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Pavla Nikolovová

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Dissertation Committee

Jan Hanousek (CERGE-EI, Charles University; chair)

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Evžen Kočenda (CERGE-EI, Charles University)

Krešimir Žigić (CERGE-EI, Charles University)

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Table of Contents

Abstract

In the first chapter of this work, I propose a simple theoretical model describing how the inflow of foreign direct investment (FDI) in a host country influences local competitors within the industry, and subsequently, what the impact of this change is on input supplying firms in the upstream sector. The model improves on existing theoretical work by incorporating two previously omitted factors: trade in intermediary goods and heterogenous efficiency of firms. The main conclusion is that FDI inflow has the potential to increase the demand for intermediary goods even though some of the old customers among the domestic firms are crowded out from the market. This effect is offset by the increased production of multinational enterprises (MNEs).

In the second chapter, I discuss the fact that even though the presence of a foreign firm is considered to have strong potential to improve domestic economic conditions, including the performance of domestic firms within the sector where MNEs enter, empirical studies of the actual impact of FDI inflow on domestic firms present rather ambiguous results. I argue that this is due to some limitations of the most prevalently used methodology, which does not separate the FDI spillover effects from changes in the competitive environment faced by domestic firms. In my research, I propose a novel estimation strategy that allows me to disentangle FDI spillovers from the effects of changing competition in response to the entry of a foreign firm. I consider this issue on the industry level, and I compare the effects of FDI to the impact of international trade on the domestic economy. My identification strategy leads me to confirm the presence of positive spillovers stemming from FDI.

In the last chapter, I describe sourcing patterns of FDI activity and test empirically whether their impact on upstream sectors of the host economy is as predicted by theoretical models. My aim is to fill a significant gap that exists in the empirical literature concerning this particular issue and to provide conclusions that could support potential policy recommendations. I focus on inter-industry interactions between an MNE, which enters the domestic market and other firms in the economy within the broader context of international trade flows: I seek to determine if the MNE uses domestic suppliers of intermediate goods, or if it purchases its supplies from abroad or from other MNEs entering the downstream sector.

My empirical analysis in the second and third chapters cover the time period 2001 – 2007 and concerns both Western and Eastern European countries.

Abstrakt

V první kapitole této práce navrhuji jednoduchý teoretický model popisující, jak příliv přímých zahraničních investic (FDI) do hostitelské země ovlivňuje místní konkurenci v rámci daného odvětví, a následně jaký je dopad této změny na dodavatele do tohoto odvětví. Můj model vylepšuje stávající teoretické práce zahrnutím dvou dříve opomíjených faktorů: obchodu s meziprodukty a heterogenní efektivity firem. Hlavním závěrem této časti je, že příliv FDI má potenciál zvyšovat poptávku po meziproduktech, přestože někteří z původních zákazníků mezi domácími firmami jsou vytlačeni z trhu. Tento efekt je totiž kompenzován zvýšenou produkcí nadnárodních firem.

Ve druhé kapitole se zabývám skutečností, že i přesto, že přítomnost zahraničních firem je považována za silný impuls pro zlepšení domácích ekonomických podmínek včetně produktivity domácích firem v odvětví, kam nadnárodní společnosti vstupují, empirické studie skutečného dopadu FDI na domácí podniky přináší spíše nejednoznačné výsledky. Argumentuji, že se tak děje kvůli některým omezením převážně používané metodiky, která neodděluje efekty technologického transferu od změn v konkurenčním prostředí, kterému čelí domácí firmy. Navrhuji novou strategii odhadu, který mi umožňuje oddělit účinky technologického transferu od účinků změny konkurence v reakci na vstup zahraniční firmy. Disktuji tuto otázku na úrovni odvětví a porovnávám dopad FDI s dopadem mezinárodního obchodu na domácí ekonomiku. Moje identifikační strategie mě vede k potvrzení přítomnosti pozitivních vedlejších efektů vyplývajících z přímých zahraničních investic.

V poslední kapitole popisuji dodavatelské vztahy nadnárodních firem a empiricky testuji, zda jejich dopad na hostitelskou ekonomiku odpovídá předpovědím teoretických modelů. Mým cílem je zaplnit významnou mezeru empirické literatury týkající se tohoto konkrétního problému a poskytnout závěry, které by mohly sloužit jako podpora pro potenciální politická doporučení. Zaměřuji se na meziprůmyslové interakce mezi nadnárodní firmou, která vstupuje na tuzemský trh, a ostatními firmami v ekonomice v širším kontextu mezinárodních obchodních toků: snažím se zjistit, zda nadnárodní společnosti využívají domácí dodavatele zboží nebo zda nakupují meziprodukty v zahraničí nebo od jiných nadnárodních společností vstupujících do navazujících odvětví.

Má empirická analýza provedená ve druhé a třetí kapitole se vztahuje na časové období 2001 - 2007 a týká se zemí jak západní, tak východní Evropy.

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All errors remaining in this text are the responsibility of the author.

Czech Republic, Prague | Pavla Nikolovová
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Introduction

In my thesis, I focus on issues related to the growing importance of international transactions in the global economy, both in the sense of moving capital and traded goods. My main purpose is to explore the issue of foreign direct investment (FDI) and various ways in which it can affect conditions in domestic markets, taking into account the global context of this phenomenon, which both substitutes and complements international trade relations.

FDI is an operation through which a multinational enterprise (MNE) acquires substantial control over a domestic firm in the target economy. FDI can be realized in several ways from which the literature distinguishes mainly between takeovers, where foreign capital enters an existing domestic company and greenfield projects, where a new firm is created with foreign capital. Under both of these arrangements, net investment inflows nowadays represent several percent of GDP in both developed and developing countries, and sales of the biggest MNEs are larger than the GDP of many developed economies. In Central and Eastern Europe particularly, the volume of FDI has been increasing over the past twenty years, and it has been seen as one of the factors which are significantly re-shaping the economies in transition from being centrally planned to being a market system. It has generally been welcomed and even promoted by domestic governments, and the debate among policy makers about how to attract foreign investors is still ongoing.

In the academic environment, there is also an ongoing debate about FDI, trying to understand what the impact of the presence of MNEs is in the domestic market and what the different ways are in which it can be beneficial to the host economy. Several arguments have been made in favor or against FDI, and many questions are yet unresolved. Throughout the thesis, I will summarize these arguments as well as the theoretical models and empirical results on which they are based. I will present my own point of view and I will show what gaps in the existing literature my work may help to fill.

In my thesis, I view FDI inflow as a shock that changes the market environment and not only represents a new challenge but also a new opportunity for domestic firms. I argue that operations of MNEs change both the level of competition within the industry, and also the structure of intermediary goods traded across industries, with implications for international trade flows.

