host economy, which can either take place directly through ownership or through indirect transfer to domestic firms. Knowledge encompasses both tangible assets such as technology and intangible ones like management practices. In contrast, pecuniary externalities are effects through the market structure. Here, the presence of an MNE changes supply and demand conditions in a sector and thereby affects the development of local firms.

The question through which mechanisms and in what magnitude FDI affects host country development is a crucial one in policy- making around the world. Its importance is amplified by countries intensified need for technological upgrading to maintain global competitiveness and the increase in FDI available during the last decades. Significant amounts of public resources are spend on inward investment promotion, and evidence exists that the amount spend may not always be justified. This is particularly an issue as we can assume that many countries with a greater need for knowledge catch-up are also ones with more limited means available. A better understanding of mechanisms and magnitude of FDI effects on host country development can contribute to more targeted policies leading to more efficient use of public funds.

Particularly the mechanisms through which FDI affects host countries have not been extensively researched. In most studies, mechanisms of FDI effects are treated as a “black box” as it is difficult to disentangle them. While the change in productivity is measured, the causes remain unknown. In this paper, we first perform a complete assessment of direct and indirect FDI effects. As a second step, we extend the study to the pecuniary effects of FDI. These may in fact be greater in magnitude than traditional spillover effects, but their study has hardly exceeded the theoretical level. Only few empirical studies are available (e.g. Görg and Strobl, 2002; Barrios et al, 2004). The assessment of pecuniary externalities potentially sheds some light into the “black box” of mechanisms through which FDI affects the host country.

In the Estonian case, both the assessment of FDI spillovers and pecuniary externalities extend the current knowledge base. While pecuniary externalities in general have hardly been studied, this study provides an addition to previous studies of spillover effects. Previous studies have either shown methodological issues or focused on one aspect of FDI spillovers. In contrast, this study provides a complete picture including all direct and indirect effects for all manufacturing industry sectors. Estonia provides a particularly interesting example for the study of FDI effects on host country development. In comparison with other Central and Eastern European (CEE) countries, Estonia has shown a particularly fast implementation of transition reforms combined with a liberal, non-discriminatory FDI policy. In contrast to other CEE countries Estonia focused on a favourable investment climate instead of subsidies and has recorded some of the highest per capita inflows.

The theoretical background outlined above is applied to the Estonian economy. This is done by means of a panel data study of all enterprises in the manufacturing sector for the time period 1998-2004. Using panel data provides an advantage over many other studies of FDI host country effects since single firms development can be observed over time. Specifically, we assess the evidence for direct and indirect spillover effects through the following three research questions. The first two assess spillover effects on productivity while the third one addresses pecuniary externalities. The first question focuses on direct effects (own firm effects) of FDI and the second question on indirect spillovers both at the horizontal and vertical dimension. The third question on pecuniary externalities assesses the role of FDI in new domestic firm development.

Research question 1: Is there evidence for a direct effect of foreign ownership on domestic firm productivity?

Research question 2: Is there evidence for indirect effects of FDI on domestic firm productivity?

Research question 3: Is there evidence for an effect of FDI on the development of new domestic

The basic limitations of this study are similar to other studies in the field. Despite relatively detailed theoretical knowledge about spillover channels, the specific importance of each cannot be quantified as they remain difficult to disentangle. While this is the case for productivity

spillovers, the assessment of pecuniary externalities contributes to our understanding of mechanisms of FDI effects on the host country. A second limitation is that pecuniary externalities are likely to emerge also through other channels then new domestic firm start-up. However, this aspect is the most salient one and should therefore be addressed first while leaving more extensive assessment of pecuniary externalities to future studies.

2. Theoretical background

In this chapter, we discuss the theoretical background of the effect of FDI and host country development. The chapter is structured as follows. First, chapter 2.1. discusses the concepts related to the reasons why FDI is expected to have an effect on the host country. Second, in chapter 2.2. we go on to discuss the specific mechanisms through which FDI is expected to affect host country development. Hence, we pass from first discussing the question why FDI affects a host country to the question of how this effect takes place.

In chapter 2.1. three specific concepts are identified. This is the academic debate on FDI and development, the multinational enterprise as the actor in FDI and the concept of ownership-specific advantages. The following Chapter 2.2 is divided into two main concepts. First, we discuss spillover effects of FDI which are further divided into direct and indirect effects. Second, we discuss FDI pecuniary externalities. Through discussion of these concepts, chapter 2 draws a complete overview of the reasons and mechanisms of FDI effects on host countries.

2.1. Foreign Direct Investment and the Multinational Enterprise

2.1.1. The impact of foreign direct investment in host countries

Spurred by economic liberalization in many countries around the world, flows of foreign direct investment have sharply risen in the past decades. The gradual economic opening of countries in Asia since the 1970s, the economic restructuring in the countries of the former Soviet Union after 1990 and increasing liberalization in other regions such as Latin America have provided much impetus to this process. From US$ 200 billion in 1990, global FDI flows rose the ten-fold to a climax in 2007 reaching US$ 2,000 billion. In 2009, they were at US$ 1,100 billion (UNCTAD, 2010).

The impact of FDI on development has been much debated. Three views of “conventional wisdom” on host country impact can be distinguished. These are the views of “Washington

Consensus", academic skepticism and dirigisme (Moran et al, 2005). The term "Washington Consensus" has come to mean economic policy founded on the unrestricted belief in market forces (Williamson, 1999). This implies fully liberalized flows of foreign direct investment, asserting that FDI is always beneficial for the host economy. In contrast, the position of academic skepticism holds that FDI has no direct impact on development. In this view, it contributes no more to an economy than any other productive activity (Rodrik, 1999). Finally, the dirigisme view holds that governments must take significant action to influence FDI flows in order to ensure host country benefit. Amongst other measures, this implies the use of local content requirements and joint ventures.

This debate remains of great importance as countries are developing their FDI policy taking into account past experiences in countries worldwide. It is clear that one common best policy for all countries cannot be found. In the past decades we have witnessed successful growth policy through both liberal economic policy in Eastern Europe countries and more state-guided policy in many parts of Asia. Hence, while a general relationship between FDI and development is difficult to establish, past experience shows us that successful policy cannot be clearly grouped into one archetype of view on FDI.

The general trend however clearly has been and continues to be an increasing liberalization of policy. Of 71 FDI policy changes adopted in 2009, approximately 70 per cent increased support for liberalization and promotion of FDI (UNCTAD, 2010b). This follows a continuing trend since UNCTAD first started to systematically track policy changes in 1992. Some decline in the ratio between FDI-promoting and restricting policy has occurred as in the early 1990s practically all policy changes promoted free capital flows. This development can however be explained by an increasing diversity of countries included and relatively easy measures having been implemented.

Increasing liberalization of policy has been accompanied by many governments taking significant action to encourage the inflow of foreign direct investment. Possibilities and limitations for taking action differ between countries due to different international treaty obligations. A multitude of different measures from direct subsidies to favorable tax policies have been used in both developed and developing countries.

Examples of tax incentives include the 12.5% corporate income tax in place in Ireland since 2003 and the policy of exempting reinvested earnings from corporate income tax altogether in Estonia (Görg and Greenaway, 2004; Eurostat, 2011). Direct subsidies have also been used in many cases and been very significant in their extent. Examples include an equivalent of US $150,000 per employee paid to Mercedes to locate in Alabama or US$ 50,000 per employee paid to Samsung in England (Girma et al, 2001).

These policies are founded on expectations of positive externalities to host economies. These positive externalities can take many forms from most visible aspects like job creation and technology transfer to more indirect ones such as competition effects. These spillovers from FDI can be defined as all benefits created by investments which are not captured by the investor (Moran et al, 2005). These carry great importance as the extent of spillovers to the local economy determines whether and to what extent host country incentives for foreign investment are justified.

2.1.2. The multinational enterprise and foreign investment

Foreign direct investment is undertaken by multinational enterprises. The MNE distinguishes itself from other organizations such as international trading firms and domestic enterprises by engaging in both cross-border production and international exchange of goods. Hence, it has two distinct features. First, it coordinates different value-added activities across borders. Second, in contrast to other organizations it internalizes some of the intermediate goods transfers within the organization (Dunning and Lundan, 2008).

Two main theoretical views are applied to explain the activities of MNEs in foreign countries. These are the internationalization theory and the eclectic paradigm of international production, also referred to as the OLI framework. Both take a similar approach and build on transaction cost theory by Coase (1937). Internationalization theory developed from several approaches and was formalized by Buckley and Casson (1976). The eclectic paradigm was first introduced by Dunning (1981) who has since expanded it several times. Both are similar in positing that firms will internalize their foreign activities when this entails lower costs than organizing the transaction through the market. However, the eclectic paradigm is more specific in stating that each MNE faces different costs depending on its home country and industry and each specific host country and industry (Dunning, 2000).

The eclectic paradigm also allows the identification of four specific motives for engaging in foreign direct investment. Companies FDI engagement can be classified either as market-seeking, resource-seeking, efficiency-seeking or strategic asset-seeking (Dunning, 2000). Market-seeking refers increasing sales in a foreign market while resource-seeking refers to the access to location-specific advantages ranging from labour to natural resources. Efficiency-seeking entails possibilities for a more efficient division of labour within a company and strategic asset-seeking is guided by the acquisition of ownership-specific assets, for instance trademarks or patents.

Stephan (2006) analyzes the motives of foreign investors over the whole CEE region. He finds that overall, market-seeking investment dominated at first and was then followed by more and more efficiency-seeking investors. The market-seeking aspect was dominant before EU accession and in its early phase in order to secure market share at an early point in time. The following efficiency-seeking investors were mainly attracted by low labour costs. Raw materials and strategic assets played a minor role. Access to raw materials was only relevant in Poland and Slovakia, whereas strategic assets only have minor relevance and when they do mainly in the form of recognized trademarks (Stephan, 2006). These motivations for FDI clearly show expectations of growth in these markets and low labour costs compared to most other EU countries as drivers of FDI.

For Estonia, the motivations of investors have also been much discussed. Hunya (2001) finds that market-seeking investment is unlikely to be a significant factor due to the small country size and the small size of the Baltic market. This is seen as a hindrance to sufficient economies of scale in plants and supply chains which are possible in larger CEE countries such as Poland. The view that market-seeking FDI is not a significant motivation for investors is however not supported by survey evidence. Several investor surveys carried out between 1997 and 2000 identify 65% of foreign investors as market-seeking.

2.1.3. The multinational enterprise and ownership-specific assets

Multinational enterprises typically possess superior knowledge compared to domestic firms. They provide 80% of all private funds made available worldwide for research and development and hold a majority of patents in the high-tech sector (Dunning, 1993). As countries are

increasingly shifting their activities towards higher value-added activities in order to increase competitiveness, tapping into this pool of research is becoming increasingly important.

The principal reason why MNE entry is expected to have a potential positive effect on host country firms arises from this superior knowledge of the MNE. To describe this knowledge, Hymer (1960) coined the term firm-specific advantage to include superior technology, economies of scale and advanced organizational techniques. Dunning (1981) incorporated the firm-specific advantages as ownership-specific advantages into the eclectic paradigm of international production. Both Hymer (1960) and Dunning (1981) base their concepts on transaction cost theory aiming to explain under which circumstances firms choose to internalize activities. Dunning (1981) however embeds the theory with locational and internationalization advantages into the eclectic paradigm as drivers of international production. Ownership specific advantages can be treated as the incorporation of firm specific advantages in to the broader theory of the eclectic paradigm, also referred to as the OLI framework.

Ownership advantages can arise from property rights, advantages of common governance and institutional assets (Dunning, 1981). By definition, ownership advantages are always intangible assets such as the experience in different fields of activity. Property rights consist for instance of rights to the use of specific technology or patents held by the firm. Advantages of common governance refer to advantages due to the existing networks and accumulated size of the MNE such as economies of scale or a relatively better bargaining position. Institutional assets include corporate culture and management systems (Dunning and Lundan, 2008).

In contrast to locational and internalization advantages, ownership specific advantages by definition consist of intangible assets. Here, the concept of knowledge capital can be used for specificity. The term knowledge capital broadly encompasses all firm specific, intangible assets which are present in a firm. It has been defined as ”a broad term which includes the human capital of the employees; patents, blueprints, procedures, and other proprietary knowledge, and finally marketing assets such as trademarks, reputations, and brand names.” (Markusen, 2004, p.9). These ownership-specific advantages grant MNEs an advantage relative to host country firms.

Potential beneficial effects to domestic firms arise from the possibility of parts of these advantages being transferred or leaking to firms in the host country. Not all advantages can potentially be transferred because some are dependent on factors that cannot be easily replicated such as firm size or home country characteristics of the MNE. Some benefits from the exploitation of these advantages are however assumed to not be fully captured by the MNE and hence leak to domestic firms as spillovers.

The possession of ownership specific assets is the core of the MNE business model. Ownership specific advantages enable the MNE to go abroad and their exploitation provides a source for its growth internationally. However, since intangible assets are non-rival in their use. As a result, MNEs take action to prevent the diffusion of these assets.

MNCs use a variety of different measures to limit knowledge diffusion. First and foremost is the formal protection of intellectual property rights. MNCs are influenced in their choice of location by the protection of intellectual property granted by host country institutions (Javorcik, 2004). Several studies show that MNCs pay higher wages in order to decrease worker mobility and hence the possible diffusion of their ownership-specific assets (Aitken et al, 1996; Girma, et al 2001). They may also choose to operate in locations where a low level technical knowledge in domestic firms makes it unlikely that domestic enterprises will be able to imitate their technology. This is based on a view that low absorptive capacity will limit technology diffusion.

2.2. Direct effects, indirect effects and pecuniary effects of FDI

2.2.1. Direct effects and indirect effects of foreign direct investment

Chapter 2.2. discusses the means through which MNEs affect the development of domestic firms in the host country. In the last chapter, we stated that potential benefits for domestic firms arise from the ownership-specific advantages of MNEs. More specifically, the superior knowledge of MNEs over domestic firms constitutes an ownership-specific advantage which may potentially be fully or partially transferred to domestic companies. The terms knowledge, technology, transfer and spillover are not used in a coherent way in the literature with many studies failing to properly distinguish them (Smeets, 2008).

We define technology in this respect as a subset of knowledge, which is broader as it incorporates not only tangible but also intangible assets. The term spillover effect specifically

refers to the broad definition of knowledge. We distinguish the terms transfer and spillover by the question whether they are intentional following Javorcik (2004). Knowledge or technology transfer is the result of a conscious action taken by the MNE to diffuse its ownership-specific assets which involves compensation for the assets transferred. In contrast, knowledge or technology spillovers are the unintentional diffusion of assets for which the MNE is not compensated. Both benefits through transfers and spillovers also need to be distinguished from pecuniary externalities of FDI which are discussed in chapter 2.3.

Next, we discuss the concepts of direct effects and spillover effects of FDI. Both are means by which foreign direct investment affects the performance of domestic firms. The distinction between these mechanisms lies in the companies which are affected by them. Direct effects of FDI are the results of foreign investment in a company on the performance of that specific company. In contrast, indirect effects occur in domestically owned companies because of contact with foreign-owned companies. We follow Damijan et al (2003) in our definition of direct effects, which is identical with the term own-firm effect also used in the literature. The terms spillover effects and indirect effects are also used interchangeably. Pecuniary effects are discussed in chapter 2.3.

These are the basic concepts in the field which have remained consistent in their use from the first studies of spillover effects (Caves, 1974; Globerman 1979) to the most recent. The approach to the study of both direct and indirect effects of FDI has stayed similar since these early studies. FDI is expected to have an effect on the productivity of domestic firms. To assess this effect, foreign ownership (in the case of direct effects) or foreign concentration in a sector (in the case of indirect effects) is related to the productivity of firms. If a difference in productivity between foreign and domestically owned firms is observed this provides evidence for a direct effect of FDI. A change in the productivity of domestic firms dependent on foreign concentration in the sector provides evidence for an indirect effect of FDI.

Later extensions of the basic framework have not deviated much from this basic approach. The limitation of this approach is evident. While it possible to measure the correlation of foreign direct investment and productivity, the specific means by which these effects cannot be disentangled in these basic studies. This problem has become known as the “black box” of FDI spillovers (Görg and Strobl, 2005). This is despite the existence of broad theoretical knowledge

about the channels through which FDI leads to knowledge spillovers. These different channels are the discussed in the next section including the more recent studies which have attempted to distinguish knowledge spillovers occurring through different channels.

In contrast to indirect effects, the mechanisms by which direct effects affect firm performance are more clear-cut. As direct effects are the effects of MNEs on local affiliates, they are expected to emerge because of the insertion of new capital, knowledge and technology by the parent company (Hanousek et al, 2011). This of course requires that a foreign investor possesses ownership-specific assets which make it superior to domestic firms (Tytell and Yudaeva, 2005). Hence, direct effects are a result of the actions taken by an MNE on a firm in which it has ownership. MNEs may also influence other firms to a significant extent for instance through providing technical assistance. This would however not be defined as a direct effect of FDI as the ownership of the firm remains domestic.

It should be noted that besides FDI three other mechanisms can be identified through which knowledge spillover may occur. These are licensing, trade, and non-equity forms of cooperation. FDI is however regarded as the most relevant way in which technology transfer as a significant element of knowledge takes place (Jindra, 2005). Licensing provides less potential gains as most developed technology is typically not available for licensing (UNCTAD, 2000). As ownership of superior firm-specific assets is the core of its business model, MNEs are unlikely to license their at least their current knowledge due to high cost of potential unauthorized use of it.

Trade and non-equity forms of cooperation on the other hand occur mostly between MNC affiliates in different countries, thereby limiting the extent of potential technology transfer (Meyer, 2003). In this case, benefits to domestic enterprises are unlikely to emerge as domestic companies simply do not get into contact with the superior knowledge of the MNE. The potentially even negative effect of the creation of such “enclave economies” of foreign-owned companies has been empirically shown (Rodriguez-Clare, 1996).

Spillover effects of foreign direct investment can be separated into vertical and horizontal spillovers. Horizontal spillovers are processes that occur within one industry (intra-industry) while vertical spillovers take place between different sectors (inter-industry). The specific

mechanisms through which knowledge spillovers are expected to occur are discussed in the following sub-chapter 2.2.1. and 2.2.2.

2.2.1. Horizontal Spillovers

Four different mechanisms through which horizontal spillovers operate have been identified in the literature. These are imitation effects, competition effects, labour market effects and export spillovers (Görg and Greenaway, 2001).

Imitation effects refer to any processes or products that domestic enterprises mimic after it has been introduced through FDI. The scope of emulation can vary between minor elements and full copying of products for instance by reverse engineering. More broadly, this effect is also often referred to as the demonstration-imitation effect. Positive effects do not necessarily involve direct imitation, but foreign enterprises may through demonstration decrease the uncertainty which domestic companies perceive about using an innovation (Blomstrom and Kokko, 2000). As a result, they may employ some element observed in foreign companies into their operations. Competition effects create spillovers through intensifying the established market divisions between competitors often found in imperfectly functioning markets. Increasing rivalry forces enterprises to increase efficiency, potentially also leading to exit of some firms and increasing overall market efficiency. Greater competitive pressure may provide incentives for technological upgrading and the introduction of new organizational techniques. As a result, overall efficiency of the market may be increased.

Labour market effects refer benefits of labour mobility and to changes in the overall wage level in a sector. MNEs have a strong incentive to pay higher than average wages in order to limit worker fluctuation and with it dissemination of the organizational knowledge. As a result, they may pay higher wages and thereby create a need for domestic enterprise to increase salaries as well. In contrast to wage effects, the effect through labour mobility applies to both horizontal and vertical relationships. When MNEs do not fully restrict worker mobility, the movement of workers from MNEs to domestic companies may increase domestic company efficiency, thereby creating a spillover effect through knowledge transfer. Finally, export spillovers occur when domestic enterprises begin exporting their goods as a result of skills they have learned from MNEs. Due to their experience of international operations, MNEs typically have much experience in this field including knowledge about market access, network structures and

political influence. They may diffuse some of their information through two different mechanisms. First, they may create necessary transportation links internationally which can then also be used by domestic companies. Second, if some of their knowledge about international markets is diffused to local companies the market entry costs for these are lowered, thereby making export more feasible (Blomström and Kokko, 1998).

While these are the theoretical mechanisms through which horizontal spillovers in an industry are expected to occur, in practice it is possible that horizontal spillovers are either difficult to find or have an overall negative effect. This is due to the interaction between the positive externalities due to the diffusion of MNE tangible and intangible assets and the negative externalities of increased rivalry. At the horizontal level, increased rivalry because of foreign entry may harm domestic enterprises to a more significant extent than any positive externalities created by foreign presence.

2.2.3. Vertical spillovers

As vertical spillovers occur across industries, the interaction between firms and hence the possible kinds of spillovers are different from horizontal ones. Vertical spillovers consist of forward and backward linkages. Forward linkages refer to dowstream effects of MNE presence. These are effects from suppliers to users of an MNE product. The performance of client firms in the host economy may be positively influenced through principally three different channels. First, sales of products to upstream firms may increase the performance of these firms and possible outsourcing activity creates additional demand for their services. For instance, downstream firms may profit from employing an innovation in their production made available by MNE presence. Second, due to MNE presence franchise and maintenance activities may emerge in the final goods sector, thereby creating additional opportunities for domestic firms. Hence, domestic upstream firms benefit as a demand for services is created through MNE presence which can be supplied by these firms.

Third, through improved infrastructure and services downstream firms may benefit from MNE presence. In this way, potential benefits of MNE presence arise from more favorable overall economic conditions which are conducive to business activity. Foreign companies may either themselves invest in infrastructure, or more likely use their political leverage to push for infrastructure improvement. This may be in various areas such as transport or communication.

Also, the presence of foreign firms with may make additional services such as specific finances and accounting companies available to domestic firms as well. In this case, increased demand by MNEs increases demand for these services so that they can viably be operated in the host country. There is some reason to assume that forward linkages have become more significant because of the development in products supplied by MNEs. Increasingly highly sophisticated products may make more intensive customer contact necessary (Blomström, 1991).

Backward linkages in contrast are downstream effects of FDI through links of MNEs with supplying sector firms. They include technical assistance to domestic suppliers, assistance in purchasing policy and customer acquisition, as well as, assistance in training of management staff (Lall, 1980). Labour moving from MNEs to upstream suppliers also is a clearly distinguishable means of knowledge transfer. Additionally, suppliers in upstream sector can also profit from FDI presence through market effects such as increased demand for intermediate inputs. Hence, backward linkage effects can cover both effects of direct action by the MNE and the indirect effects of MNE presence on goods supplied by upstream firms.

There are several reasons to assume that spillovers are more likely to take place between different industries. The strong incentive for companies to limit knowledge transfer to competitors may be a reason why intra-sectoral spillovers are often found to be insignificant or negative. MNCs do not have to fear competition from firms which do not operate at the same level of production but in up- and downstream sectors and hence may take less rigid measures to limit spillovers. More importantly, MNCs even have strong incentives to assist their suppliers in upstream industries through providing technical and financial aid in order to assure quality standards of the products supplied and lower prices. Hence, the firms may transfer knowledge in order to obtain lower supply prices, thereby attaining a private benefit. However, a social benefit may emerge when MNCs are unable to reap all the benefits of their action (Blalock and Gertler, 2008).

This assistance can be either in the form of direct transfer of knowledge or high quality requirements leading to productivity increases in the suppliers. Both mechanisms have been observed in the CEE. The likelihood of spillover effects through this channel is also increased by several related mechanisms. In order to avoid holdout problems, MNEs are likely to grant assistance to several suppliers. By doing so, the MNE frees itself from the risk of becoming

dependent on one partner. As a consequence, knowledge spreads to more companies and spillovers become more likely (Blalock and Gertler, 2004).

2.3. Pecuniary effects of foreign direct Investment

Since its beginning, the study of spillover effects through FDI has largely limited itself to studying the correlation between foreign concentration in a sector and the effect on productivity of domestic firms. The previous sections have described these mechanisms through which traditionally FDI effects have been studied. This approach strongly limits the effects of FDI which can be observed as it is based on a very limited view of the implications of foreign direct investment for the host economy. Effects of FDI on the host economy are expected to only occur through foreign enterprises transferring knowledge to domestic firms and this transfer resulting in changes in the domestic firm production function. However, foreign entry in itself has an effect on the structure of the industry in which it operates. The entry of an MNE affects supply and demand conditions, as well as, competition within the industry, thereby exerting influence on the conditions under which domestic firms operate.

The distinction between direct effects, spillover effects and pecuniary externalities is the way in which they affect domestic enterprises. Direct and indirect effects are the results of actual an actual transfer or spillover of tangible and intangible assets between firms. In contrast, pecuniary externalities firms affect each other indirectly through the changes the prices of goods on the market. While direct effects and spillover effects affect the production function through knowledge transfer, pecuniary externalities affect the profit function of firms in an industry through cost reductions or revenue increases (Görg and Strobl, 2004).

Hence, pecuniary externalities affect competitive conditions within an industry. Kugler (2000) identifies two mechanisms through which this may occur, namely managerial incentives and selection effect. These effects occur at the intra-industry level upon entry of an MNE. First, increased competition may raise the managerial incentives to increase efficiency in domestic firms in order to prevent the loss of market share. For instance, firms may upgrade technology or introduced new organizational structures. Second, increased competition may lead to a selection effect as inefficient firms are forced to leave the market as a result of increased competition. As a result, overall efficiency in the market is increased but the number of domestic firms in the market may be reduced.

However, pecuniary externalities may also have a beneficial effect for domestic firm development. In theory, this effect occurs through the increased demand for intermediate products caused by MNE entry. The increased demand changes the price for intermediate products and thereby affect firm profitability, an effect which is recognized for instance in Kugler (2000). The theoretical literature on FDI has only recently focused more on this aspect. The simple mechanism of increased demand for intermediates is expanded in papers by Markusen and Venables (1999) and Rodriguez-Clare (1996). Both show at the theoretical level that pecuniary externalities may in fact overall be beneficial for domestic firm development.

The theoretical framework by Markusen and Venables (1999) lays out the theory of the effect of foreign direct investment on the development of local firms which we sketch out briefly. The entry of an MNE in a sector is expected to have two consequences. First, foreign presence may harm domestic firms through increased product market competition. Second, the increased demand by foreign companies may have a positive effect on firms in the supplying sector. The increased demand increases profits for existing supplier sector firms while facilitating the entry of new ones. Under economies of scale in production, prices of intermediate goods decrease. This in turn makes conditions for entry of new domestic firms in the downstream sector in which the MNE is present more favourable. Hence, this process would cause local industrial development in the form of new firm entry. Markusen and Venables show that it may even lead to the displacement of MNEs by domestic firms (Markusen and Venables, 1999).

The positive effect of FDI on local industrial development through pecuniary externalities has also been discussed in two other theoretical papers. Equally to Markusen and Venables (1999), these papers also expect the effect on local industrial development to be caused by the increased demand for intermediate inputs as a result of MNE entry. However, both differ in the elements of local industrial development emphasized. Rivera-Batiz (1990) predicts an increase in the domestic firm entry rate but emphasizes the benefits caused by an increased range of intermediate goods available. Rodriguez-Clare (1996) also sees a greater selection of specialized inputs as the main benefit of increased demand for intermediates.

As noted earlier, the potential effects of FDI on the domestic firm structure has not been much researched. Besides the studies mentioned above which extend the classic approach of studying productivity effects, the only other field which has contributed to this discussion is the industrial

organization and occupational choice literature. The few studies available in this field show a negative effect of FDI on the development of domestic firms and relate it to changes in individual professional choices. Although these studies are built on a different theoretical base, they also discuss the relationship between FDI and the foundation of new domestic firms.

Grossman (1984) argues that FDI entry reduces domestic firm entry through changing the incentives for those who potentially would found companies. The argument is that FDI reduces prices in a sector, thereby decreasing the potential benefits of entrepreneurial activity while creating employment opportunities in MNEs. As a result, potential entrepreneurs choose to be employed instead of starting a company. DeBacker and Sleuwaegen (2002) also posit a negative effect of FDI on domestic firm entry through crowding out effects on product and labour markets. In fact, industries with high entry barriers may attract FDI because MNEs through their ownership-specific advantages are able to overcome these barriers more easily than domestic companies. As a result, entry barriers for domestic firms increase further through MNE entry and domestic entry in the sector declines.

In essence, both Grossman (1984) and DeBacker and Sleuwaegen both predict a decrease in the domestic firm entry rate as a result of competition effects within a sector. Despite the different theoretical background, these studies hence are in line with the studies of pecuniary externalities mentioned earlier. These two studies simply discuss specific aspects of competition effect focusing on crowding out of domestic firms on the labour market. Hence, the final effect of pecuniary externalities on domestic firms depends on the interaction between competition effects on one side and beneficial effects through increased demand on the other. At the intra-industry level, a decrease in the domestic firm entry rate would be an indication that competition effects dominate. If however the beneficial effects through changes in demand and prices dominate, we would expect a positive effect on the domestic firm entry rate. This would be a possible indication that FDI may lead to local industrial development.

2.3.4. Other factors influencing the occurrence of spillover effects

Additionally to the factors previously discussed, there are some additional determinants which are frequently discussed in the spillover literature. Partly, they clearly are particularly related to the application in developing countries while others remain valid in the developed country context.

The extent to which the ownership structure of a host country MNE affiliate affects the occurrence of spillover effects has been much analyzed. Joint ownership may be beneficial to spillovers for two reasons. Domestic firms in a sector may have easier access to knowledge in joint ventures projects, also because knowledge transferred to such projects is often less sophisticated. Also, joint venture projects may more easily find local suppliers and hence source more inputs locally, thereby increasing the likelihood of vertical spillovers (Javorcik and Spatareanu, 2008). The studies available indicate that indeed joint ownership is more likely to generate positive spillovers to the host economy. Aitken and Harrison (1999) show joint ownership to be beneficial in the Venezuelan manufacturing sector. The positive effect of joint ownership on productivity is also confirmed by Dimelis and Louri (2007) for Greece.

The extent of local sourcing also has an important influence on spillover effects. MNCs with little local sourcing can create “enclave economies”. There is significant evidence that these self-detained agglomerations in host countries hinder local development (Rodriguez-Clare, 1996). When MNCs integrate into existing networks, increased demand through local sourcing can lead to greater economies of scale in local suppliers, thereby making their production more efficient. Additionally, local connections open up this channel of potential spillovers also to other kinds of spillovers such as dissemination of knowledge through worker mobility. Evidence however shows that MNCs tend to source much of their inputs locally. This observation is coherent with the theory of the firm which states that cheaper sourcing of intermediates is one of the possible drivers of the decision to invest abroad.

The question of the influence of a technological gap between foreign MNEs and the local economy also remains current. This is due to the great importance that host countries attach to the possibility of technology transfer. This can be seen especially in the developed country context where joint venture requirements are commonplace. This issue has however also been discussed in the industrialized country context, where research more commonly refers to the absorptive capacity of local firms. A higher absorptive capacity implies more likely technology transfer.

Two opposing views exist on the relationship between technological gap and spillover effects. For instance Findlay (1978) argues that a larger technological gap is beneficial to spillovers as it offers ample opportunities for development. In this scenario, backwardness creates a more urgent

need for progress and implementation produces large results, thereby resulting in increased spillovers. However, overall the argument that a certain technological level is needed for domestic firms to be able to adopt MNE technology is more justifiable. This is also confirmed by the majority of studies on this aspect which find that the likelihood of technological spillovers is greater with a smaller technology gap (Glass and Saggi, 1998; Girma et al, 2001). If domestic firms are too far behind technologically, they will not be able to absorb spillover effects nor receive assistance for upgrading as part of a MNE supplier network.

The overall effect of all different kinds of horizontal and vertical spillovers may be positive or negative. For instance in the case of competition effects, long-run sustainability through increased efficiency may come at the expense of negative impact on domestic firms in the short run. Wage spillovers can also be negative exerting downward pressure on wages. The currently existing studies provide inconclusive results as they show both positive and negative effects in developed and developing countries (Aitken et al, 1996; Lipsey and Sjöholm, 2001).

Besides effects on the host country, effects of FDI in the MNC home country have been researched but to a much more limited extent. There are several channels through which outward FDI potentially influences the home country. Domestic enterprises may profit from learning how to operate internationally, secure access to raw materials and gain access to foreign assets such as capital markets (Buckley et al, 2007). Furthermore, there is evidence for a positive effect on the productivity of enterprises which engage in outward FDI, as Damijan et al (2007) show for Slovenia and Vahter and Masso (2006) for Estonia. Outward FDI also has potential negative home country effects. These may occur for instance due to potential job losses if production is shifted. These effects are relevant as they may influence the FDI flows for instance through policy measures in MNE home countries. This paper however is limited to the effects of foreign direct investment on host countries.

2.3. Literature Review: Previous studies of FDI spillovers

2.3.1. Horizontal spillover effects

The study of spillover effects began with the assessment of horizontal effects. The first contribution directly to the effects of FDI on host economies dates back to Caves (1974) study assessing the correlation between FDI and productivity. The Caves study searches for evidence

on competition effects which are expected to increase firm selection in an industry and force technological upgrading while also assessing other channels of technology transfer. The general ideas of this study still remain valid for current ones and numerous studies have been based on it. In another early study in this field, Globerman (1979) confirms the positive correlation of FDI on labour productivity, also for the manufacturing sector in Canada like Caves. The Globerman (1979) study is typical for much of the literature on FDI spillovers in its approach of measuring correlations between productivity in a sector and a measure of foreign enterprise presence in that sector. Since then, different studies assessing externalities of FDI have refined and used different measures of productivity and concentration while maintaining to a great degree the same theoretical assumptions about their interaction.

The two pioneering studies are exceptional because they both study developed economies. After these studies, the research focus of intra-industry studies to a very large degree shifted to the developing world. The selection of countries followed investment flows as most countries studies can be considered emerging economies. Examples are Mexico (Blomström, 1986; Kokko, 1996), Indonesia (Sjöholm 1999), Morocco (Haddad and Harrison, 1993) and Venezuela (Aitken and Harrison, 1999). A comprehensive overview can be found in Görg and Greenaway (2004).