I base my work on a theoretical model, which I present in the first chapter of my dissertation, and then I follow with two empirical studies that test the predictions of my model on data for European countries (with a special focus on CEE countries) in the years 2001-2007.

Chapter 1

Multinational Customers - a Curse or a Blessing? A Theoretical Model of Intra- and Inter-industry Impacts of FDI

1.1 Introduction

The research presented in this chapter enters into the stream of literature studying foreign direct investment and the ways in which it is re-shaping the structure of the host country industry via linkages among firms. This question has attracted the attention of many researchers, who would like to analyze and describe the impact that the inflow of FDI has on host markets.

Even though the research in this field is very intensive and the literature is extremely abundant, there are still significant gaps that need to be filled. For instance, there is a clear dominance of empirical work that analyzes the issue of FDI, relying on rather scarce theoretical support. There are only a very limited number of papers that propose a theoretical model describing how the inflow of FDI influences the conditions in the target industry as well as in related sectors, and the papers that exist have severe limitations and definitely can be improved.

This is exactly the main purpose of the first chapter of my dissertation, where I propose a simple theoretical model describing how the inflow of FDI in a country influences the local competitors within the sector, and subsequently, what the impact of this change is on input-supplying firms in the upstream sector. The main focus is on the research question of whether the entry of new MNEs increases or decreases the demand for inputs, but many other interesting results are derived along the way. These are discussed with respect to existing empirical evidence in order to show that the predictions of my model can help to explain the complex reality of the issue of FDI.

1.2 Literature review

The literature dedicated to the activity of multinational firms and its influence on the target economy distinguishes two types of FDI impact: one on the horizontal level and the other on the vertical level. The horizontal level consists of interactions within the industry in which the MNE entered, i.e., among its local competitors. The vertical level consists of interactions with either upstream (backward linkages) or downstream (forward linkages) domestic firms, i.e., the suppliers or the customers of the MNE. Both on the vertical and horizontal levels, theoretical literature mentions two main channels of interactions between the MNE and other firms in the economy. The first channel concerns the market structure: The entry of a foreign investor increases competition on the horizontal level and at the same time increases the demand for intermediate goods on the vertical level. The second channel concerns technology transfers (also called spillovers): Technologically more advanced MNEs represent a positive example that domestic firms can follow by copying or by hiring workers or managers that have had experience in these multinational companies.

Both of these channels are described in the theoretical model of Markusen and Venables (1999), who compare three different scenarios: 1) the goods on the domestic market produced by domestic firms, 2) the goods produced by MNEs operating in the domestic market and 3) the goods imported from abroad. The model predicts that the second and the third scenarios increase competition within the industry and may thus threaten domestic firms, but the second scenario also has the potential to create positive market linkages between industries by boosting demand for intermediate goods and bringing profit to domestic suppliers. In addition, the second scenario, as opposed to the third one, also provides scope for technological spillovers, assuming that these need a face-to-face interaction between the two parties (domestic firms and MNEs), a hypothesis also supported by Ethier (1986).

In the empirical literature, the focus is mainly on technological spillovers and questions of the changing market structure are often disregarded. Keller (2010) revises empirical evidence on the impact of FDI and clearly illustrates that the majority of studies published in this field concern technological transfers. An even more detailed survey of these papers can be found in Hanousek, Kocenda, and Maurel (2011) who show that horizontal spillovers are often found to be insignificant or negative and forward spillovers are found to be insignificant, whereas backward spillovers are found to be significant and rather positive. However, this evidence is very mixed and depends usually on the country and time period over which the analysis was performed. The reason for these heterogeneous results lies in the limitations of the commonly used methodology — TFP estimation of the production function. As Melitz (2000) shows, this method does not allow us to separate demand and technology shocks, and since we know from the above mentioned theoretical model that both are present when FDI is shaping the domestic market, we should consider this inability to disentangle technological spillovers from changes in demand as a significant methodological drawback.

Javorcik and Spatareanu (2005) discuss this issue for the particular case of backward spillovers. They claim that the activity of MNEs in an upstream sector may both increase the demand for intermediate goods as well as lead to technological spillovers towards suppliers of these goods. In both cases, the impact on the downstream sector is positive, which implies that if an empirical study finds a positive correlation between the presence of an MNE and the productivity of domestic suppliers (which is usually the case), it does not really prove the presence of spillovers because these are not disentangled from the effect of increasing demand.

On the other hand, a question has to be asked if indeed the inflow of FDI in the upstream sector necessarily means that the demand for intermediate goods increases. To understand under which conditions this happens, we have to refer again to Markusen and Venables (1999), the seminal paper of the field[1]. The authors argue that if the number of MNEs in the upstream sector increases, some domestic firms from that particular sector

[1]Markusen and Venables (1999) is one of two theoretical models that study the impact of MNEs on the local suppliers of intermediate goods, and it reflects the situation when MNEs and domestic firms produce comparable types of final goods. The second model, proposed by Rodríguez-Clare (1996), is more suitable in the context of underdeveloped countries (which is the explicit intention of the author) because it assumes a large technological difference between the MNE's country of origin and the target country, leading to a production of different types of final goods. Rodríguez-Clare (1996) considers the situation when domestic firms in the FDI target country are not able to produce more complex final goods because there are not enough suppliers of more sophisticated intermediate goods (that would be necessary for such production) in the country, and, unlike the MNEs, the domestic firms cannot import the intermediate goods from abroad. It is the activity of the MNEs that can, under specific conditions, induce the production of sophisticated intermediate goods in the country and thus also the production of more complex final goods, which is seen as the positive effect of the MNE activity.

are crowded out from the market (a prediction that is also confirmed by Kosova (2010)). The incoming MNEs raise the demand for intermediate goods, but the crowding out of domestic firms has the opposite effect. Overall, the demand created by the MNEs may or may not offset the loss of demand by domestic firms that have been crowded out, and so the effect on domestic suppliers may be either positive or negative. In Markusen and Venables (1999) model, the sign of the effect depends mainly on the intensity with which the domestic firms and the MNEs use intermediate goods: If MNEs use them less intensively, they will not offset the loss of demand by domestic firms that have been crowded out.

There are two significant drawbacks of this model. The first one is that it does not allow for trade in intermediate goods, which is a very unrealistic assumption in today's globalized economy, especially given multiple theoretical analyses (see e.g. Helpman (1984)) and empirical evidence (see e.g. Javorcik and Spatareanu (2009)) about the close link between FDI and trade patterns. The second one is that the model does not consider heterogeneous firms: the efficiency is the same for all domestic firms and for all MNEs (meaning that domestic firms and MNEs can have a different efficiency level, but this efficiency does not vary within the two groups). This leads to an equilibrium in which either only domestic firms or only MNEs can operate in the upstream sector, which is another unrealistic property of the model. The purpose of my work is to improve upon these two mentioned drawbacks and present a model of the impact of FDI on domestic suppliers of intermediate goods that leads to more sensible predictions that could be tested empirically in further research.

1.3 Model

1.3.1 Geography and industry structure

In my model, there are two countries, which I will refer to as the Domestic country and the Foreign country. In both countries, there is production of two types of goods: consumer goods and intermediate goods. Whereas for the production of intermediate goods, only one input is required (the numeraire good, can be also thought of as labor input), for the production of consumer goods, the numeraire good as well as the intermediate goods are required as inputs.

The producers of the consumer goods have to purchase the intermediate goods. There is trade in intermediate goods between the two countries, and so the producers of consumer goods can purchase the intermediate goods locally (from their own country) or import them from abroad. There is no trade in consumer goods; these can be produced only locally. However, in addition to domestic firms, in the sector of consumer goods, there are also multinational firms (MNEs) — firms with foreign owners that operate in the Domestic country. In other words, consumer goods can be produced by domestic firms or by firms with foreign owners, but all these firms have to be situated in the country where the goods are sold.

The focus of the analysis is on the firms in the Domestic country. The industry structure there (in the sense of the source of the two goods) can be visualized as follows:

$$\begin{cases} \text{Intermediary goods} & \begin{cases}\text{Domestic firms}\\ \text{Foreign firms (imported goods)}\end{cases} \\ \\ \text{Consumer goods} & \begin{cases}\text{Domestic firms}\\ \text{Multinational firms}\end{cases}\end{cases}$$

Such a structure reflects the research idea of my model: It serves to analyze how an increase in the number of multinational firms affects the domestic firms within the sector (of consumer goods) and the trade flows from the upstream sector (of intermediate goods) in terms of sourcing patterns, i.e. in terms of the share of purchases from domestic suppliers or imports from abroad.

We know that MNEs do not use only domestic suppliers: for example, Javorcik and Spatareanu (2009) discuss that in some cases, MNEs prefer to source their supplies abroad because the higher quality of imported intermediaries can offset the transportation costs. Also, there is a whole strand of literature dedicated to vertically integrated industries predicting that MNEs may have access to intermediate goods produced by their own subsidiaries at lower prices, which would also offset transportation costs that arise in cases where these subsidiaries are abroad (e.g. in the country of origin of the MNE). It is therefore essential to allow for trade in intermediate goods, which is what I do in my model, bringing thus a significant improvement into the original Markusen and Venables (1999) framework.

On the other hand, I simplify this framework by forcing only local production in the consumer goods sector. I realize that this is rather unrealistic and that this restriction could be alleviated in future extensions of the model. However, it can be foreseen that allowing for trade in intermediate goods would not significantly enrich my model's predictions. This issue is already treated in Markusen and Venables (1999), who show that foreign firms exporting to the Domestic country in the sector of consumer goods replace some of the MNEs. They have a similar competition effect (crowding out) on the domestic firms in the sector, but it is assumed that they do not source from domestic suppliers. Hence, it can be easily seen that imports of consumer goods should not affect the domestic producers of intermediate goods. If we accept this assumption, the structure of industries in my model is sufficient to answer my research question while being simple enough for tractable analysis.

1.3.2 Monopolistic competition and heterogeneous firms

Like Markusen and Venables (1999), I use the Dixit and Stiglitz (1977) model to describe the structure within each industry. This means that in both consumer goods and intermediate goods industries, there is a continuum of firms, each producing a variety of the given good and each behaving as monopolist over that variety, i.e., each firm maximizing its profits by choosing the price of the variety it is producing. All varieties within each of the two industries are substitutes, and both industries can be characterized by the overall price index q that combines the prices p of the varieties ω and their elasticity of substitution θ:

$$q = \left(\int\limits_{\omega \in \Omega} p^{1-\theta}(\omega) \mathrm{d}\omega \right)^{\frac{1}{1-\theta}} ,$$

where Ω is the set of all available varieties within the industry. Even though each firm chooses a price for its product, it is considered to be too small to influence the overall price index.

The prices that firms choose depend on their efficiency. There is one substantial difference in my approach as compared to Markusen and Venables (1999), who treat the firms within the industry as being the same in terms of efficiency; more precisely, in the sector of consumer goods, they allow the domestic firms to have a different efficiency from the multinationals, but all domestic firms are supposed to be the same, and all MNEs are supposed to be the same, as well (and therefore, there is one price charged by all domestic firms and a second price charged by all MNEs). This leads to a rather unpleasant property in the equilibrium of the Markusen and Venables (1999) model, where either only domestic or only multinational firms can operate in the market. To remedy this unrealistic consequence, in my model I allow the firms in both sectors to have different degrees of efficiency defined in the following way: A more efficient firm needs less input to provide the same level of output. This can be seen as technical efficiency, but ultimately also as cost efficiency because a lower factor requirement means lower costs of production. Firms with different levels of efficiency charge, consequently, different prices, similarly as in the model of Melitz (2003).

1.3.3 Intermediate goods sector

Basic setup

All firms in this sector use for the production only the numeraire good. They have different levels of efficiency $\nu > 0$: The firm with efficiency level ν needs ν units of the numeraire good to produce one unit of the intermediate good. Hence, lower ν means higher efficiency. The level of efficiency determines the price that the firm sets for its product, the amount produced, and hence, also its profits, as we will see later.

The total volume of intermediate goods demanded will be denoted by I and specified later because it is conditioned by the factor requirements of the sector of consumer goods. From the Dixit-Stiglitz model, we know that the demand $x_i(\omega)$ for each variety of intermediate goods ω that has a price $p_i(\omega)$ is

$$x_i = I p_i^{-\theta} q_i^{\theta} \quad , \tag{1.1}$$

where θ is the elasticity of substitution between varieties (note that $\theta > 1$ by an assumption in the Dixit-Stiglitz model). The reference to variety ω was omitted as it will be throughout the rest of the chapter, but the reader should keep in mind that all firm-specific characteristics and quantities are referring to one variety of intermediate good. The index i denotes the sector of intermediate goods and will be complemented, when necessary, by indices d or f to distinguish between domestic and foreign firms respectively.

When we consider the domestic firms in the sector, we can define their revenues as $p_{id}x_{id}$ (price set times quantity produced) and their costs of production as $x_{id}\nu_{id} + F_{id}$, where F_{id} is the fixed cost and $x_{id}\nu_{id}$ the variable cost (quantity produced times input requirement times the price of the input — the numeraire good, which is normalized to one). Hence, the profit of a domestic firm in the sector of intermediate goods is

$$\pi_{id} = p_{id}x_{id} - x_{id}\nu_{id} - F_{id} \quad ,$$

and, as a monopolist over the variety, the firm maximizes this profit by setting the price

$$p_{id} = \sigma\nu_{id} \quad , \tag{1.2}$$

where $\sigma = \frac{\theta}{\theta-1} > 1$[2].