The findings of these studies are very much correlated with the research methodology employed. Besides the studies by Haddad and Harrison (1993) and Aitken and Harrison (1999) all studies up to 1999 use cross-sectional data instead of panel data. Generally, the evidence for spillover effects tends to be weaker using panel data which we is also confirmed for Central and Eastern European transition economies in section 2.3.5. While Haddad and Harrison (1993) find inconclusive evidence of spillovers, Aitken and Harrison (1999) find negative effects while the remaining studies mentioned find positive effects based on cross-sectional data. This finding is also corroborated by other cross-sectional studies finding evidence for spillovers (Chuang and Lin, 1999) and panel studies finding no effects (Görg and Strobl, 2002).

The correlation between research methodology and findings holds for transition economies (see section 2.3.5.) while it does not hold for other developed countries. Several studies using panel data find significant evidence for horizontal spillovers in developed countries (Haskel et al, 2002, in the United Kingdom; Dimelis and Louri, 1997 in Greece).

Several factors may explain the fact that panel data studies overall tend to show less evidence of spillover effects. In developed countries, evidence of spillover effects is strong enough for significant results to be found also in panel data studies. The use of panel data studies is likely to generate more valid results. They allow a single firm to be tracked over a longer time period of time instead of simply selecting one moment for observation. Through observation over a longer time period, medium- and long-term effects of FDI are made observable. Additionally, through observation over time cross-sectional data makes it possible to control for factors which potentially affect foreign investment (Görg and Strobl, 2001). The identification problem and establishing causality between firm performance and FDI in a sector is key issue in the study of spillover effects.

If an industry with greater foreign presence shows better performance compared to another industry, it is without additional information not possible to establish whether there is causality. Foreign investment may have increased performance, but better-performing industries may also attract more foreign investment. Use of panel data makes it possible to observe the development of both performance measures and FDI over time, thereby providing an indication of their order. While this provides more credible results, it does not provide evidence of causality. Hence, studies in the field clearly delineate that they establish correlations between foreign presence in a sector and the effect on the host country firms instead of referring to causality between the two.

Overall, evidence for horizontal effects remains weak particularly in developing countries and transition economies inconclusive or negative spillovers effects are found. Likely, competition effects play an important role in explaining this result. While there may be a positive effect of foreign investment, Domestic increased competition on the horizontal level likely creates an overall negative effect for domestic firms.

2.3.2. Vertical spillover effects

An important extension to the research methodology on FDI spillovers was the extension of research to inter-industry spillovers. Most of the FDI spillover literature focuses only on intra-industry spillovers and only later have researchers started to assess spillovers between industries. After the pioneering study by Lall (1980) assessing vertical linkages in least developed countries this issue was not significantly further developed. Javorcik (2004) revived the interest in vertical spillovers with her study of the Lithuanian manufacturing industry.

In its simplest form, vertical spillover effects simply employ the methodology of horizontal studies but link different sectors of the economy according to supply relationships between them. Supply relationships between sectors are typically established through input-output tables for the whole economy. The evidence for vertical linkages generally is much stronger than for horizontal ones. Evidence for backward linkages has tended to be much stronger than for forward linkages. However, there are differences in the extent to which vertical spillover effects are found in countries at different stages of development. A relatively larger number of studies have been published for transition economies compared to both developing and developed economies. However, the total number of studies which measures spillover effects between sectors is significantly smaller than for intra-industry effects.

For transition economies, there are several studies showing vertical spillover effects. Particularly evidence for backward linkages is found in several studies. Also, when assessing all of the CEE, evidence for backward linkages if present is found to be ten times more important than horizontal linkages (Damijan et al, 2003). Backward linkages for the manufacturing sectors are found for Lithuania, Hungary Romania (Javorcik, 2004; Halpern and Muraközy, 2007; Schoors and van der Tol, 2002; Smarzynska and Spatareanu 2004). Only one study finds significant evidence of forward linkages (Schoors and and van der Tol, 2002). The relatively greater importance of backward linkages Hence, for transition economies there is evidence that especially spillovers through backward linkages exist. However, more recent CEE wide data shows that vertical linkages may in fact have become less important than horizontal ones (Damijan et al, 2008). Particularly given the currently relatively low number of studies, more upcoming research will help to clarify more exactly the relative importance of vertical spillover effects.

For both developing and developed countries less research has been published on vertical spillover effects. Studies for developing countries exclusively show evidence of backward linkages. These are observed in panel studies of Colombia and Indonesia (Kugler, 2001; Blalock and Gertler, 2003). In developed countries, the number of studies on vertical spillovers is even more limited and does not make it possible to derive a pattern from it. Driffield (2002) finds a positive forward linkage effect in the UK while Girma et al (2001b) finds a backward linkage effect but only for domestic firms with much export activity. Harris and Robinson (2004) assess

backward and forward linkage effects in 20 different sectors of the UK manufacturing sector for the period 1974-1995. Across different industries, the study does not reveal a clearly distinguishable pattern across industries as positive, negative and insignificant results for vertical spillover effects are found.

2.3.3. Pecuniary effects of foreign direct Investment

In contrast to the relatively large number of studies on the effects of FDI on productivity, the pecuniary externalities of FDI have been discussed to a much more limited extent. In the available studies the focus is mostly on the effect of FDI on domestic firm entry. The results are mixed and strongly depend on the study approach taken.

The first approach is the Markusen and Venables (1999) framework. Despite considerable interest in the theory so far few studies applying the framework exist. A reason may be the highly specific requirements that the framework poses for its application. The framework has only been applied to a transition country in the study by Altomonte and Resmini (2002) for the manufacturing sector in Poland between 1990 and 1998. Their application follows closely the theoretical framework but extends it to include MNE entry from the final goods to the intermediate goods sector. They find that while MNE presence promotes the development of domestic firms through backward and forward linkages, there is not sufficient evidence for self-sustaining local industrial development.

Several studies in the Irish manufacturing sector also build on the Markusen and Venables framework to examine FDI effects on local industrial development. They do however not specifically test for the emergence of a self-sustaining pattern of domestic firm development. These studies assess the effect of FDI on the entry rate of domestic firms (Görg and Strobl, 2002; Barrios et al 2004), as well as, survival and growth (Görg and Strobl, 2004) using plant level data. The studies all find a positive correlation between foreign concentration in a sector and domestic firm entry. Up until a threshold of approximately 20% of foreign concentration in a sector, competition effects however outweigh positive effects of FDI on firm entry (Barrios et al, 2004). Foreign presence increases the chances of plant survival in high-technology sectors while also reducing domestic firm growth (Görg and Strobl, 2004). Fotopoulus and Louri (2004) also use the Markusen and Venables framework to assess domestic firm growth instead of entry. They find that a positive correlation is present in sectors with higher than average growth rates.

The finding that benefits accrue mainly in technologically advanced sectors is corroborated for the number of domestic firms in the Czech Republic, showing that the benefits of FDI for domestic firms dominate over the market-stealing effect (Kosova 2003). Contrary results are sparse. In a cross-sectional study of Belgium from 1990 to 1995, DeBacker and Sleuwaegen (2002) find that the entry of domestic decreased following foreign direct investment in a sector. Therefore the vast majority of studies hence find a positive relationship between foreign concentration and the creation of new domestic firms.

2.3.5. Previous empirical studies in the CEE and Estonia

A few studies have been carried out on FDI linkage effects in Estonia including those which include Estonia as one of several countries. A majority of studies focuses on horizontal spillover effects within one industry. Overall, the evidence for spillover effects is mixed, with many studies not finding significant spillover effects.

The most extensive studies of spillovers in the CEE have been the studies by Damijan et al (2001; 2003). Both studies examine firm level data from eight CEE countries with the later study using a larger number of firms. 8,000 firms in ten CEE transition countries are assessed in this panel study. For Estonia, they find statistically significant results only for direct spillover effects of FDI. There is no evidence for positive or negative effects through linkages. Overall, for all CEE countries evidence for horizontal, forward and backward linkages is very limited with significant results found only for a minority of countries and indicators. Moreover, coefficients in some cases do not carry the expected signs but the authors but this may be caused by small sample size for several countries. In an extension of the study somewhat stronger evidence is found when firm-specific effects have been explicitly controlled for (Damijan et al, 2008). However, overall the results remain mixed without consistent patterns across countries or types of spillover effects.

These studies remain the only ones which cover the whole CEE region. All other studies are significantly smaller and only include a subset of countries, e.g. Poland, Bulgaria and Romania as for instance in Konings et al (2001). As an additional research methodology, meta-analysis of existing studies has recently been used. Hereby, existing studies are drawn together and analyzed despite different individual results in between them in order to find commonalities through

pooling them. An example of this new approach is the study by Hanousek et al (2011). This study however also finds only weak evidence for spillover effects. They note that this may be due to the simultaneous evolution of FDI effects and spillover methodologies. Increased effects of foreign investment can be expected from more recent studies because they had more time to develop, but at the same time more recent studies use panel data instead of cross-sectional data techniques which tend to show lower results. Hence, in the end evidence for spillover effects remains weak (Hanousek et al, 2011). Looking at all of the CEE, evidence for spillover remains relatively weak and inconsistent across different study methodologies.

Next, we assess the available studies focusing specifically on the Estonian economy. Since the first study in 2004, these have gradually evolved in research methodology. The earlier studies of Sinani and Meyer (2004) and Damijan and Knell (2005) are limited in their interpretability due to specific methodological issues. Sinani and Meyer use panel data for 405 firms initially, while Damijan and Knell use a panel study of 1,454 firms. Both studies use small datasets biased towards large firms for their analyses, while the study by Sinani and Meyer (2004) additionally shows attrition problems as the number of firms decreases significantly during the study period (Vahter, 2010). These studies do not measure the causal relationship between FDI and performance but rather correlation between these factors. Sinani and Meyer (2004) find strong evidence for both direct and indirect spillover effects while Damijan and Knell (2005) find evidence for direct effects.

These issues are avoided by subsequent studies. Additional studies on spillover effects specifically in Estonia have since been conducted by Vahter and Masso (2006), Vahter (2010) and Masso et al (2010). All avoid the problem of selection bias through using complete panel datasets of Estonian firm. Vahter and Masso (2006) use a database of all 41,000 Estonian firms, while Vahter (2010) and Masso et al (2010) use data of all firms in the manufacturing sector. Vahter and Masso (2006) and Vahter (2010) find no significant evidence for an effect of FDI on productivity. Both Vahter (2010) and Masso et al (2010) however find evidence related to innovation. Vahter (2006) finds that innovation is significantly positive increased by FDI in the same sector while Masso et al (2010) shows that foreign invested enterprises use knowledge sourcing more intensively and face less hindrances in innovation.

This study compliments the existing studies. It avoids the issues present in earlier studies and adds a complete view of the correlation of FDI and domestic firm performance in Estonia. This is achieved through assessing equally direct and indirect effects of FDI both at the horizontal and vertical level. A complete picture of spillover effects through FDI within the Estonian manufacturing industry is created. Additionally, the relevance of pecuniary externalities has not been addressed in previous studies.

3. Empirical Application

3.1. Research Question

Based on the theoretical background described in chapter 2, this paper responds to three empirical research questions. These research questions are answered using a model described in section 3.3., the data used is described in chapter 4 and the estimation results are presented in chapter 5.

Foreign direct investment can influence a domestic firm directly or indirectly. Effects which occur within an enterprise with foreign ownership are considered direct effects (often also referred to as own-firm effect). In contrast, indirect effects of FDI are effects of foreign-owned firms on domestically-owned firms. The first research question assesses whether firms with foreign ownership have higher productivity than domestically-owned firms.

> **Research question 1:** Is there evidence for a direct effect of foreign ownership on domestic firm productivity?

Next, we assess the evidence for indirect effects of FDI. An indirect effect of FDI would be present if foreign concentration in an industry sector is related to the productivity of domestic firms in the same sector or in up- or downstream sectors. Indirect effects consist of horizontal and vertical linkage effects. Horizontal linkage effects affect the productivity of domestic firms in the same sector, while vertical linkage effects affect domestic firms in supplier sectors (backward linkage effect) and customer sectors (forward linkage effect).

Research question 2: Is there evidence for indirect effects of FDI on domestic firm productivity?

Finally, we assess the link between foreign direct investment and local industrial development. Apart from direct and indirect effects as described above, FDI may through its influence on market structure affect the entry of new domestic firms. We estimate this relationship by assessing the correlation between FDI presence in a sector and the domestic firm entry rate in the third research question.

> **Research question 3:** Is there evidence for an effect of FDI on the development of new domestic firms?

3.2. The development of FDI flows in Estonia

This study assesses the impact of inward FDI in Estonia. Estonia is a country with 1.4 million inhabitants situated in North-Eastern Europe. GDP amounted to 20,608 USD per capita (PPP) in 2010 (UNCTAD, 2012). After regaining independence from the Soviet Union in 1990, the country has shown an unparalleled pace in reforming its economy and re-integrating into the global community. Since 2004, Estonia has been a member of the European Union and adopted the Euro as its currency in 2011. Estonia is the only EU member state which is practically free of sovereign debt. Estonia is also a member of the International Monetary Fund and the World Trade Organization.

The extent of foreign investment received by Estonia since its economic opening has been immense. From the beginning 1990s until 1997, annual investment inflows fluctuated around 200 million USD yearly, then starting to rise reaching 700 million USD in 1998 (UNCTAD, 2012). From 1998, the trend has been a rapid rise in FDI inflows albeit with substantial fluctuations between different years. In 2005 and 2007, record numbers for FDI inflow were recorded at around 2700 million USD. The extent of new foreign investment in Estonia however decreased particularly strongly during the financial crisis, falling by 36% between 2007 and 2008. In 2010, foreign investment inflows were at 1540 million USD (UNCTAD, 2012). In 2010, the inward FDI stock was 5,700 million USD (UNCTAD, 2012). Since the economic opening, Sweden and Finland have constantly been the most important sending countries.

The magnitude of investment received is also remarkable in comparison with other Central and Eastern European transition economies. Since 2003, Estonia has constantly recorded the highest per capita inflow in the CEE. In 2010, inward FDI per capita was at 1,148 USD compared to 411

USD for Slovenia which received the second highest per capita investments (UNCTAD, 2012). Parallel to inward FDI, outward foreign direct investment has increasingly also started to play a role. Outward investments grew from 61 million USD in 2000 to 1640 million in 2007 but then decreased to 130 million USD in 2010 (UNCTAD, 2012). In the transition to a market economy, Estonia among other CEE countries faced the challenge of upgrading the technology stock in order to catch-up with global standards and productivity levels. In order to become competitive internationally in a market environment, foreign investment provided a potential means to attain the capital and knowledge required.

The Estonian government began early with measures to increase the attractiveness of the country to investors. Privatization of formerly state-owned assets in Estonia was enacted quickly and with a focus on complete sale to investors instead of sale to company insiders. This facilitated technological upgrading through concentration of ownership. The privatization method offered the possibility of the introduction of more efficient corporate governance without the risk of insiders blocking restructuring (Konings, 2001).

Additionally to outsider privatization, state policy focused on a fiscal policy aimed at increasing foreign investment. The most characteristic aspect of this approach has been the exclusion of reinvested earnings from corporate taxation since 2003. While several CEE countries chose to focus on fiscal policy instead of subsidies around the same time, the focus on corporate income taxation has remained a distinct feature of Estonian policy (Cass, 2006).

3.3. Model development

The development of the econometric models follows the framework given by the research questions. First, we develop a model for the direct effects of FDI and then continue to model for indirect effects. As a third step, we create a model for the entry of domestic firms.

The models developed to measure direct and indirect effects of FDI are based on the same Cobb-Douglas production function approach. Different specifications of this approach have been used in much of the FDI spillover literature from the early studies such as Caves (1974) to more recent ones since Aitken and Harrison (1999). The basic model is represented as

$$Y_{ijt} = \beta_0 + \beta_1 K_{ijt} + \beta_2 L_{ijt} + \beta_3 M_{ijt} + \alpha_t + \alpha_j + \varepsilon_{ijt} \qquad (1)$$

The dependent variable Y_{ijt} denotes the output of firm i in sector j at time t. The same subscripts are used for all variables and throughout the study. We use the logarithms of the production inputs for the following model:

$$ln\, Y_{ijt} = \beta_0 + \beta_1 lnK_{ijt} + \beta_2 lnL_{ijt} + \beta_3 lnM_{ijt} + \alpha_t + \alpha_j + \varepsilon_{ijt} \qquad (2)$$

The term K_{ijt} is the log of fixed assets in the firm, $L_{ijt}$is the log of the number of employees and M_{ijt} is the log of material inputs. Fixed assets, material inputs and sales are measured in Estonian crowns (EEK) which have been deflated to year 2000 values. The term α_t is a control variable for year-specific effects and α_j is a control variable for sector-specific effects. The term ε_{ijt} is the remaining randomly distributed error term. Its properties are discussed in connection with the more specific applications. Many previous studies on larger countries in the CEE and other regions analyze regions separately (e.g. Altomonte and Resmini, 2002). For Estonia, we do not apply this approach given as the small country size makes nationwide supply relationships feasible. Hence, assessing regions separately would not reflect real linkages in the economy.