When we consider the foreign firms in the sector, we can again define their revenues as $p_{if}x_{if}$, but we have to redefine the costs as $x_{if}\tau_{if}\nu_{if} + F_{if}$. The term τ_{if} represents the transportation costs, modeled here as iceberg cost. In order to sell one unit of the produced good on the domestic market, the foreign firm has to produce τ_{if} units, where $\tau_{if} > 1$. Hence, the foreign firm maximizes the profit

$$\pi_{if} = p_{if}x_{if} - x_{if}\tau_{if}\nu_{if} - F_{if}$$

and sets the price

$$p_{if} = \sigma\tau_{if}\nu_{if} \quad . \tag{1.3}$$

The price of a variety of the intermediate good thus depends on whether the producing firm is foreign or domestic. The notation can be unified if we define transportation costs for domestic firms formally as $\tau_{id} = 1$ and hence $p_{id} = \sigma\tau_{id}\nu_{id}$. This allows us to define a generalized cost efficiency level for all firms in the sector as

$$\psi = \nu\tau_i \quad ,$$

which takes into account both the efficiency of the firm and the transportation costs which the firms face. Higher transportation costs τ_i lead to higher ψ and thus to a less efficient firm. In other words, foreign firms must be more efficient (in terms of having lower ν) than domestic firms in order to compensate for transportation costs and to serve the domestic market.

Overall, the expressions (1.2) and (1.3) can be unified, and the price for a variety of

[2] See the derivation in Appendix 1.A.1.

intermediate good can be written as

$$p_i = \sigma\psi \quad . \tag{1.4}$$

Simple comparative statics show that $\frac{\partial p_i}{\partial \psi} = \sigma > 0$, which means that less efficient firms (with higher ψ) set higher prices.

Using the expression for price (1.4), we get the amount of the variety produced

$$x_i = I\sigma^{-\theta}\psi^{-\theta}q_i^{\theta}$$

and the profit of the firm

$$\pi_i = I\sigma^{-\theta}q_i^{\theta}(\sigma - 1)\psi^{1-\theta} - F_i \quad . \tag{1.5}$$

Simple comparative statics show that $\frac{\partial x_i}{\partial \psi} < 0$ and $\frac{\partial \pi_i}{\partial \psi} < 0$, which means that more efficient firms (with lower ψ) produce larger amounts and have larger profits. Further, we can also see that both the amount produced and the profit depend positively on the price index q_i.

Equilibrium conditions

The purpose of this section is to determine what the price index q_i is and how many producing firms are in the market in equilibrium. The mass of producing firms is modeled by the distribution of the generalized efficiency ψ, which is assumed to be drawn from a continuous distribution defined on the interval $[\underline{\psi}, \overline{\psi}]$. Only firms with positive profits can operate in the market, which means that firms that are efficient enough (have ψ low enough) can actively produce: In equilibrium, there is a cut-off efficiency level ψ^* above which the firms cannot operate in the market. Throughout this chapter, I will assume that $\psi^* < \overline{\psi}$: The efficiency distribution is such that if the conditions on the market become more favorable, there are potential new firms that were not able to produce before but are now able to start their production.

The efficiency cut-off level represents the number of firms in the industry: When ψ^* is higher, the mass of firms producing intermediate goods is larger. As it was mentioned in the previous section, the output and profits of all these producing firms are influenced by the price index q_i. Hence, to determine the price index and the efficiency cut-off level, it is essential to understand how many firms can operate in the sector and what their profits are.

There are two conditions that allow us to determine the equilibrium: I will call them the Price Index condition and Zero-Profit condition. The Price Index condition (PIC) is given simply by redefining the price index q_i so that the firms are indexed by their generalized efficiency ψ:

$$q_i = \left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi) \mathrm{d}\psi \right)^{\frac{1}{1-\theta}} \quad . \tag{1.6}$$

The Zero-Profit condition (ZPC) determines the profit of a firm with the cut-off level productivity. We know from the previous section that lower productivity represented by higher ψ leads to lower profits, and so the cut-off firm is the one with minimum productivity (maximum level of ψ) such that its profit is still non-negative. Hence, in this limiting case, we can say the profit of the cut-off firm is equal to zero:

$$\pi\left(\psi^*\right) = 0 \quad .$$

By using equation (1.5) and assuming fixed costs F_i to be the same for all firms in the sector, we can express the price index q_i as a function of the cut-off productivity level ψ^* and some parameters:

$$q_i = I^{-\frac{1}{\theta}} \sigma (\sigma - 1)^{-\frac{1}{\theta}} F_i^{\frac{1}{\theta}} {\psi^*}^{\frac{\theta - 1}{\theta}} \quad . \tag{1.7}$$

Equations (1.6) and (1.7) give us the two conditions for determining q_i and ψ^* in equilibrium.

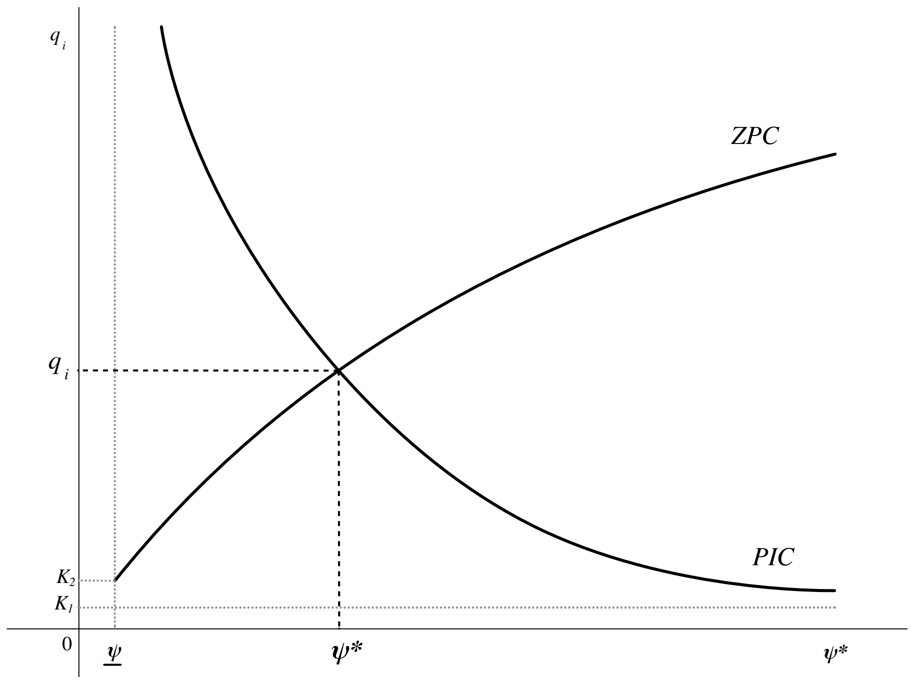
To illustrate the equilibrium, I draw the two functions given by equations (1.6) and (1.7) in the ψ^* - q_i phase space, where I let ψ^* go from $\underline{\psi}$ to $+\infty$. It is easy to mathematically derive[3] that whereas the PIC curve is decreasing with ψ^*, the ZPC curve is increasing with ψ^*, and the two curves have to cross at some point, which then defines the equilibrium. This property of the PIC and ZPC conditions has a clear economic meaning. When the cut-off efficiency level ψ^* is higher, there are more firms in the market, and the competition between the varieties pushes the price index down (PIC is decreasing with ψ^*). However, this also means that less efficient firms are in the market, and to allow them to have positive profit, the price index has to be higher (ZPC is decreasing with ψ^*). These two effects go in opposite directions, and they offset each other in the

[3] See the derivation in Appendix 1.A.1

equilibrium.

The two conditions are visualized in Figure 1.1. The intersection of the two curves determines the equilibrium price index and the productivity cut-off level.

Figure 1.1: Equilibrium



Properties of equilibrium

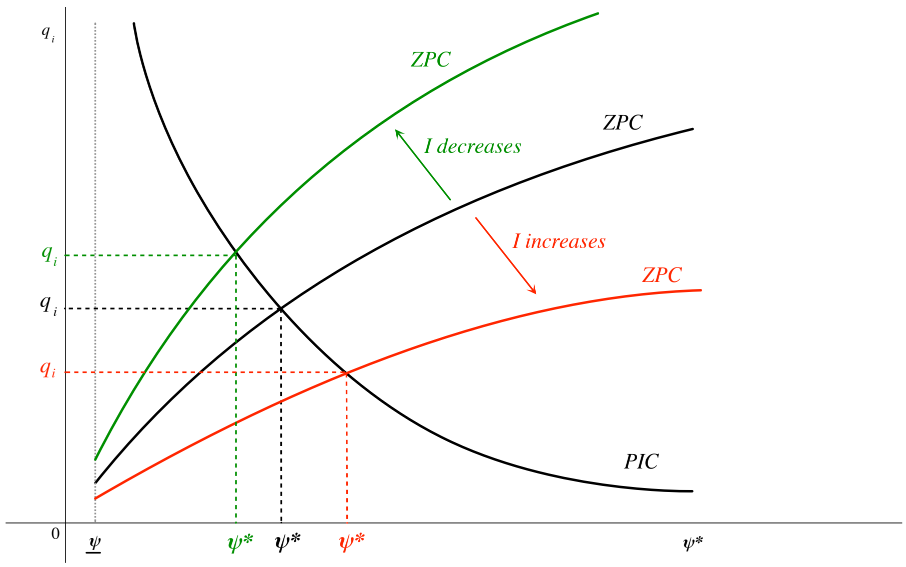
From the equations of the two conditions, we can see that they depend on a set of other model parameters. Most of these are just exogenously given quantities, but there is an important factor which is not exogenous to the model: it is the demand for intermediate goods conditioned by the production in the sector of consumer goods - I. In the subsequent section, I will derive how I is influenced by the increase of the number of multinational firms in this sector, but here let me show how the change in I affects the sector of intermediate goods.

I will illustrate this impact graphically, using the PIC and ZPC conditions that determine the equilibrium. From equation (1.6), we see that I has no impact on the PIC condition. However, I appears in the ZPC condition given by (1.7), and we can easily derive that

$$\frac{\partial q_i}{\partial I} = -\frac{1}{\theta} I^{-\frac{1+\theta}{\theta}} \sigma(\sigma-1)^{-\frac{1}{\theta}} F_i^{\frac{1}{\theta}} \psi^{*\frac{\theta-1}{\theta}} < 0 \quad .$$

This means that when I increases, the ZPC curve shifts down and vice versa. This is visualized in Figure 1.2, where also the impact on equilibrium values of q_i and ψ^* is illustrated. We can see that if I increases, ψ^* increases and q_i decreases. This means the

Figure 1.2: Impact of I on equilibrium



increase in demand allows firms with lower levels of efficiency to operate in the market because it offsets the decrease in the price index given by the larger amount of varieties of intermediate goods at disposition. When I decreases, the effect is the opposite.

This observation is formally summarized in the following lemma, whose proof can be found in Appendix 1.A.1.

Lemma 1. *When the demand for intermediate goods I increases, the price index q_i decreases and the efficiency cut-off level ψ^* increases:*

$$\frac{\mathrm{d}q_i}{\mathrm{d}I} < 0 \qquad \textit{and} \qquad \frac{\mathrm{d}\psi^*}{\mathrm{d}I} > 0 \quad .$$

In section 1.3.5 of this chapter, I will explain under what conditions the demand for intermediate goods rises when new multinational firms enter the sector of consumer goods. According to Lemma 1, in such circumstances the efficiency cut-off level ψ^* rises, which means that, overall, there are more active firms in the sector of intermediate goods. The question is what happens to the profits of these firms and especially to the profits of the firms that were active before the change of ψ^*. It is easy to show that for these firms, the profits are larger than before the change, as summarized in the following Lemma, whose proof we provide in Appendix 1.A.1:

Lemma 2. *If the efficiency cut-off level in the sector of intermediate goods increases, the profits of firms operating in this sector rise.*

This Lemma allows us to see that if the efficiency cut-off level ψ^* rises as a consequence of an increasing demand for intermediate goods, not only are there more active firms in the sector of intermediate goods, but also all firms in this sector have larger profits. The rise in demand for intermediate goods has therefore a positive effect on all suppliers of these goods. I will determine if the increase in the number of multinational firms in the consumer goods sector can lead to a rise in demand for intermediate goods and hence towards a positive effect on the suppliers of intermediate goods later on in this chapter. Before I do so, I need to derive the basic characteristics of this sector.

1.3.4 Consumer goods sector

Basic setup

Recall that in the consumer goods sector, there are domestic and multinational firms operating in the market, but no consumer goods can be imported from abroad (so there are no foreign firms). All firms in this sector use for the production the numeraire good and the intermediate good. Following a similar notation as Markusen and Venables (1999), I assume that the proportion of intermediate versus numeraire good needed for the production is $\mu_c : 1 - \mu_c$ (index c stands for the sector of consumer goods). Unlike Markusen and Venables, I keep this proportion the same for domestic and multinational firms.