3.4. Direct effects of FDI

In order to measure direct effects of FDI, a dummy for foreign ownership is added to our basic model:

$$ln\, Y_{ijt} = \beta_0 + \beta_1 lnK_{ijt} + \beta_2 lnL_{ijt} + \beta_3 lnM_{ijt} + \beta_4 FDI_{ijt} + \alpha_t + \alpha_j + \varepsilon_{ijt} \qquad (3)$$

The inclusion of FDI_{ijt} as a dummy variable is used to measure the correlation between foreign ownership in an enterprise and its effect on productivity. The variable $\beta_4 FDI_{ijt}$ takes the value 1 if the company is majority foreign-owned or 0 otherwise. Direct effects of foreign direct investment are productivity differences in companies which have a foreign direct investment stake compared to domestically owned companies. A positive coefficient for the variable FDI_{ijt} would indicate that firms with foreign ownership have higher productivity compared to domestic firms. A negative coefficient for the variable would indicate lower productivity of firms with foreign ownership.

3.5. Indirect effects of FDI

As a next step, this basic model is then extended to include measures of horizontal linkages and vertical linkages including both forward and backward linkages.

$$ln\, Y_{ijt} = \beta_0 + \beta_1 lnK_{ijt} + \beta_2 lnL_{ijt} + \beta_3 lnM_{ijt} + \beta_4 HORIZ_{jt-1} + \beta_5 BACKW_{jt-1} + \beta_6 FORWD_{jt-1} + \alpha_t + \alpha_j + \varepsilon_{ijt} \quad (4)$$

In this full model $HORIZ_{jt}$ measures the concentration of foreign ownership in the same sector. The term $BACKW_{jt}$ measures the cumulative foreign concentration in supplying (upstream) sectors. The term $FORWD_{jt}$ measures the cumulative foreign concentration in sectors to which output is supplied (downstream sectors). These three measures of linkages are specific to industry j and time t. We next discuss the way in which they are calculated.

The variable $HORIZ_{jt}$ measures foreign concentration in a sector based on employment. It is calculated as the ratio of employees in foreign-owned firms relative to all employees in the industry:

$$HORIZ_{jt} = \frac{Employees\ in\ firms\ with\ foreign\ ownership_{jt}}{Total\ number of\ employees_{jt}} \quad (5)$$

The parameter of the variable $HORIZ_{jt}$ is a measure of the correlation between FDI concentration in a sector and domestic firm performance in the same sector. A positive coefficient indicates a positive correlation with domestic firm performance while the opposite is true for a negative coefficient. We expect the variable to show a negative coefficient as competition effects through foreign firms are expected to exert a stronger influence on domestic firm productivity than beneficial effects. A possible positive coefficient would indicate that the competition effect is overall positive. This could be cause by foreign firms forcing domestic firms to upgrade organizational structure or technology

Vertical linkages are the effects of foreign presence in a sector on domestic firm performance in a different sector. We measure and assess the evidence for the extent of backward and forward linkages. Backward linkages are the effects of foreign presence in a sector on domestic firm

performance in sectors which supply to it. In contrast, Forward linkages are effects of foreign presence on domestic firm performance in sectors to which they supply. In order to assess the evidence for vertical linkage effects, we need to combine the measures of foreign concentration in each sector with the intermediate input supply relationships between different sectors. Using these measures, we can define the share of sector output sold to foreign firms and the share of input bought from foreign firms. The first mentioned measure refers to backward linkages while the latter refers to forward linkages.

In order to measure backward and forward linkages we use the ratio of output in firms with foreign ownership as a share of total output in a sector. In order to account for the relative magnitude of the supply-use relationship the ratio is weighted by the share supplied to a sector. In this way, we can include both the extent of the output flow between sectors and the concentration of foreign firms in the estimation of forward and backward linkages. This specification predicts that backward linkages are expected to increase both with increased demand from the using sector and with increased foreign concentration in the producer sector (Schors and van der Tol, 2002). It can be noted as:

$$BACKW_{jt} = \sum (\alpha)(HORIZ_{jt}) \qquad (6)$$

$$FORWD_{jt} = \sum (\gamma)(HORIZ_{jt}) \qquad (7)$$

The letter α denotes the share of inputs supplied by the upstream sector. For each supplier sector, the share of inputs received from the sector is multiplied by the foreign concentration in the supplier sector measured as $HORIZ_{jt}$. This value is calculated for each supplier sector, and $BACKW_{jt}$ is the sum of all values for the supplying sectors. The sum for $FORWD_{jt}$ is calculated analogously taking the measures for all sectors to which output is supplied. The letter γ denotes the share of output supplied to one downstream sector.

We can use a simple fictional example to illustrate the calculation. There is a wood sector which supplies half of its outputs each to the furniture sector and the paper sector. The foreign concentration in the wood sector is 0.8, while it is 0.5 in the furniture sector and 0.3 in the paper sector. The backward linkage coefficient for the wood sector would be (0.5)(0.5) + (0.5)(0.3) and equal 0.4.

To define the relationships between sectors we use two-digit input-output tables combined with a measure of concentration of foreign ownership in each sector (Blalock, 2003). The input-output table accounts for material flows between manufacturing sectors according to two-digit NACE classification, hence including sectors 15 to 37. For each manufacturing industry sector, linkages with all other manufacturing industry sectors are calculated.

In the FDI spillover literature there are two dominant approaches to establishing supply-use relationships between sectors. The first method is using the share of inputs sourced from the domestic economy as the total of inputs used by a firm. However, using this measure clearly limits the effects which can be studied. First, only backward linkage effects can be assessed as the complete economy is treated as one supplying sector with the foreign firm separated from its structure. Second, linkages between different industries can also not be assessed. As a result, the limited view of FDI effects on the economy provides little understanding of the mechanisms and input for policy formulation.

The second widely used approach for establishing supply-use relationships is the use of economy-wide input output tables. The use of these tables overcomes the limitations caused by using ratios of domestic input. There are two considerations for the use of input-output tables. First, they are only available at a relatively aggregated level which is typically the two-digit NACE level. This means that the precision to which supply-use relationships can be observed is limited and poses a common limitation to all studies of FDI effects between industry sectors. Supply and use sectors of the economy are also to some extent overlapping as the exchange of inputs also occurs between firms in the same sector. Imports and exports of goods are not included in the calculation.

The second consideration in the use of input-output tables relates to the frequency of their publishing. For Estonia, the currently available tables are for the year 2000 and 2005. Hence, supply and use relationships between sectors are always based on snapshots of the economy but do not precisely match the relations for each year. This is a common limitation to all studies in this field. Similar model specifications have been used in several studies including Aitken and Harrison (1999) and Javorcik (2004). The values for the data of foreign firms in different sectors

are lagged by one period as we can expect that correlations of MNE presence will not materialize immediately.

3.6. Domestic Firm Entry

Next, we construct a model for domestic firm entry in order to assess whether FDI exerts an influence on the entry of domestic firms. The research on the effect of FDI on domestic market entry conditions has only been analyzed in a very limited number of studies. As a result, modeling of entry has also not been discussed much in the FDI literature. Hence, we build our model using those studies at the plant level which are available and combining it with literature from general microeconomic theory.

The standard model of firm entry has remained consistent since early studies. The entry decision is based on the expected returns which can be achieved in an industry after entry. The expected return depends on the sum of incentives and disincentives to market entry. Incentives are the expected profit and growth of the industry while disincentives are various entry barriers faced by a new entrant. One example of a classic simple firm entry model is Orr (1974) using growth of industry output to proxy incentives to entry. We also include industry growth as an explanatory variable in our model which is described later.

As a result, the difference between studies of firm entry is limited to the elements included in entry incentives and disincentives and their operationalization. The study by Orr (1974) includes past industry profit rate and rate of output growth as incentives while capital requirements, advertising costs, R&D intensity, risk of failure and industry concentration are included as entry barriers. Shapiro (1987) extends the model by the existence of multi-plant firms as an additional entry barrier. Acs and Audretsch (1989) later add union membership of workers as a barrier and firm innovation rate as a possible compensation for entry barriers.

More recent studies also apply models which are structured in a similar way. Some extensions include more specific inclusion of costs for financing and size of the market (e.g. Mata, 1993). The existing studies on the effects of FDI on domestic firm development use similar measures. They typically include sectoral growth rate, industry size, minimum efficient scale of firms and a foreign investment proxy (Barrios et al 2004; Görg and Strobl, 2002; Görg and Strobl, 2004).

Barrios et al (2004) additionally includes the age of a firm while Görg and Strobl (2004) include measures of concentration and industry growth rate. We use a similar model to model firm entry:

$$E_{jt} = \beta_0 C + \beta_1 GR_{jt-1} + \beta_2 SIZE_{jt-1} + \beta_3 MES_{jt-1} + \beta_4 CONC_{jt-1} + \beta_5 HORIZ_{jt-1} + \varepsilon_{ijt} \quad (9)$$

The entry rate E_{jt} is defined as the net number of indigenous firms entering the NACE two-digit sector between time t and t+1 divided by the total number of firms in sector j at time t. The term $\beta_0 C$ is the constant. The remaining independent variables are all measured for sector j at time t-1. The variables are lagged by one period as we expect a time lag between the observation of the sector level characteristics by a potential entrant and the actual entry decision.

The sector growth rate GR_{jt} is measured as the rate of net annual output growth in the sector. The sectoral growth rate GR_{jt} is expected to be positively correlated with domestic firm entry. A higher sectoral growth rate implies a higher expected profit rate for the entrant firm. When the industry growth rate is higher, the additional supply by the entrant firm is also less likely to depress prices in the sector (Orr, 1974b). Therefore, a higher sectoral growth rate may increase profit expectations of potential entrants and hence affect domestic firm entry rate. The variable $SIZE_{jt}$ measures the size of the sector as the log of total employment in the sector. The size of a market $SIZE_{jt}$ is also expected to be positively correlated with domestic firm entry. Larger market size potentially increases the number of firms present in the sector, making incumbents less likely to retaliate against a new entrant.

The minimum efficient scale of a firm MES_{jt} is measured as the log of mean firm employment size in the sector. The minimum efficient scale MES_{jt} is included as a measure of the entry barrier cause by the minimum size of a firm to enter. The minimum size required to enter is expected to influence how many firms may enter the industry given a specific profit signal (Mata, 1993). We expect that MES_{jt} is negatively correlated with the entry rate. A higher minimum scale required increases the cost of entry and creates a greater entry barrier for new firms.

The firm concentration in a sector $CONC_{jt}$ is measured by the mean value for the Lerner index for each sector. First, the Lerner index is calculated for each manufacturing sector firm. The Lerner index is calculated by using sales, material inputs and employment costs for each firm:

$$LERNER_{ijt} = \frac{sales_{ijt} - material\ inputs_{ijt} - employment\ costs_{ijt}}{sales_{ijt}} \quad (10)$$

All values are in deflated Estonian kroon (EEK). The Lerner index for each firm can range between the values of 0 and 1. The value 0 hence would indicate that a firm has no market power while a value of 1 indicates absolute market power. We then take the average Lerner index for each year and sector to model $CONC_{jt}$. Firm concentration $CONC_{jt}$ is expected to be negatively correlated with firm entry rate. High concentration is expected to be a deterrent to entry as incumbent firms are more likely to notice the new entrant and take retaliatory measures (Shapiro, 1987).

As in our previous model of productivity spillover effects, $HORIZ_{jt}$ again measures the foreign concentration in a sector as the share of employment in foreign-owned companies relative to total employment in the sector as shown in equation (5). If foreign concentration in a sector has a positive impact on domestic firm entry $HORIZ_{jt}$ would be positively correlated with the entry rate. This would be an indication that foreign entry can serve as a driver of local industrial development. In case the coefficient is negative this would imply that competition effects dominate and foreign presence in a sector creates higher entry barriers for domestic companies.

3.7. Econometric Considerations

Three main econometric challenges need to be addressed. These are the selection bias of firms in the dataset, the simultaneity bias of firm intermediate inputs and the estimation method for the models described in the previous section. These three economic considerations all relate to the potential presence of selection bias and unobserved heterogeneity. Sample selection bias refers to the non-random selection of firms for foreign investment. Unobserved heterogeneity refers to firm-specific characteristics which are not explicitly accounted for through control variables. The models specified in this section are estimated in chapter 5.

First, we discuss selection bias. The study is potentially affected by selection bias because of the selective nature of foreign investment. We can assume that the companies which are foreign-owned are not randomly selected but rather foreign investment is disproportionately allocated to firms which had higher than average performance before the acquisition. Hence, if a foreign-owned firm shows increased output this could either be linked to foreign ownership of the firm or it could show superior performance irrespective of foreign ownership. Not taking this factor into account would potentially lead to an overestimation of the correlation between foreign ownership and firm productivity. Applying corrections for this bias at the firm level also corrects it at the industry level as we are still measuring individual firm productivity.

Another aspect of selection bias would result from the exit of firms in our model. If firms which are underperforming leave the market they would no longer be accounted for in our dataset after the year in which the exit. This is a potential source of attrition bias in the data. In theory, this result could go either way as the firm exiting the market could be domestically owned or foreign owned. However, we expect a selection bias towards better performing firms in the selection of firms with a foreign stake as described above. As a result, it is more likely that a firm exiting the market would be domestically owned. Hence, not accounting for this effect would potentially bias the estimation of foreign investment effect on firm productivity upwards. However, using our dataset we can assume that this second aspect of selection bias is to some extent accounted for by using unbalanced panel data for the complete Estonian manufacturing sector. We do not have to exclude firms from the analysis if they are not present throughout the complete time period observed, thereby accounting for entry and exit of firms.

The Heckman two-stage procedure by Heckman (1979) is applied to counter the selection bias through non-random assignment of foreign ownership. This approach has been widely used in this field for studies which account for selection bias (e.g. Damijan et al 2003; Damijan et al 2008; Djankov and Hoekman, 2000; Haskel et al 2002). The Heckman procedure allows us to estimate the magnitude of potential selection bias contained in the data. This is achieved through estimating the likelihood of a firm being selected for foreign direct investment. In the first stage of the Heckman procedure we calculate the probability that the characteristics of a firm determine whether it is selected for foreign direct investment. The probit model used is similar in form to the ones used in Damijan et al (2003; 2008). We estimate the following probit model:

$$Pr\left(FDI_{it1} = 1 \mid X_{i,\ t1}\right) = \Phi\left(X_{\text{it1,FDI = 1}} \neq X_{\text{it1,FDI = 0}}\right) \qquad (10)$$

The variable FDI takes the value 1 if a firm has foreign ownership and 0 if it is domestically owned. The letter Φ is the cumulative normal distribution function. We assume that the error terms are independent and identically distributed. The error terms and Φ are also expected to be normally distributed. The variable X is a vector of firm and industry-specific characteristics which are expected to influence the selection for foreign ownership. All variables of X are measured identically to their previous specification with the equation number given in brackets. The firm-specific characteristics we include are firm size (see eq. 9), capital intensity (eq. 1) and total factor productivity (eq. 1) and the industry-specific characteristic foreign concentration (eq. 5). All measurements are for the first year in our observation time period (t=1).

The variables used of the probit estimation do not vary much between different studies and the variables we use follow these conventions. Firm size, capital intensity and different productivity measures are used widely (Sinani and Meyer, 2004; Vahter, 2004; Damijan et al 2003; Damijan et al 2008). Industry size and foreign concentration are employed by Damijan et al (2003; 2008). Other variables used are industry affiliation (Sinani and Meyer, 2004) and export propensity (Vahter, 2004; Damijan and Knell 2005). Including these variables is unlikely to increase the precision of our estimation of the non-hazard rate. Including a sector code for industry affiliation will likely only have an effect on foreign ownership through other industry-specific characteristics such as foreign concentration which is included in our variables. The inclusion of export propensity is more relevant in studies which study the effect of foreign ownership on firm exports.

The results of the probit model described above can be referred to as the mills ratio or the non-hazard rate of a firm. The non-hazard rate is calculated for each firm and is a measure of the probability that a firm has foreign ownership. As the results are based on a probit model, the values for the non-hazard rate range from 0 to 1. A higher value indicates a higher probability that a firm has foreign ownership. The non-hazard rate can now be used as an additional variable in the random effects estimation. This effectively counters the self-selection bias of foreign ownership arising from the fact that foreign ownership is not randomly assigned to firms in our dataset.

The following second economic consideration is the simultaneity problem of inputs. This is a common problem in productivity estimation. The productivity of a firm is determined by the inputs of production. In our model, these are measures of labour, capital and material inputs. The simultaneity problem arises because a firm determines its output at least to some extent simultaneously with its input use. This simultaneity causes an endogeneity problem, meaning that firm output (the dependent variable) is correlated with the error term in case of economic shocks. In the case of a positive economic shock, a profit-maximizing firm will increase both its output and its input demand simultaneously as a reaction. The reverse is true for negative economic shocks.