As in the intermediate goods sector, the firms in the consumer goods sector have different levels of efficiency $\varphi \in [\underline{\varphi}, \overline{\varphi}]$, where $\underline{\varphi} > 0$: The firm with efficiency level φ needs φ units of inputs to produce one unit of intermediate good. Hence, lower φ means higher efficiency. The level of efficiency determines the price that the firm sets for its product, the amount produced, and hence also its profits, as we will see later. As in the sector of intermediate goods, there is a cut-off level of efficiency here, which I denote as φ^* and which I assume to be such that $\varphi^* \in [\underline{\varphi}, \overline{\varphi}]$. This cut-off level allows me to write the price index for consumer goods q_c as

$$q_c = \left(\int_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi) \mathrm{d}\varphi \right)^{\frac{1}{1-\varepsilon}} \quad , \tag{1.8}$$

where $\varepsilon > 1$ is the elasticity of substitution between the varieties of consumer good.

Similarly as in Markusen and Venables (1999), the demand for consumer goods with respect to the price index is modeled as $Cq_c^{-\eta}$, where C and η are constants such that $C > 0$ and $1 < \eta < \varepsilon$ (these assumptions are the very same that Markusen and Venables use in their paper). From the Dixit-Stiglitz model, we know that the demand x_c for each variety of consumer goods that has the price p_c is

$$x_c = p_c^{-\varepsilon} C q_c^{\varepsilon-\eta} \quad . \tag{1.9}$$

Following the same logic as in the sector of intermediate goods, the profit of the firm with efficiency level φ in the sector of consumer goods is defined as

$$\pi_c = p_c x_c - x_c \varphi \left(1 - \mu_c + \mu_c q_i\right) - F_c \quad ,$$

and the firm maximizes this profit by setting the price

$$p_c = \alpha \mu(q_i) \varphi \quad , \tag{1.10}$$

where $\alpha = \frac{\varepsilon}{\varepsilon-1} > 1$, and $\mu(q_i) = 1 - \mu_c + \mu_c q_i$[4].

Given this price, the amount produced by the firm is

$$x_c = \alpha^{\varepsilon} \varphi^{-\varepsilon} \mu^{-\varepsilon}(q_i) C q_c^{\varepsilon-\eta} \quad , \tag{1.11}$$

and the profit is

$$\pi_c = (\alpha - 1) \alpha^{\varepsilon} \mu^{1-\varepsilon}(q_i) C q_c^{\varepsilon-\eta} \varphi^{1-\varepsilon} - F_c \quad .$$

Simple comparative statics show that $\frac{\partial x_i}{\partial \varphi} < 0$ and $\frac{\partial \pi_i}{\partial \varphi} < 0$, which means that companies with higher efficiency (lower φ) set lower prices, produce large amounts of output, and achieve higher profits.

[4] See the derivation in Appendix 1.A.2.

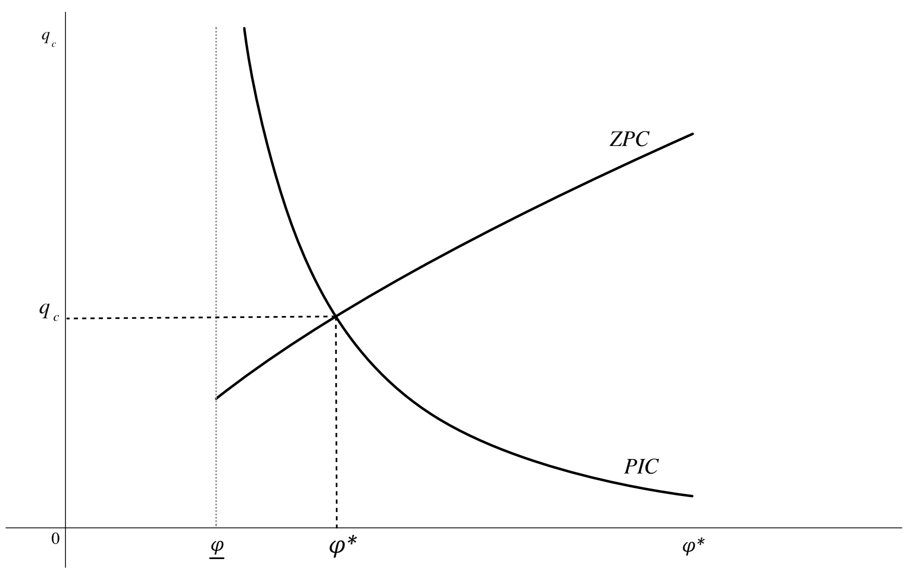
Equilibrium conditions

As well as in the sector of intermediate goods, conditions for the equilibrium price index q_c and the cut-off efficiency level φ^* can be found for the sector of consumer goods, using the PIC condition given by (1.8) and the ZPC condition that arises from setting the profit of the cut-off firm equal to zero and expressing

$$q_c = F_c^{\frac{1}{\varepsilon-\eta}} \alpha^{\frac{\eta}{\varepsilon-\eta}} \mu(q_i)^{\frac{\varepsilon-1}{\varepsilon-\eta}} C^{\frac{1}{\eta-\varepsilon}} (\alpha-1)^{\frac{1}{\eta-\varepsilon}} \varphi^{*\frac{\varepsilon-1}{\varepsilon-\eta}} \quad . \tag{1.12}$$

The equilibrium given by the intersection of these two conditions is visualized in Figure 1.3[5].

Figure 1.3: Equilibrium — sector of consumer goods



Modeling the inflow of FDI

The purpose of this chapter is to determine how the inflow of FDI in the sector of consumer goods influences the sector of intermediate goods. By the inflow of FDI, I mean the increase in the number of multinational firms operating in the sector of consumer goods. Throughout the chapter, I associate the number of firms in the industry with the length of the interval $[\underline{\varphi}, \varphi*]$: The larger this interval is, the more firms there are. Up to now,

[5] The visualization is based on a mathematical analysis of the two expressions showing that the ZPC curve is increasing with $\varphi*$ and the PIC curve is decreasing with $\varphi*$.

I considered the lower bound $\underline{\varphi}$ to be fixed, and I focused only on the change of φ^*, assuming that there is a given mass of firms, and the only issue is to determine the cut-off efficiency above which the firms cannot operate in the market under the given conditions.