As the level of input use is endogenously determined by the firm it can only be observed within the firm and not by the data available to economists. This problem was first formalized by Marschak and Andrews (1944). As a result, ordinary least squares and random effects estimations would be biased upwards (Yasar et al, 2008). Arnold (2005) suggests estimating a fixed effects model. This however requires making the assumption that the unobserved firm-specific estimation errors due to endogeneity, as well as, the growth rate of total factor productivity are constant throughout the time period studied. However, from the theory expect total factor productivity to change in reaction to FDI presence and cannot assume that unobserved firm-specific errors due to endogeneity are constant. In consequence, results of fixed effects estimation as suggested by Arnold (2005) are likely to be biased.

Two different methods are used to counter the simultaneity bias. Several studies (e.g. Javorcik, 2004; Javorcik and Spatareanu, 2005) employ the technique developed by Olley and Pakes (1996). Olley and Pakes use investment to control for unobserved firm-specific differences in productivity. We employ the Levinsohn Petrin method which is based on the standard Olley and Pakes approach but extends it. In contrast to Olley and Pakes, it is used in more recent studies (e.g. Girma et al, 2008) and uses intermediate inputs to control for unobserved firm-specific differences.

The Levinsohn Petrin has two main advantages compared to Olley Pakes. First, using data on intermediate inputs allows us to retain many observations in our dataset which would have been discarded because of missing data on investment. Second, we can assume that the use of

intermediate inputs is more directly connected to economic shocks than investment decisions are. When an economic shock occurs, the cost of adjustment for intermediate input use is likely to be lower than the cost of adjusting investments and is hence done faster. As a result, the Levinsohn Petrin method provides a less "lumpy" measure of the impact of economic shocks.

The Levinsohn Petrin estimator overcomes the simultaneity bias by separating the error term into two different components which are denoted ω_t and η_t. Latter term is the randomly distributed error and therefore not correlated with firm output. The term ω_t however is correlated with firm output as it is the part of the error term which is due to decisions made by the firm to adjust its intermediate input use to econometric shocks. The Levinsohn Petrin makes it possible to define ω_t as a function of capital inputs k_t and material inputs m_t:

$$\omega_t = \omega_t(k_t, m_t) \qquad (11)$$

The main assumption underlying this modeling is that ωt is monotonically increasing. A decrease in the price of intermediates is expected to proportionally increase their use while the reverse is true for an increase in prices. This is an assumption that we can reasonably make. The Levinsohn Petrin method is discussed in more detail in Levinsohn and Petrin (2003).

Other approaches applied to counter the simultaneity bias are the generalized method of moments (GMM; e.g. Bwalya 2006) and instrumental variables (e.g. Vahter, 2010). However, these alternative approaches are also not free of limiting assumptions about the data. Rather, each of them imposes partially very specific requirements on data and limitations in interpretability (see Ackerberg et al, 2006). As our dataset contains information on intermediate inputs and hence allows use of the Levinsohn Petrin method, this is our preferred option.

This leads to our third econometric consideration, the choice of estimation method. The main distinction is whether fixed effects or random effects estimation should be used. Generally, random effects would be preferable as it renders a more efficient estimation and the loss of degrees of freedom of fixed effects is avoided. However, random effects estimation is only appropriate if we can assume that the error terms are random across the units of observations (in our case the single firms in our dataset). In using random effects, we assume that all systematic

disturbances are included in the independent variables and the remaining error term is fully random.

This is a strong assumption to make. Certainly, there are situations in which it this assumption is valid. The classic case is a small random sample of individuals drawn from a large population and precautions taken to make it representative (Baltagi, 2005). However in our case of using firm data for all sectors of the Estonian manufacturing industry there is some reason to doubt this assumption. The firms show great discrepancies in their characteristics ranging from size to use of inputs. This is a result of the diversity in different firms due to the broad range of firms from different sectors included in the study. Firm output may hence also be influenced by firm-specific factors which are not observed in our model. This is an indication that a fixed effects model would be preferable in order to control for these firm-specific effects. The required assumption is that unobserved firm-specific effects are constant over the complete time period. As we study only a relatively short time period from 1998 to 2004, this is a reasonable assumption to make.

Despite the significant advantage of controlling for firm-specific characteristics, there however is one important caveat to the sole use of fixed effects estimation. This is the extent to which fixed and random effects estimations make use of the data in our dataset. While random effects accounts for changes in variable parameters both within and between units, fixed effects estimation only assesses variations within each specific unit in our dataset.

Applied to our dataset, this means that fixed effects estimation only makes use of variable parameters which change for an individual firm during the time period. If a variable parameter is constant, this information is not used for the fixed effects estimation results. In the context of this study, the implications are most important for the variable FDI_{ijt} which measures foreign ownership. The fixed effects estimation results only include those firms for which ownership changes at least once during the study period. While the results are valid, much of the data remains unused. Hence, there are significant reasons why both random effects and fixed effects estimations should be included in the study. The possible threat of unobserved firm-specific characteristics affecting the random effects estimation can be reduced by the inclusion of control variables for year and industry sector in the estimation (see for instance Vahter, 2004).

4. Data and Descriptive Statistics

The data used in our study is discussed in the order of the general structure of the study. First, we discuss the firm-level data used for the empirical application on the direct and indirect effects of FDI. Then, we go on to discuss the sector-level data which is used in the second part of the empirical application, the pecuniary effects of FDI. The link between the two parts of the empirical application is created by the discussion of the linkage variables. These are measured at the sectoral level and used in both the firm-level and sectoral-level models.

The firm-level data used in this study is based on the company balance sheets in the Estonian business register. The study period is the time period from 1998 to 2004. The initial dataset contains data for all firms in the Estonian manufacturing industry. As this data naturally reflects the entry and exit of firms, it is an unbalanced panel dataset. The dataset contains information on total sales, intermediate inputs use, fixed assets, foreign ownership, number of employees, and NACE two-digit industry classification for each firm and each year. Each value can be linked to the specific firm.

The manufacturing industry is defined according to the NACE classification of firms in its revision 1.1. All firms from sector 15 to 37 are included in the dataset (see table 3). NACE is the statistical classification of economic activities in the European Community. The NACE classification is directly comparable to the United Nations International Standard Industrial Classification of All Economic Activities (ISIC) and national classifications within the European Union, such as the Estonian EMTAK classification.

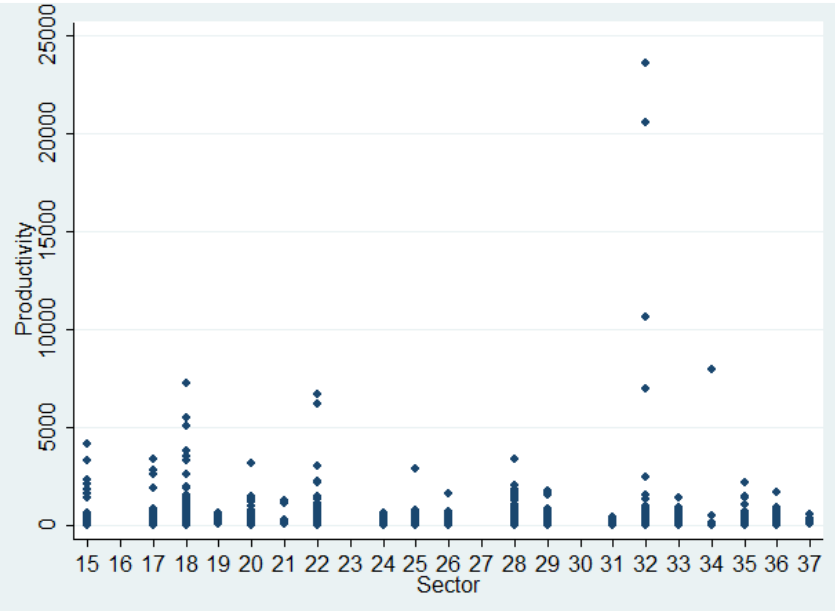
The total number of firms in the Estonian manufacturing industry for the time period studies is 10,357 firms, representing 33,961 unique observations. In three NACE sectors there are only domestic firms operating, hence these sectors are excluded from the study. In sector 23 this concerns 13 observations, in sector 27 these are 45 observations, and in sector 30 these are 60 observations. Hence, a total of 118 observations is removed. Sector 16 (tobacco products) is not included in the study as there are no firms at all active in this sector in Estonia during the period studied.

From the remaining dataset of 33,843 observations, we need to remove those observations for which productivity cannot be observed as the relevant data values are missing. We require data

for output, fixed assets, number of employees and material inputs in order to assess total factor productivity (TFP) using the Levinsohn Petrin method. Further use of the term productivity in this chapter refers to TFP calculated according to the Levinsohn Petrin method. There are 15,734 observations for which productivity cannot be calculated because required data is missing in the dataset. These observations are dropped, thereby creating a panel dataset of 18,109 observations for the years 1998-2004.

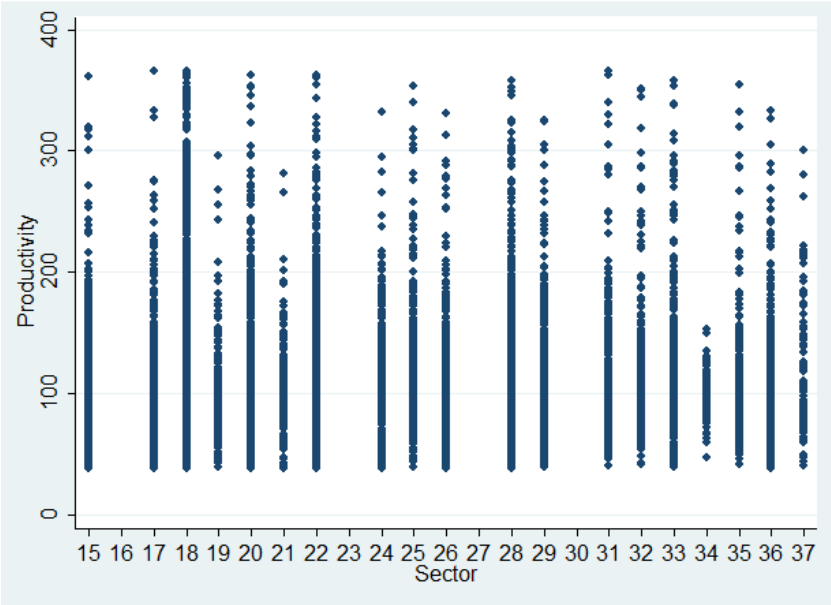
There are clearly extreme outliers in the data as figure 4 shows. The mean productivity is 199.61, while some of the observations record a productivity higher than 10,000. Clearly, these observations represent special cases of firms or errors in the data. In the case of sector 32, it is likely that the outliers represent Elcoteq, an electronics manufacturer for which the dataset records very high output but near-zero material inputs. We remove the outliers from the dataset by removing the lowest and highest one per cent of observations based on the productivity measured. 724 observations are removed from the dataset, thereby creating the final dataset of 17,385 observations shown in figure 5. The total number of observations of unique firms is 5,178. As this is an unbalanced panel, the exact number of firms varies between 1,624 and 3,087 (see table 1).

Figure 4: Firm productivity by industry sector before removal of outliers



Source: own calculations based on dataset

Figure 5: Firm productivity by industry sector after removal of outliers



Source: own calculations based on dataset

Table 1: Number of firms in the dataset	
Year	Number of firms
1998	1624
1999	1884
2000	2455
2001	2576
2002	2818
2003	2941
2004	3087

The number of dropped observations is typical for studies in this field due to the comparatively high data requirements. The number of dropped observations equals 48.7 per cent of total observations, which is comparable for instance to Aitken and Harrison (1999) with 37.8 per cent dropped observations. Table 2 gives the summary statistics for the variables used in the study while an overview of the firm data is given in table 3.

Table 2: Summary statistics of firm-level variables and linkage variables			
	Number of observations	Mean	Standard Deviation
ln Y	17385	14.732	1.754
ln K	17385	12.760	2.156
ln L	17385	2.778	1.331
ln M	17385	13.976	2.000
HORIZ	17385	0.267	0.177
BACKW	17385	0.269	0.121
FORWD	17385	0.503	0.267

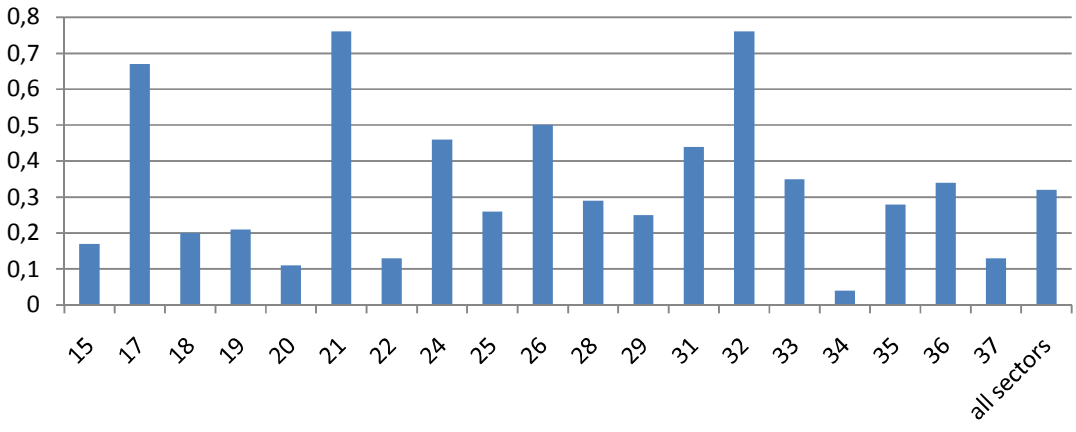
Table 3: Number of firms, ownership and foreign concentration per industry sector					
Manufacturing sector	NACE 1.1 sector code	Ownership and Number of Firms*			Foreign concentration**
		Domestic firms	Foreign firms	Firms Total	Share of employees
Food products, beverages and tobacco	15	537	46	562	0.17
Textiles	17	185	42	221	0.67
Wearing apparel; dressing and dyeing of fur	18	367	50	404	0.20
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	19	48	17	60	0.21
Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials	20	1049	74	1104	0.11
Pulp, paper and paper products	21	48	12	59	0.76
Publishing, printing and reproduction of recorded media	22	434	38	462	0.13
Chemicals and chemical products	24	96	17	110	0.46
Rubber and plastic products	25	153	40	187	0.26
Other non-metallic mineral products	26	161	34	187	0.50
Fabricated metal products, except machinery and equipment	28	692	78	755	0.29
Machinery and equipment	29	235	58	284	0.25
Electrical machinery and apparatus	31	89	25	111	0.44
Radio, television and communication equipment and apparatus	32	72	28	96	0.76
Medical, precision and optical instruments, watches and clocks	33	143	21	163	0.35
Motor vehicles, trailers and semi-trailers	34	32	8	36	0.04
Other transport equipment	35	88	11	98	0.28
Furniture; manufacturing	36	507	73	560	0.34
Recycling	37	35	1	36	0.13

Manufacturing industry total	all sectors	4971	673	5495	0.26

* Number of firms given as total numbers of unique firms for 1998-2004. 317 firms included in domestic and foreign columns because of ownership change in study period.
**Foreign concentration measured as share of employees in foreign firms as share of total sector employment, average for 1998-2004
Source: own calculations based on Estonian business register

The data shows that the number of firms varies significantly between industry sectors. The highest number of firms is recorded in sector 20 (wood and wood products) with 1,104 firms in the dataset. The lowest number of firms is in sector 37 (recycling). Of the overall number of 5,495 firms in table 3, 673 have majority foreign ownership. This equals 12.25 per cent of the total number of firms. Foreign concentration measured as the share of employment in foreign-owned companies is 32 per cent of total manufacturing industry employment.

Figure 6: Foreign concentration across industry sectors



The data shows that there are great differences in foreign concentration across different industries. In figure 6 we see that the highest foreign concentration is found in the radio and television equipment (76 per cent, sector 32) with an equal value in the paper products sector (76 per cent, sector 21). Both sectors have relatively few enterprises with 59 firms in paper products and 96 firms in radio and television equipment. The textile sector has high foreign concentration averaging 76 per cent. The by far lowest foreign concentration is recorded for sector 34 (motor vehicles) with 4 per cent. Four other sectors can be classified as having a low share of employment in foreign firms below 20 per cent. These are food products (sector 15), wood and wood products (sector 20), publishing (sector 22) and recycling (sector 37). All remaining sectors have medium concentrations of foreign direct investment ranging from 20 per cent to 50 per cent of employment share.