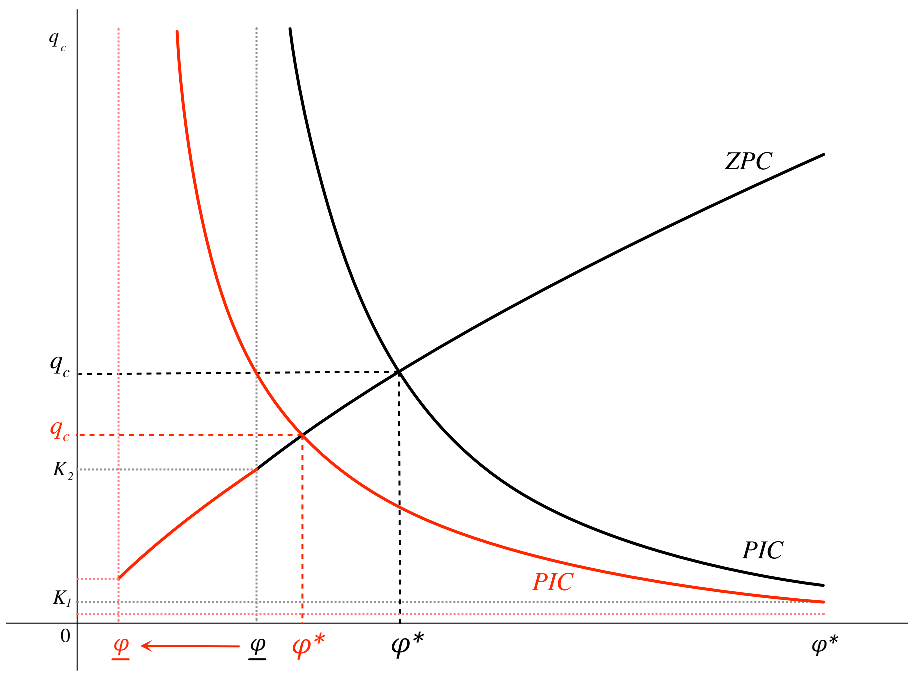
However, when I model the number of multinationals in the sector of consumer goods, I follow a different logic. I assume that MNEs are firms with very high efficiency levels: This fact is theoretically supported by Melitz (2003) and further proven by several empirical analyses. Following the same approach as Kosova (2010), I suppose that when an MNE enters the market, it has higher efficiency than any of the domestic competitors. This means that the distribution of the efficiency of firms operating in the domestic market is shifted towards higher levels by the entry of an MNE. In this chapter, I model this change as the shift of the lower bound for efficiency $\underline{\varphi}$. More precisely, an increase in the number of multinational firms in the consumer goods industry results in lower $\underline{\varphi}$, which signals that more efficient firms are now operating in the market.

Obviously, any change in $\underline{\varphi}$ has to result in a change of the equilibrium cut-off level φ^*. As has been discussed in many papers (Melitz (2003), Kosova (2010)), if more efficient firms enter the market, which faces still the same level of demand, less efficient firms have to be crowded out. In my model, this effect can be illustrated using the graphical representation of PIC and ZPC conditions for the sector of consumer goods. As we can see from (1.7), the change in $\underline{\varphi}$ has no effect on the ZPC condition (other than the change of the limit in $\underline{\varphi}$, which is now a different constant). However, it has an impact on the PIC condition given by (1.8). As I show in Appendix 1.A.2, for the PIC condition, it holds that

$$\frac{\partial q_c}{\partial \underline{\varphi}} > 0 \quad ,$$

which implies that when $\underline{\varphi}$ decreases, the whole curve shifts down. This effect is visualized in Figure 1.4, where we can see that when $\underline{\varphi}$ decreases, the cut-off level φ^* decreases as well. This is the crowding-out effect: The entry of more efficient firms forces the less efficient firms to leave the market.

Figure 1.4: Equilibrium — sector of consumer goods



1.3.5 Demand for intermediate goods

The total demand for intermediate goods, conditioned by the production in the sector of consumer goods, is derived as

$$I = \int_{\underline{\varphi}}^{\varphi^*} x_c \varphi \mu_c \mathrm{d}\varphi \quad . \tag{1.13}$$

It is a product of the amount of consumer goods produced (x_c) multiplied by the fraction of intermediate goods that are needed for this production ($\varphi\mu_c$), summed over all producing firms in the consumer goods industry. As I explained in Section 1.3.3, it is crucial to determine how the change in the number of multinational firms influences I because it is the change in I that brings either positive or negative effects to the suppliers of intermediate goods. If I increases, the effect on the suppliers is positive.

Since I model, in this chapter, the change in the number of multinational firms as the change in the lower bound efficiency $\underline{\varphi}$, technically, I need to determine the first derivative $\frac{\partial I}{\partial \underline{\varphi}}$. If the derivative is positive, it means that when more efficient multinational firms enter the market ($\underline{\varphi}$ decreases), the demand for intermediate goods decreases. If the derivative is negative, it means that the entry of more efficient multinational firms ($\underline{\varphi}$

decreasing) causes the demand for intermediate goods to increase.

Before I derive the sign of this derivative, let me express here briefly the different terms from which it is composed and discuss their economic meaning, showing why, intuitively, we may expect the demand for intermediate goods to increase or to decrease and what are the mechanisms driving this change.

To find the derivative, we have to use the Leibniz rule, keeping in mind that both φ^* and x_c (which depends on q_c) are functions of $\underline{\varphi}$:

$$\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} = x_c(\varphi^*)\varphi^*\mu_c\frac{\mathrm{d}\varphi^*}{\mathrm{d}\underline{\varphi}} - x_c(\underline{\varphi})\underline{\varphi}\mu_c + \int_{\underline{\varphi}}^{\varphi^*} \frac{\partial x_c}{\partial \underline{\varphi}}\varphi\mu_c\mathrm{d}\varphi \quad , \tag{1.14}$$

The first two terms on the right-hand side of this equation represent the change in demand that is given by the fact that some firms with lower efficiency are being replaced by firms with higher efficiency. They stand for the shift of the interval $[\underline{\varphi}, \varphi^*]$. The third term reflects how this change affects the output x_c of all firms from this interval.

Thus, the first two terms represent the effect given by the fact that the least efficient firms are crowded out and replaced by highly efficient ones. We know from equation (1.11) that firms with higher efficiency produce more output. On the other hand, we also know that these firms need less inputs for their production (because they are more efficient). Thus, the question is what effect prevails? Does the increased production by highly efficient firms outweigh the fact that less input is now needed by one unit of production, and consequently, do the new highly efficient firms demand more intermediate goods than those firms which were crowded out?

It can be easily shown that the first term on the right-hand side of equation (1.14) is always smaller than the second one, so the two terms all together are negative. I state this finding in the following lemma, whose proof can be found in Appendix 1.A.3.

Lemma 3. *For all values of the parameters of the model, it always holds that*

$$x_c(\varphi^*)\varphi^*\mu_c\frac{\partial\varphi^*}{\partial\underline{\varphi}} - x_c(\underline{\varphi})\underline{\varphi}\mu_c < 0 \quad .$$

This means that the increased production by the new firms outweighs the crowding-out effect, and the demand for intermediate goods increases when the least efficient firms are replaced by the most efficient ones.