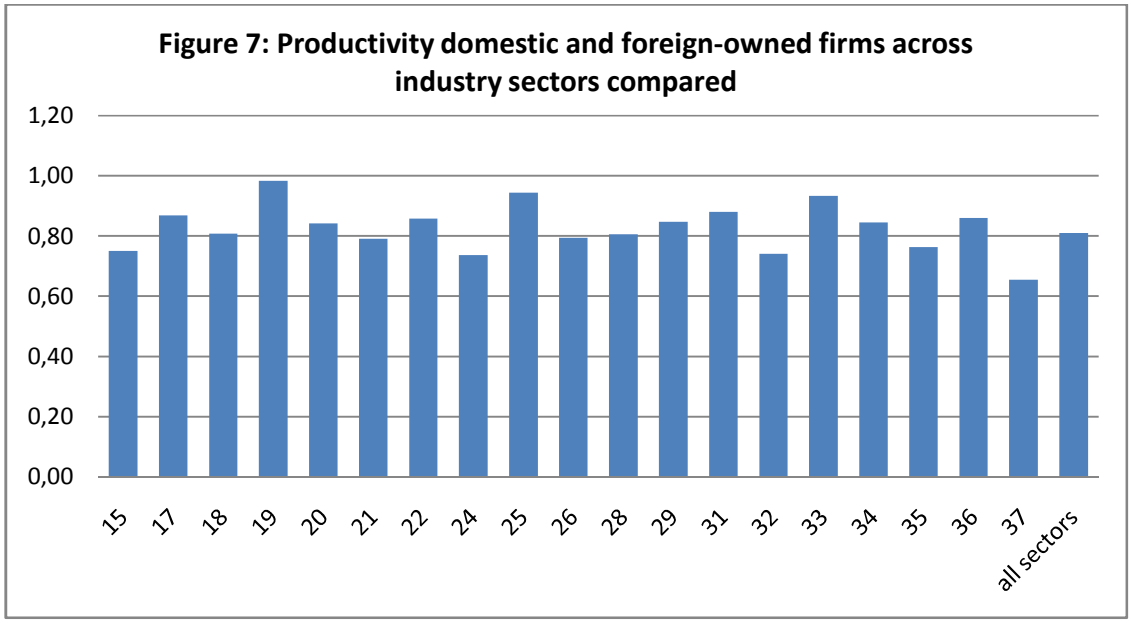
Next, we assess the detailed firm level data comparing foreign and domestic firms per sector and over the whole industry. A detailed overview of average productivity, employment and output of foreign and domestic firms is given in table 4. For the whole manufacturing sector, foreign firms on average have higher total factor productivity (TFP), a higher number of employees and higher output. However, the difference is less significant in TFP than in output and number of employees. The domestic firm average TFP is 81 per cent of that of foreign firms while this value is 19 per cent for output. In contrast, domestic firms are on average only 29 per cent of the size of foreign firms. This means that in the overall manufacturing industry, foreign firms have higher productivity but are disproportionately greater in terms of employment size and output produced.

Table 4: Firm-level characteristics of domestic and foreign firms across sectors*

Sector	Total factor productivity**			Number of employees			Output***		
	Domestic firms	Foreign firms	Ratio****	Domestic firms	Foreign firms	Ratio****	Domestic firms	Foreign firms	Ratio****
15	85.72	114.27	0.75	30.18	78.69	0.38	14.6	123.0	0.12
17	96.24	110.8	0.87	27.55	242.55	0.11	10.3	89.7	0.11
18	118.81	147.14	0.81	34.88	52.72	0.66	6.4	10.2	0.62
19	96.94	98.52	0.98	42.59	29.56	1.44	6.4	7.5	0.86
20	86.48	102.79	0.84	17.24	29.46	0.59	8.4	19.7	0.43
21	97.37	123.14	0.79	14.01	134.79	0.10	5.7	111.0	0.05
22	113.58	132.4	0.86	13.55	25.00	0.54	5.5	12.6	0.43
24	109.20	148.07	0.74	24.96	102.44	0.24	19.0	121.0	0.16
25	111.53	118.1	0.94	22.63	26.18	0.86	14.2	29.5	0.48
26	98.74	124.35	0.79	16.28	77.08	0.21	7.1	76.5	0.09
28	101.42	125.92	0.81	17.06	65.49	0.26	6.9	43.2	0.16
29	101.73	120.04	0.85	22.44	27.95	0.80	7.3	20.0	0.37
31	106.47	120.96	0.88	22.24	112.73	0.20	9.7	53.2	0.18
32	109.19	147.32	0.74	14.76	171.16	0.09	4.9	56.1	0.09
33	116.99	125.26	0.93	14.30	44.23	0.32	5.0	52.2	0.10
34	96.48	114.15	0.85	44.86	17.27	2.60	20.7	12.9	1.60
35	106.04	138.96	0.76	17.56	119.52	0.15	5.9	65.9	0.09
36	89.98	104.62	0.86	21.32	72.94	0.29	7.2	39.8	0.18
37	115.18	175.81	0.66	11.27	24.17	0.47	14.2	21.6	0.66
Industry	98.78	121.91	0.81	21.51	73.60	0.29	8.6	46.4	0.19

* All data as averages for 1998-2004
**Calculated according to Levinsohn Petrin method using logarithms of employment, output, fixed assets and material inputs based on deflated financial data
***Output in million Estonian kroon (EEK), deflated
****Ratio: Domestic firm parameter value / Foreign firm parameter value (foreign firm mean is 1.00)
Source: own calculations based on Estonian business register

We are primarily interested in productivity differences between domestic and foreign firms. Figure 7 displays a comparison of the TFP of both domestic and foreign firms. Average productivity of foreign firms is higher in all industry sectors but there are differences in the size of the productivity gap to average value for domestic firms. In three sectors, average domestic firm productivity is more than 90 per cent of average foreign firm productivity. These are the sectors of leather manufacture (sector 19), rubber products (sector 25) and medical and optical instruments (sector 33). The productivity gap is particularly large in sector 37 (recycling), where domestic firms show only 66 per cent of foreign firm productivity on average.



Next, we discuss the data related to the measurement of indirect effects of FDI. To measure the indirect effects of FDI we employ linkage variables for horizontal linkages, backward linkages and forward linkages. Horizontal linkages are measured with the variable HORIZ, backward linkages with the variable BACKW and forward linkages with the variable FORWD. All linkages variables are measured for each sector and each year according to the methodology described in chapter 3.

We first give the statistical summary of the linkage variables for each year at the industry level in table 4. Then, table 5 presents averages of the linkage variables for each sector over the time period studied. All linkage variables have been calculated based on the Estonian business register data in our dataset. Supply and use relationships between different sectors were established using

the year 2000 input-output table at the NACE two-digit level obtained from the Estonian statistical office. This table is used throughout the study as input-output tables are not available for more specific time intervals. Through the inclusion of the measure of foreign concentration for each year and sector, it is however possible to represent supply and use relationships between sectors taking foreign firm concentration into account.

Table 5: Summary statistics for spillover variables

		HORIZ		*BACKW*		*FORWD*	
Year	Number of sectors	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
1998	19	0.235	0.146	0.274	0.117	0.381	0.172
1999	19	0.267	0.189	0.300	0.137	0.517	0.237
2000	19	0.236	0.161	0.238	0.097	0.527	0.292
2001	19	0.298	0.211	0.222	0.089	0.527	0.302
2002	19	0.278	0.183	0.291	0.133	0.534	0.294
2003	19	0.269	0.173	0.294	0.124	0.489	0.222
2004	19	0.276	0.163				

The summary statistics of the linkage variables show several patterns. All three linkage variables however show strong fluctuations in their values over time. No variable clearly exhibits a specific development over time. Trends in the variables can however be distinguished. The horizontal variable overall increases its mean value over time, albeit this trend is not constant. This is an indication that foreign concentration in the manufacturing industry sectors has on average increased. The values of the backward linkage variable are relatively lower in the middle years of the study period. This is an indication that firms have decreased their use of intermediate inputs produced by foreign firms in these years. The mean values of the forward linkage variables are relatively constant over time with the exception of the first year of the study period. As backward and forward linkage variables are used only as lagged variables by one year, values for the last study period are not required for these variables.

Table 6: Coefficients for linkage variables per industry sector (overall mean 1998-2004)

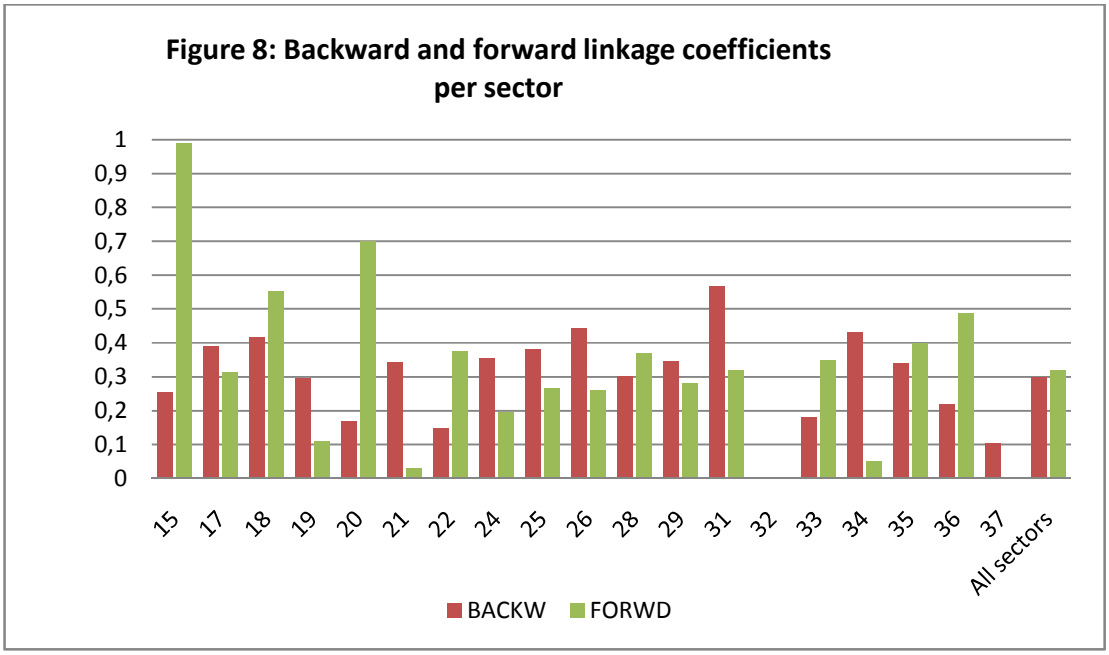
Sector	Linkage coefficients		
	Horizontal (*HORIZ*)	Backward (*BACKW*)	Forward (*FORWD*)
15	0.1707	0.2547	0.9900
17	0.6573	0.3907	0.3141
18	0.2046	0.4177	0.5525
19	0.2002	0.2979	0.1107
20	0.1075	0.1695	0.7008
21	0.7437	0.3436	0.0310
22	0.1306	0.1495	0.3771

24	0.4700	0.3561	0.1951
25	0.2585	0.3823	0.2672
26	0.5005	0.4437	0.2628
28	0.3007	0.3026	0.3693
29	0.2397	0.3472	0.2811
31	0.4397	0.5690	0.3187
32	0.7626	0.0000	0.0000
33	0.3364	0.1816	0.3489
34	0.0408	0.4318	0.0498
35	0.2735	0.3401	0.3998
36	0.3366	0.2199	0.4888
37	0.1387	0.1028	0.0049
Industry	0.2672	0.3000	0.3191
Source: own calculations based on Estonian business register and Statistics Estonia year 2000 input-output table			

The forward and backward linkage coefficients are displayed in figure 8. Horizontal linkages are not discussed as their calculation is identical to the measures of foreign concentration discussed earlier. The sectors vary considerably in their extent of both forward and backward linkages. The variation between sectors is somewhat larger for forward linkages as seen in the higher standard deviation of the forward linkage coefficient (see table 5). The highest value for the backward linkage coefficient is found in sector 31 (electrical machinery). This indicates that this sector sources a comparatively high share of its intermediate inputs from sectors in which foreign concentration is high. The by far largest value for forward linkages is found in sector 15. This value has been checked for possible miscalculations in the data. The high forward linkage value is however simply the cumulative result of the comparatively high share of sector output sold to sectors with high foreign concentration.

It should also be noted that both forward and backward linkage coefficients are nil for sector 32 (communications equipment) and the forward linkage coefficient is nil for sector 37 (recycling). For both sectors, this would imply that none of the sector output is sold to sectors with foreign concentration while for sector 32 additionally none of the intermediate inputs are bought from sectors with a foreign share. These sectors demonstrate a limitation of studying the forward and backward linkages in the manufacturing industry only while assuming no trade. For sectors 32 and 37, it is likely that supply and use relations are primarily with sectors outside manufacturing (such as services) or conducted on the international level. For the study as a whole this does

however not pose a threat. Possible distortions would only affect the measurement of indirect effects of FDI while the remaining parts of the study concerning direct effects and pecuniary externalities are not affected. Also, the effect on the assessment of indirect effects is likely to be very small as both sectors are among the smallest in the manufacturing industry.



Next, we discuss the sectoral-level data collected for the second part of the empirical application. We use this sectoral-level data for the model of domestic firm entry in each manufacturing sector. As in the first part of the empirical application, our data is for the Estonian manufacturing industry. Due to data requirements, the study period is modified to the period 1999-2004. We conduct a sector-level analysis of the 19 manufacturing sectors as our units of observation. The definition and selection of sectors remains unchanged from their previous use. The data source also remains the same as the sectoral-level data is also based on Estonian business register. Table 7 presents the statistical summary of the units used in the sectoral-level study. There is a total of 114 observations for all variables based on 19 industry sectors with measurements taken for each of the six years.

Table 7: Summary Statistics of sectoral-level variables

	Number of observations	Mean	Standard Deviation
E	114	0.065	0.099

GR	114	0.129	0.308
ln SIZE	114	7.755	1.087
ln MES	114	12.472	3.257
CONC	114	0.166	0.060
HORIZ	114	0.332	0.235

Table 8 gives an overview of the domestic firm entry rates for each sector and each year. There are strong fluctuations between entry rates in the different years which can be explained by the detail of the study level and hence the small sector size. Overall, entry rates are comparatively higher in the first half of the period studied between 1998 and 2000 and decrease in the second half. In the second half, the net effect on the number of domestic firms is negative for many sectors particularly in 2002. Domestic firm entry rates vary considerably between sectors. The highest average entry rates are observed in sectors 37 (recycling), 25 (plastic products), 28 (metal products) and 34 (motor vehicles). In sectors 32 (communication equipment), 15 (food products) and 19 (leather manufacture) the average growth rate over the study period is close to zero.

Table 8: Domestic firm entry rates across manufacturing industry sectors

Sector	Year						
	1998	1999	2000	2001	2002	2003	Sector Average
15	0.11	0.11	-0.03	-0.02	-0.05	-0.04	0.01
17	0.04	0.09	0.04	0.00	0.00	0.06	0.04
18	0.06	0.07	0.02	-0.01	0.02	0.00	0.03
19	0.03	-0.03	0.05	0.04	-0.01	-0.01	0.01
20	0.10	0.08	0.04	0.07	0.05	0.07	0.07
21	-0.02	0.18	0.02	0.00	0.21	-0.04	0.06
22	0.13	0.09	-0.01	0.05	-0.02	0.07	0.05
24	0.09	0.02	0.06	0.05	0.00	0.03	0.04
25	0.17	0.06	0.21	0.10	-0.01	0.10	0.11
26	0.01	0.19	-0.02	0.08	-0.02	0.07	0.05
28	0.26	0.08	0.08	0.02	0.04	0.15	0.11
29	0.07	0.03	0.05	0.06	0.06	0.12	0.07
31	0.22	-0.01	0.13	0.15	-0.06	0.02	0.08
32	-0.08	-0.20	0.06	0.08	-0.05	0.07	-0.02
33	0.06	0.19	0.14	0.08	0.09	-0.01	0.09
34	0.29	0.07	0.23	-0.03	-0.08	0.18	0.11
35	0.07	0.16	0.12	0.12	0.04	0.11	0.10
36	0.10	0.13	0.03	0.11	0.03	0.07	0.08
37	0.67	0.24	0.23	-0.09	-0.03	0.00	0.17
Year Average	0.13	0.08	0.08	0.05	0.01	0.05	

Source: own calculations based on Estonian business register

5. Estimation Results

The presentation of the estimation results is divided into two parts. In chapter 5.1. we estimate the models related to direct and indirect effects of FDI including the estimation of the Heckman selection model. In chapter 5.2. we then estimate the results for our model on domestic firm entry in order to assess the evidence for pecuniary externalities of FDI.

5.1. Estimation results for productivity effects

We first estimate the probit model for the Heckman two-stage procedure in order to control for selection bias in foreign ownership. The possible threat of selection bias arises from the non-random assignment of foreign ownership to firms. It may be the case that foreign ownership is disproportionately allocated to better-performing firms. The discussion of selection bias and the Heckman procedure along with the specifications of the probit model to be estimated are discussed in detail in chapter 3. The results attained from the probit model allow us to calculate the non-hazard rate (inverse Mills ratio) for each firm which can then be included in the productivity estimations.

Table 9: Estimation of the Heckman probit model
Dependent variable: Foreign ownership

Variable	Random effects model		
	Coefficent	Std. Error	p-value
ln L	.1559227	.014088	0.000
ln K	.1147329	.0088954	0.000
TFP (LP)	.0053565	.0002749	0.000
HORIZ	.944881	.070233	0.000
constant	-3.929439	.1036268	0.000

Source: own calculations based on panel dataset

The parameters used to estimate the probit model are the log of firm size, the log of fixed assets, and total factor productivity of each firm. Additionally, foreign concentration is added as a industry-specific characteristic. The estimation is shown in table 9. The estimated parameters for each firm are then used to create the inverse Mills ratio, or the non-hazard rate for each firm. The use of these combined values as an additional variable in the direct and indirect effects

regression however does not produce reliable results. The effect of the calculated inverse Mills ratio on the estimation is on a scale which does not allow conclusions about the other variables studied. We interpret this as an indicator that significant selection bias in present in the data. Hence, we do not include the inverse Mills ratio in our estimations in the following sub-chapters. This implies that the random effects estimations in these models need to be treated carefully as they are likely to be influenced by selection bias to some extent. This does not mean that they cannot be used for analysis, however this caveat needs to be taken into account when interpreting random effects estimation results.

5.1.1. Direct effects of FDI

To assess the evidence for direct effects of FDI we run fixed- and random effects for all manufacturing sectors in the first step. We estimate total factor productivity calculated according to the Levinsohn Petrin method as discussed in chapter 3.4 . There are a few differences between the random and fixed effects estimations due to the economic consideration discussed in chapter 3.7 . The random effects estimation includes dummy variables for both sector and year-specific effects. In the fixed effects estimation, these dummy variables are not included as the fixed effects estimation only compares one unit of observation (one firm) to the same firm. Hence, sector- and year-specific terms do not need to be explicitly controlled for. Table 9 presents the results of our estimation for all manufacturing sectors.

Table 10: Regression results for direct effects of FDI, manufacturing industry level

Study period: 1998-2004 Dependent variable: total factor productivity (Levinsohn Petrin estimation)

Variable	Random effects model			Fixed effects model		
	Coefficent	Std. Error*	p-value	Coefficent	Std. Error*	p-value
ln K	5.633	0.405	0.000	6.165	0.598	0.000
ln L	-2.981	0.856	0.000	-6.887	1.315	0.000
ln M	-6.006	0.669	0.000	-8.036	0.981	0.000
FDI	17.944	1.819	0.000	5.502	2.692	0.041
constant	-3331.871	325.054	0.000	150.257	12.042	0.000
Sector dummy	included					
Year dummy	included					
Hausman test	Prob>chi2 = 0.0000					

*robust standard errors
Source: own calculations based on panel dataset

Table 9 presents both the random and fixed effects regression results. In our discussion of fixed and random effects estimation we state that fixed effects estimation is likely to be preferable when there is a large enough number of observations. In this case, the disadvantage of fixed effects estimation of using less of the information contained in the data does not play such an important role. As we are analyzing the complete dataset for the manufacturing sector in this estimation, the number of observations is clearly large enough for fixed effects to be preferable. This reasoning is further corroborated by a Hausman test resulting in a p-value of 0.0000. This indicates that the null hypothesis that random effects regression is more suitable can be rejected and fixed effects estimation should be used.

For the estimation of direct effects in the complete manufacturing industry, fixed and random effects results do however not differ to a large extent. Both show that foreign ownership correlates with higher total factor productivity in companies. There is some difference in significance however, as the FDI dummy variable is only significant at the five percent level in the fixed effects estimation while it is significant at the one per cent level in the random effects model. This may however be related at least to some extent to selection bias and the fixed effects model is preferred. Hence, as a result of the estimation of direct effects of FDI we see that a correlation between foreign ownership and total factor productivity of firms in the manufacturing industry can be observed. This finding is in line with previous research both in the CEE and worldwide in studies of the correlation between FDI and productivity.

Next, we continue with the estimations for individual sectors. Due to the small number of observations in some of the sectors, fixed effects estimation would likely be biased. Due to small sector size, for a significant share of sectors reliable fixed effects estimations could not be calculated. Hence, a random effects model is used for the individual sector estimations. A summary of the estimation results for the FDI variable is found in table 11.

Table 11: Regression results for direct effects of FDI, sector level

Study period: 1998-2004
Dependent variable: total factor productivity (Levinsohn Petrin estimation)

Sector	Variable	Random effects model		
		Coefficent	Std. Error*	p-value
15	FDI	10.35776	4.86852	0.033**
17	FDI	15.22494	7.624346	0.046**
18	FDI	23.33496	6.228721	0.000***

19	FDI	14.96608	8.391493	0.075*
20	FDI	9.371294	3.643389	0.010***
21	FDI	19.46034	8.584582	0.023**
22	FDI	13.42573	5.8511	0.022**
24	FDI	26.19725	7.635277	0.001***
25	FDI	10.38529	6.377401	0.103
26	FDI	17.60595	5.353733	0.001***
28	FDI	24.864	5.488746	0.000***
29	FDI	11.94521	4.474511	0.008***
31	FDI	8.199618	13.02732	0.529
32	FDI	13.84133	12.42766	0.265
33	FDI	20.80508	15.88509	0.190
34	FDI	9.132556	6.336951	0.150
35	FDI	42.68577	15.79011	0.007***
36	FDI	11.84778	3.202615	0.000***
37	FDI	31.99649	17.44806	0.067*
		***/**/* significant at 1/5/10 per cent level		
*robust standard errors Source: own calculations based on panel dataset				

The possibility that the results of the random effects estimation contain some degree of selection bias needs to be kept in mind for their interpretation. The extent of effect may be overestimated to a differing degree in different sectors. However, despite this fact the sector results still yield information about the sectors in which direct effects of FDI are more likely to play a greater role. This is particularly the case as the sectors in which a significant correlation between foreign ownership and total factor productivity of firms is found are mostly significant at the one per cent level. In a total of eight sectors this is the case.

While these eight sectors are quite diverse, two specific clusters can be identified. The first one is a knowledge and technology intensive cluster around machinery, metal products, mineral products and chemicals. These are sectors 24 and 26 to 29. The second cluster is interestingly related to wood processing, namely the wood sector itself (sector 20) and the furniture sector (sector 36). Both are sectors with a relatively high number of firms in which foreign owned tend to firm significantly larger than domestic firms as the descriptive data in chapter 4 shows. This fits our observation on productivity. It is likely that the larger foreign firms have greater economies of scale and that they are able to implement innovative changes more effectively than their small domestic counterparts. This may cause the high correlation between FDI and productivity in these sectors.

As a result, we can state that there is a correlation between foreign ownership and productivity at the firm level in the manufacturing industry. This is an indication that direct effects (own firm) indeed may cause higher productivity in foreign-owned firms. However, this evidence for these effects is clearly not evenly strong across different sectors. Rather, some sectors seem to profit more from a possible direct effect than others.

5.1.2. Indirect effects of FDI

Next, we estimate the regressions relating to the indirect effects of FDI on productivity. Hence, we include the linkage variables for horizontal, backward and forward linkages in our model as discussed in chapter 3.5.. All linkage variables are used in lagged form by one period. This regression is also estimated first for the complete manufacturing industry and then for individual sectors. Table 12 shows the estimation results for the complete manufacturing industry and table 13 shows estimation results for the individual sectors.

Table 12: Regression results for indirect effects of FDI, manufacturing industry level

Study period: 1999-2004
Dependent variable: total factor productivity (Levinsohn Petrin estimation)

Variable	Random effects model			Fixed effects model		
	Coefficent	Std. Error*	p-value	Coefficent	Std. Error*	p-value
ln K	6.135	0.449	0.000	5.190	0.710	0.000
ln L	-2.592	0.939	0.006	-6.920	1.547	0.000
ln M	-5.927	0.741	0.000	-9.738	1.182	0.000
HORIZ	1.069	3.571	0.765	8.638	4.864	0.076
BACKW	21.044	4.745	0.000	-11.927	6.366	0.061
FORWD	-18.700	2.076	0.000	14.967	2.975	0.000
constant	-4051.129	491.606	0.000	180.024	15.199	0.000
Sector dummy	included					
Year dummy	included					
Hausman test	Prob>chi2 = 0.0000					

*robust standard errors
Source: own calculations based on panel dataset

In the estimation of indirect effects of FDI, the results of the fixed effects and random effects estimation differ significantly from each other. Based on the dataset used and the result of a

Hausman test, the fixed effects model is preferable. The fixed effects estimation shows that horizontal, backward and forward linkage variables all have a statistically significant correlation with firm total factor productivity. This effects is most significant for the forward linkage variable. It is in an indication that firms which sell a greater share of their output to sectors with higher foreign concentration are expected to have higher total factor productivity. The next finding is that backward linkages are statistically significant but negative. This is an indication that receiving a higher share of output from foreign firms is correlated with lower total factor productivity in the receiving firm. The third finding concerning indirect effects is that horizontal linkages are correlated with higher firm productivity. Next, we discuss the sector-level correlation of FDI on total factor productivity.

Table 13: Regression results for indirect effects of FDI, sector level

Study period: 1999-2004
Dependent variable: total factor productivity (Levinsohn Petrin estimation)
Overview of statistically significant results (see appendix for full data)

Random Effects model									
Sector	Variable	Coefficent	Std. Err*	p-value	Sector	Variable	Coefficient	Std. Err.*	p-value
15	HORIZ	108.6483	47.79129	0.023**	28	HORIZ	256.0794	154.2808	0.097*
17	BACKW	-285.4084	64.75017	0.000***		BACKW	-455.923	220.637	0.039**
	FORWD	369.2086	85.36808	0.000***		FORWD	328.5662	116.1722	0.005***
18	HORIZ	-171.49	74.09196	0.021**	29	BACKW	-36.8536	53.05566	0.046**
20	HORIZ	-253.182	104.4676	0.015**		FORWD	87.61555	43.90553	0.000***
	BACKW	228.3616	85.06541	0.007***	32	HORIZ	1.522343	21.75657	0.07**
	FORWD	10.01837	4.920647	0.042**	33	HORIZ	-107.103	59.24474	0.071*
24	HORIZ	321.0668	145.6645	0.028**		BACKW	-215.571	62.72629	0.001***
	BACKW	-536.9405	254.4795	0.035**		FORWD	-124.781	49.51427	0.012**
25	HORIZ	261.517	129.0344	0.043**	36	HORIZ	-88.5301	44.74494	0.048**
						BACKW	-125.032	45.58966	0.006***
						FORWD	101.829	37.64726	0.007***

* robust standard errors
Source: own calculations based on panel dataset

***/**/* significant at 1/5/10 per cent level

The indirect effects at the sectoral level show a very diverse picture of different effects between sectors. There are some conclusions that can be drawn based on the random effects results. First, inter-sectoral effects are only measured in about half of the sectors while they are not significant in the remaining ones. The results for the remaining sectors can be found in the appendix.

Second, when inter-sectoral linkages are found they tend to have comparatively strong significance. Third, evidence for one kind of indirect effects in a sector makes it more likely that other kinds are also found. This is particularly true with forward and backward linkages where one kind often is observed together with the other.

5.2. Pecuniary externalities

As the second part of the empirical application we evaluate the evidence for pecuniary externalities of FDI through assessing the correlation between foreign concentration in a sector and the domestic firm entry rate in the following year. If FDI has an influence through changes in the market structure and on entry conditions for domestic firms, we would expect to see a correlation between foreign concentration and entry rate. If the correlation is positive, this would be an indication that foreign investment may act as a driver of local industrial development.

Table 14: Regression results for domestic firm entry rate

Study period: 1999-2003
Dependent variable: domestic firm entry rate per sector

Variable	Random effects model		
	Coefficent	Std. Error	p-value
GR	0.0616	0.0245	0.012
ln SIZE	-0.0071	0.0075	0.344
ln MES	-0.0028	0.0035	0.415
COMP	0.0940	0.2184	0.667
HORIZ	-0.0053	0.0343	0.876
constant	0.0873	0.0830	0.293
Hausman test	Prob>chi2 = 0.9362		

Source: own calculations based on panel dataset

The estimation the random effects model does not corroborate the assumption that FDI may serve as a source of local industrial development through increasing the entry rate of domestic firms in a sector. The findings for the relationship are statistically insignificant. The basic firm entry model employed cannot show that FDI affects the entry rate. This does however not mean that pecuniary externalities of FDI do overall not exist but only applies to the definition employed in this model. Pecuniary externalities on firm entry may require a longer time to emerge and hence may need a longer time horizon to be observable. They may exert a more indirect effect for instance through the development of price levels for goods traded between

sectors which may affect market conditions for domestic firms. Hence, the model used in this study does not find a correlation but could be extended in order to track pecuniary externalities more specifically.

6. Conclusions

Foreign direct investment and its effect on host countries have been much discussed topics in both academia and the public policy sphere. They likely will remain on the agenda in the future to come as states continue to compete for capital and knowledge accompanied by increasingly less restrictions on the international transfer of both of them. Likely, potential investors in the future will also be offered incentives by host governments.

The results of this study suggest that there may not be sufficient evidence for much special support being put in place to attract FDI. This study exploits a large and detailed panel data set of firms in the Estonian economy to assess the evidence of direct and indirect effects of FDI. The study is conducted through assessing the correlation of foreign ownership at the firm and sectoral level and firm productivity. Additionally, at the sectoral level the evidence for pecuniary externalities is evaluated through a model of domestic firm entry based on foreign investments in a sector.

The inflow of foreign direct investment may affect the host country through a large variety of different mechanisms which have been discussed in the literature. Most effects are not unequivocally positive or negative but depend much on case-specific circumstances. This study has assessed three mechanisms through which FDI may affect the host country. These are the direct (own firm) effects, indirect spillover effects and pecuniary externalities of foreign investment.

The results are mixed. This study adds to the existing literature through three results based on data for the Estonian economy. First, foreign ownership is found to have a positive correlation with productivity in firms in the host country. While the extent of this effect may vary between sectors, overall there is relatively strong evidence for direct effects of FDI on productivity. Second, the results are more mixed concerning indirect effects of FDI. The study finds horizontal and forward linkages to have a positive correlation with firm productivity while the correlation is

negative for backward linkages. The study makes it possible to compare effects in different sector for both direct and indirect effects, thereby providing directions for further research into sector-specific characteristics facilitating spillover effects. As a third finding, the study cannot corroborate the assumption that positive effects of FDI may to a significant extent occur through pecuniary externalities. The simply entry rate model employed in the study does not find a correlation between domestic firm entry and foreign concentration in a sector.

The results differ from much of the previous studies given the fact that most studies have found stronger evidence for a positive effect through backward linkages than for other kinds of spillovers. These mixed findings reflect the variety of mechanisms by which FDI affects a host country. The mixed findings point to the direction in which future research should continue. Most studies in the field focus on direct and indirect effects of FDI while the exact mechanisms through which spillovers occur still remain largely a "black box". This study makes a contribution to other kinds of spillovers through assessing the effect of FDI on one aspect of pecuniary externalities. Further research needs to aim at disentangling more precisely the specific mechanisms at work through which effects on the host country may occur. Given the promising findings concerning indigenous firm development found for mainly Ireland and Poland in the literature, the mechanisms of pecuniary externalities should be a focus of attention.

As with other studies in the same field, we need to be cautious with policy conclusions as we are measuring the correlation between two factors but not directly the possible causal link between them. Generally, there is evidence that inflow of FDI is correlated with increased productivity especially when ownership is transferred. This result provides some rationale for countries to actively encourage the inflow of foreign investments. However, policy also needs to incorporate the fact that the specific mechanisms of host country effect are still largely unclear.

These two policy implications are already found in the Estonian policy regime towards FDI and their continuation can hence be recommended. Based on the findings of this study, the strength of the regime lies in its focus on creating an overall favourable investment. This is in contrast to very specifically targeting sectors or kinds of investments and providing subsidies for these as has been the case in other countries. The rationale of specific subsidies is not sufficiently corroborated by the empirical literature including this study and hence may only distort investment flows. Estonia has been successful in the attraction of FDI through its policy of non-

discrimination between different sources of investments and hence its continuation can be recommended.

There is no reason why lessons from the Estonian FDI policy experience may not also be applicable in particular to other transition economies. However, particularly three specific characteristics of the Estonian situation need to be taken into consideration when applying similar measures as these characteristics may affect outcomes. First, Estonia early introduced a clear and consistent FDI policy regime. The small size of the country may have played a role in the quick and consistent implementation. Second, Estonia at the time of its economic liberalization already had a relatively high standard of development when compared to other transition economies. This may have facilitated the development of positive host country effects. Third, the cultural and geographic proximity to the Nordic countries has served as a comparatively easily accessible source of investments. Such an advantage is arguably not available to many other transition economies.

7. Appendix

Appendix: Regression results for indirect effects of FDI, sector level				
Study period: 1999-2004 Dependent variable: total factor productivity (Levinsohn Petrin estimation)				
Sector	Variable	Random effects model		
		Coefficent	Std. Error*	p-value
15	HORIZ	108.6483	47.79129	0.023**
	BACKW	60.46662	64.18597	0.346
	FORWD	-4.60302	9.295153	0.620
17	HORIZ	7.874538	6.696237	0.240
	BACKW	-285.4084	64.75017	0.000***
	FORWD	369.2086	85.36808	0.000***
18	HORIZ	-171.49	74.09196	0.021**
	BACKW	-36.15805	70.14407	0.606
	FORWD	107.4209	66.80178	0.108
19	HORIZ	-363.3114	730.8245	0.619
	BACKW	-90.99053	252.2163	0.718
	FORWD	1123.457	2039.455	0.582
20	HORIZ	-253.182	104.4676	0.015**
	BACKW	228.3616	85.06541	0.007***
	FORWD	10.01837	4.920647	0.042**
21	HORIZ	84.00779	219.4383	0.702
	BACKW	587.1753	1738.556	0.736

	FORWD	-8765.382	26773.18	0.743
22	HORIZ	16.52144	405.0925	0.967
	BACKW	-50.42496	466.7071	0.914
	FORWD	2.489286	15.46988	0.872
24	HORIZ	321.0668	145.6645	0.028**
	BACKW	-536.9405	254.4795	0.035**
	FORWD	60.26415	160.4213	0.707
25	HORIZ	261.517	129.0344	0.043**
	BACKW	69.54607	65.08481	0.285
	FORWD	-361.3796	236.9083	0.127
26	HORIZ	97.29398	93.83184	0.300
	BACKW	21.63538	112.3486	0.847
	FORWD	-75.43876	154.8777	0.626
28	HORIZ	256.0794	154.2808	0.097*
	BACKW	-455.9235	220.637	0.039**
	FORWD	328.5662	116.1722	0.005***
29	HORIZ	-36.85368	53.05566	0.487
	BACKW	87.61555	43.90553	0.046**
	FORWD	110.6455	31.37677	0.000***
31	HORIZ	.600165	9.816331	.951
	BACKW	-36.23904	87.42135	0.678
	FORWD	104.9645	117.7466	0.373
32	HORIZ	1.522343	21.75657	0.07**
	BACKW	-	-	-
	FORWD	-	-	-
33	HORIZ	-107.1033	59.24474	0.071*
	BACKW	-215.5712	62.72629	0.001***
	FORWD	-124.7813	49.51427	0.012**
34	HORIZ	-34.57129	347.9393	0.921
	BACKW	-7.126194	323.524	0.982
	FORWD	50.372	4064.411	0.990
35	HORIZ	32.43023	28.32748	0.252
	BACKW	-26.45678	131.8247	0.841
	FORWD	55.89969	85.78636	0.515
36	HORIZ	-88.53015	44.74494	0.048**
	BACKW	-125.0325	45.58966	0.006***
	FORWD	101.829	37.64726	0.007***
37	HORIZ	53.11422	70.73582	0.453
	BACKW	102.0371	296.1224	0.730
	FORWD	-9635.63	10973.19	0.380

*robust standard errors
Source: own calculations based on panel dataset

8. References

Ackerberg, D., C. Lanier Benkard, et al. (2007). "Econometric tools for analyzing market outcomes." Handbook of econometrics **6**: 4171-4276.

Ackerberg, D., C. Lanier Benkard, et al. (2007). "Econometric tools for analyzing market outcomes." Handbook of econometrics **6**: 4171-4276.

Acs, Z. J. and D. B. Audretsch (1989). "Small-firm entry in US manufacturing." Economica: 255-265.

Aitken, B. J. and A. E. Harrison (1999). "Do domestic firms benefit from direct foreign investment? Evidence from Venezuela." American economic review: 605-618.

Altomonte, C. and L. Resmini (2001). "Multinational corporations as catalyst for industrial development: the case of Poland."

Arnold, J. M. (2005). "Productivity estimation at the plant level: A practical guide." Unpublished manuscript **27**.

Baltagi, B. H. (2005). Econometric analysis of panel data, Wiley.

Barrios, S., H. Görg, et al. (2005). "Foreign direct investment, competition and industrial development in the host country." European Economic Review **49**(7): 1761-1784.

Blalock, G. and P. J. Gertler (2004). "Learning from exporting revisited in a less developed setting." Journal of Development Economics **75**(2): 397-416.

Blalock, G. and P. J. Gertler (2008). "Welfare gains from foreign direct investment through technology transfer to local suppliers." Journal of International Economics **74**(2): 402-421.

Blomstrom, M. (1992). Host country benefits of foreign investment, National Bureau of Economic Research.

Blomström, M. (1986). "Foreign investment and productive efficiency: the case of Mexico." The Journal of Industrial Economics: 97-110.

Blomström, M. and A. Kokko (1998). "Multinational corporations and spillovers." Journal of Economic surveys **12**(3): 247-277.

Blomström, M., A. Kokko, et al. (2000). Foreign direct investment: firm and host country strategies, Palgrave Macmillan.

Blomström, M. and F. Sjöholm (1999). "Technology transfer and spillovers: does local participation with multinationals matter?" European Economic Review **43**(4): 915-923.

Buckley, P. J. and M. Casson (1976). The future of the multinational enterprise, Macmillan London.

Buckley, P. J., L. J. Clegg, et al. (2007). "The determinants of Chinese outward foreign direct investment." Journal of international business studies **38**(4): 499-518.

Bwalya, S. M. (2006). "Foreign direct investment and technology spillovers: Evidence from panel data analysis of manufacturing firms in Zambia." Journal of Development Economics **81**(2): 514-526.

Cass, F. (2007). "Attracting FDI to transition countries: the use of incentives and promotion agencies." Transnational Corporations **16**(2): 77.

Caves, R. E. (1974). "Multinational firms, competition, and productivity in host-country markets." Economica **41**(162): 176-193.

Chuang, Y. C. and C. M. Lin (1999). "Foreign direct investment, R&D and spillover efficiency: Evidence from Taiwan's manufacturing firms." The Journal of Development Studies **35**(4): 117-137.

Coase, R. H. (1937). "The nature of the firm." Economica **4**(16): 386-405.

Damijan, J. P. and M. Knell (2005). "How important is trade and foreign ownership in closing the technology gap? Evidence from Estonia and Slovenia." Review of World Economics **141**(2): 271-295.

Damijan, J. P., M. Knell, et al. (2003). "The role of FDI, R&D accumulation and trade in transferring technology to transition countries: evidence from firm panel data for eight transition countries." Economic systems **27**(2): 189-204.

Damijan, J. P., S. Polanec, et al. (2007). "Outward FDI and Productivity: Micro-evidence from Slovenia." The World Economy **30**(1): 135-155.

Damijan, J. P., M. Rojec, et al. (2008). Impact of Firm Heterogeneity on Direct and Spillover Effects on FDI: Micro Evidence from Ten Transition Countries, Institute for Economic Research.

De Backer, K. and L. Sleuwaegen (2003). "Does foreign direct investment crowd out domestic entrepreneurship?" Review of Industrial Organization **22**(1): 67-84.

Dimelis, S. and H. Louri (2002). "Foreign ownership and production efficiency: a quantile regression analysis." Oxford Economic Papers **54**(3): 449-469.

Dimelis, S. P. and M. N. Lyriotaki (2007). "Inventory investment and foreign ownership in Greek manufacturing firms." International Journal of Production Economics **108**(1-2): 8-14.

Djankov, S. and B. Hoekman (2000). "Foreign investment and productivity growth in Czech enterprises." The World Bank Economic Review **14**(1): 49-64.

Driffield, N., M. Munday, et al. (2002). "Foreign direct investment, transactions linkages, and the performance of the domestic sector." International Journal of the Economics of Business **9**(3): 335-351.

Dunning, J. H. (1981). International production and the multinational enterprise, Allen & Unwin London.

Dunning, J. H. (1993). "Trade, location of economic activity and the multinational enterprise: a search for an eclectic approach." The theory of transnational corporations **1**: 183-218.

Dunning, J. H. (2000). "The eclectic paradigm as an envelope for economic and business theories of MNE activity." International business review **9**(2): 163-190.

Dunning, J. H. and S. M. Lundan (2008). Multinational enterprises and the global economy, Edward Elgar Publishing.

Findlay, R. (1978). "Relative backwardness, direct foreign investment, and the transfer of technology: A simple dynamic model." The Quarterly Journal of Economics **92**(1): 1-16.

Fotopoulos, G. and H. Louri (2004). "Firm growth and FDI: are multinationals stimulating local industrial development?" Journal of Industry, Competition and Trade **4**(3): 163-189.

Geroski, P. A. (1995). "What do we know about entry?" International Journal of Industrial Organization **13**(4): 421-440.

Girma, S., H. Görg, et al. (2008). "Exporting, linkages and productivity spillovers from foreign direct investment." Canadian Journal of Economics/Revue canadienne d'économique **41**(1): 320-340.

Girma, S., D. Greenaway, et al. (2001). "Who benefits from foreign direct investment in the UK?" Scottish Journal of Political Economy **48**(2): 119-133.

Glass, A. J. and K. Saggi (1998). "International technology transfer and the technology gap." Journal of Development Economics **55**(2): 369-398.

Globerman, S. (1979). "Foreign direct investment and'spillover'efficiency benefits in Canadian manufacturing industries." Canadian journal of economics: 42-56.

Görg, H. and D. Greenaway (2004). "Much ado about nothing? Do domestic firms really benefit from foreign direct investment?" The World Bank Research Observer **19**(2): 171-197.

Görg, H. and D. Greenway (2001). Foreign direct investment and intra-industry spillovers: a review of the literature, GEP.

Gorg, H. and E. Strobl (2001). "Multinational companies and productivity spillovers: A meta-analysis." The Economic Journal **111**(475): 723-739.

Görg, H. and E. Strobl (2002). "Multinational companies and indigenous development: An empirical analysis." European Economic Review **46**(7): 1305-1322.

Görg, H. and E. Strobl (2004). "Foreign direct investment and local economic development: Beyond productivity spillovers." Globalisation, Productivity and Technology Research Paper No. 2004/11.

Grossman, G. M. (1984). International trade, foreign investment, and the formation of the entrepreneurial class, National Bureau of Economic Research Cambridge, Mass., USA.

Haddad, M. and A. Harrison (1993). "Are there positive spillovers from direct foreign investment?* 1:: Evidence from panel data for Morocco." Journal of Development Economics **42**(1): 51-74.

Halpern, L. and B. Muraközy (2007). "Does distance matter in spillover? 1." Economics of transition **15**(4): 781-805.

Hanousek, J., E. Kocenda, et al. (2011). "Direct and indirect effects of FDI in emerging European markets: A survey and meta-analysis." Economic systems.

Harris, R. and C. Robinson (2004). "Productivity impacts and spillovers from foreign ownership in the United Kingdom." National Institute Economic Review **187**(1): 58-75.

Haskel, J. E., S. C. Pereira, et al. (2002). Does inward foreign direct investment boost the productivity of domestic firms?, National Bureau of economic research.

Heckman, J. (1979). "kSample Selection Bias as a Specification Error, lEconometrica, 47 (1)." $161: 153.

Heckman, J. J. and G. J. Borjas (1980). "Does unemployment cause future unemployment? Definitions, questions and answers from a continuous time model of heterogeneity and state dependence." Economica **47**(187): 247-283.

Hunya, G. (2004). "FDI in small accession countries: the Baltic states." EIB papers.

Hymer, S. (1960). The international operations of national firms: A study of direct foreign investment, Massachusetts Institute of Technology.

Javorcik, B. S. (2004). "Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages." The American Economic Review **94**(3): 605-627.

Javorcik, B. S. and M. Spatareanu (2005). "Disentangling FDI spillover effects: what do firm perceptions tell us?" Does foreign direct investment promote development: 45-72.

Javorcik, B. S. and M. Spatareanu (2008). "To share or not to share: Does local participation matter for spillovers from foreign direct investment?" Journal of Development Economics **85**(1-2): 194-217.

Jindra, B. (2005). "Theory and Review of latest research on the Effects of FDI into CEE." Technology Transfer via Foreign Direct Investment in Central and Eastern Europe, Palgrave Macmillan, Basingstoke.

Kokko, A., R. Tansini, et al. (1996). "Local technological capability and productivity spillovers from FDI in the Uruguayan manufacturing sector." The Journal of Development Studies **32**(4): 602-611.

Konings, J. (2001). "The effects of foreign direct investment on domestic firms." Economics of transition **9**(3): 619-633.

Kosova, R. (2010). "Do foreign firms crowd out domestic firms? evidence from the czech republic." The Review of Economics and Statistics **92**(4): 861-881.

Kugler, M. (2000). "The diffusion of externalities from foreign direct investment: theory ahead of measurement."

Kugler, M. (2006). "Spillovers from foreign direct investment: Within or between industries?" Journal of Development Economics **80**(2): 444-477.

Lall, S. (1980). "VERTICAL INTER-FIRM LINKAGES IN LDCs: AN EMPIRICAL STUDY*." Oxford Bulletin of Economics and Statistics **42**(3): 203-226.

Lipsey, R. E. and F. Sjoholm (2001). Foreign direct investment and wages in Indonesian manufacturing, National Bureau of Economic Research.

Markusen, J. R. (2004). Multinational firms and the theory of international trade, The MIT Press.

Markusen, J. R. and A. J. Venables (1999). "Foreign direct investment as a catalyst for industrial development." European Economic Review **43**(2): 335-356.

Marschak, J. and W. H. Andrews Jr (1944). "Random simultaneous equations and the theory of production." Econometrica, Journal of the Econometric Society: 143-205.

Masso, J., T. Roolaht, et al. (2010). "Foreign direct investment and innovation in Central and eastern Europe: evidence from Estonia." University of Tartu-Faculty of Economics and Business Administration Working Paper(67).

Mata, J. (1993). "Entry and type of entrant:: Evidence from Portugal." International Journal of Industrial Organization **11**(1): 101-122.

Meyer, K. E. and E. Sinani (2009). "When and where does foreign direct investment generate positive spillovers? A meta-analysis." Journal of international business studies **40**(7): 1075-1094.

Moran, T. H. (2005). "How does FDI affect host country development? Using industry case studies to make reliable generalizations." Does foreign direct investment promote development: 281-313.

Olley, S. and A. Pakes (1996). Dynamic Behavioral Responses in Longitudinal Data Sets: Productivity in Telecommunications Equipment Industry, Working Paper.

Orr, D. (1974). "An index of entry barriers and its application to the market structure performance relationship." The Journal of Industrial Economics **23**(1): 39-49.

Petrin, A., B. P. Poi, et al. (2004). "Production function estimation in Stata using inputs to control for unobservables." Stata Journal **4**: 113-123.

Regionali, S. and S. e Ricerche "Multinational Corporations as a Catalyst for Local Industrial Development. The Case of Poland."

Rivera-Batiz, L. A. and P. M. Romer (1990). Economic integration and endogenous growth, National Bureau of Economic Research.

Rodriguez-Clare, A. (1996). "Multinationals, linkages, and economic development." The American Economic Review: 852-873.

Rodrik, D. (1999). "Making openness work: the new global economy and the developing countries." Washington, DC: The Overseas Development Council.

Schoors, K. and B. Van Der Tol (2002). Foreign direct investment spillovers within and between sectors: Evidence from Hungarian data, Working Papers of Faculty of Economics and Business Administration, Ghent University, Belgium, 2002/157.

Shapiro, D. and R. S. Khemani (1987). "The determinants of entry and exit reconsidered." International Journal of Industrial Organization **5**(1): 15-26.

Sinani, E. and K. E. Meyer (2004). "Spillovers of technology transfer from FDI: the case of Estonia." Journal of Comparative Economics **32**(3): 445-466.

Smeets, R. (2008). "Collecting the pieces of the FDI knowledge spillovers puzzle." The World Bank Research Observer **23**(2): 107-138.

Stephan, J. (2006). Technology Transfer via Foreign Direct Investment in Central and Eastern Europe: Theory, Method of Research and Empirical Evidence, Palgrave Macmillan.

Stephan, J. (2006). Technology Transfer via Foreign Direct Investment in Central and Eastern Europe: Theory, Method of Research and Empirical Evidence, Palgrave Macmillan.

Tytell, I. and K. Yudaeva (2006). "The role of FDI in Eastern Europe and new independent states: New channels for the spillover effect." Centro Studi Luca d'Agliano Development Studies Working Paper No. 217.

UNCTAD 2012. Unctadstats database. Available at**:** unctadstat.unctad.org

UNCTAD 2010 World Investment Report. Available at**:** unctad.org/en/docs/wir**2010**_en.pdf.

Vahter, P. (2010). "Does FDI spur innovation, productivity and knowledge sourcing by incumbent firms? Evidence from manufacturing industry in Estonia." University of Nottingham Research Paper No. 2010/09.

Vahter, P. and J. Masso (2006). "Home versus host country effects of FDI: Searching for new evidence of productivity spillovers." William Davidson Institute Working Paper No. 820.

Vahter, P. and T. Ülikool (2004). The effect of foreign direct investment on labour productivity: evidence from Estonia and Slovenia, Tartu University Press.

Williamson, J. (1990). "What Washington means by policy reform." Latin American adjustment: how much has happened **7**: 7-20.

Yasar, M., R. Raciborski, et al. (2008). "Production function estimation in Stata using the Olley and Pakes method." Stata Journal **8**(2): 221.