To see what happens with the demand for intermediate goods conditioned by the production of the remaining firms, we have to focus on the third term on the right-hand side of equation (1.14). Its sign obviously depends on the sign of the derivative $\frac{\partial x_c}{\partial \underline{\varphi}}$. From equation (1.11), we see that x_c depends positively on the price index for consumer goods q_c, and from Figure 1.4, we can see that when $\underline{\varphi}$ decreases, the price index q_c also decreases: A more efficient industry as a whole produces the output at a lower price. This drives the amount of output x_c in each firm to be lower, which decreases then the demand for intermediate goods. Intuitively, this means that the firms in the market suffer from the competition given by the highly efficient new firms, they reduce their production and consequently also their demand for inputs. Technically, we can expect the sign of $\frac{\partial x_c}{\partial \underline{\varphi}}$ to be positive (decreasing $\underline{\varphi}$ implies decreasing x_c).

Hence, the first two terms on the right-hand side of equation (1.14) together are negative, and the third term is positive. The question of the overall sign of $\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}}$ is, thus, still open — it is not clear from the discussion above which effect should prevail. The different factors that are at play here are the change in produced output by firms operating in the market as well as the change in the composition of these firms in terms of efficiency. The final effect depends on the parameters of the model, in the way it is stated in the following theorem, whose proof is provided in Appendix 1.A.3.

Theorem 1. *When the elasticity of substitution among the varieties of intermediate good is larger than the elasticity of demand for consumer goods, then the entry of new multinational firms in the consumer goods sector will raise the demand for intermediate goods:*

$$\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} < 0 \qquad \mathit{if} \qquad \theta > \eta \quad .$$

This theorem states the conditions under which an increase in production by highly efficient firms outweighs the crowding-out effect and the increase in competition that the surviving firms face. It says that the demand for intermediate goods will increase when the condition $\theta > \eta$ is satisfied. Intuitively, we can interpret this condition using a simple cost-revenues analysis: Firms in the consumer goods sector will produce more (and thus demand more inputs) when their revenues are higher and their costs are lower. We can see from equation (1.9) that the revenues of a firm in the consumer goods sector is decreasing with increasing elasticity of demand for these goods. On the other hand, we can expect that if the elasticity of substitution between the varieties of the intermediate goods is high, firms in the consumer goods sector can substitute more easily towards cheaper varieties and reduce their costs. In other words, firms' revenues are inversely proportional to the elasticity of demand η, and their costs are inversely proportional to the elasticity of substitution θ. Hence, to have higher revenues and lower costs, firms should prefer to face low η and high θ, which gives us the intuition behind the condition of Theorem 1.

Even though the condition $\theta > \eta$ is theoretic and hardly verifiable in practice, in my opinion, it should not be considered as very binding. Remember that throughout the whole chapter, I assume that $\varepsilon > \eta$[6], where ε is the elasticity of substitution of the varieties of the consumer good. This condition reflects the idea that the different varieties are considered to be better substitutes among themselves than the consumer good is as a whole among other comparable goods. Whereas there is no reason nor need to set exactly $\varepsilon = \theta$, it is still logical to expect that the substitution among varieties should have the same order of magnitude in the two sectors, which means larger than the price elasticity of the good that is composed of these varieties.

Hence, I can basically say that my model predicts that the increase of the number of multinational firms in the consumer goods sector presents a positive demand shock for the suppliers of intermediate goods. This finding is further developed in the subsequent section.

1.4 Implications of the model

The model I presented is very simple and certainly does not capture all the aspects of the complexity of the studied issue. However, there are four important implications that can be derived from it.

1.4.1 The crowding-out effect

The model captures the crowding out effect in the sector of consumer goods: It predicts that the increased overall efficiency of this sector, given by the entry of multinational firms, forces some less efficient firms to leave the market. This is in line with general models of firms efficiency (see e.g. Jovanovic (1982)), with the more concrete model of FDI entry by Kosova (2010) and with the model by Markusen and Venables (1999). My representation overcomes the model of Kosova (2010) by taking into account the interaction with the sector of intermediate goods, and it improves the model of Markusen and

[6] This assumption is first stated and explained at the beginning of Section 1.3.4.

Venables (1999) by allowing heterogenous efficiency of firms, which leads to a coexistence of both multinationals and domestic firms in equilibrium.

1.4.2 Increasing demand

The model proves the potential of the entry of multinational firms to boost the demand for intermediate goods, showing that newly created demand by the MNEs can overcome the crowding-out effect of domestic firms. This finding is similar to the one presented by Markusen and Venables (1999), who show that an increase in the number of multinationals has the potential to increase the number of suppliers of intermediate goods. However, to obtain this result, the authors have to assume that MNEs source the intermediate goods relatively more intensively than domestic firms (in the notation of my model, they allow the factor μ_c to be larger for MNEs than for domestic firms). My result holds without this assumption, and it is quite intuitive to expect that it should be even strengthened if I took this assumption into account.

1.4.3 Domestic versus foreign suppliers

The basic setup of the model is based on the Dixit-Stiglitz representation of monopolistic competition. The limitation of this approach is that each producer of a variety of consumer goods needs for his production a certain amount of the intermediate good as a whole, which is composed of all the varieties. In other words, no firm in the consumer sector can prefer some of the suppliers of the intermediate good over others. This limits to some extent our understanding of the impact of the increased demand on the suppliers of intermediate goods. I show that all of them benefit, but can we say, for example, if the domestic suppliers benefit more than the foreign firms who export their production to the domestic market?

To answer this question, I will focus on the only feature that makes the foreign firm different from the domestic firms in my model, which is the transportation cost τ_i. Higher transportation costs lead to higher ψ because

$$\psi = \tau_i \nu \quad ,$$

where ν is the proper efficiency of the firm. For domestic firms, $\tau_i = 1$ whereas for foreign firms, $\tau_i > 1$. This means that foreign firms must be more efficient as compared to domestic firms, in order to compensate for transportation costs and achieve similar results. The transportation costs are a barrier for trade and we can expect that they depend on the distance between the domestic and the foreign country as well as on import tariffs. In this section, I will discuss that we can also allow the transportation costs to depend on the number of multinational firms in the consumer goods industry and what consequences this allowance can have.

Vertical integration

Many authors claim that due to various reasons, the barriers between foreign suppliers and MNEs operating in the domestic market are lower and that for this reason, MNEs often prefer to buy their intermediate goods from foreign rather than from domestic suppliers. Rodríguez-Clare (1996), for example, considers in his model an extreme case of such a situation, when only MNEs can source from abroad, and this access to foreign supplies is one of the reasons for their superiority over domestic firms. I refer to this situation as "vertical integration". Even though in the Dixit-Stiglitz setup of my model, I do not really allow the firms in the consumer goods sector to prefer some suppliers over others, there is still a way to represent the overall preference of MNEs for foreign suppliers. Suppose transportation costs τ_i depend inversely on the number of MNEs in the consumer goods sector: This would mean that the more MNEs are operating in this sector, the easier and the more likely it will be for this sector to source the inputs from abroad. In the notation of my model, this would mean that

$$\frac{\partial \tau_i(\underline{\varphi})}{\partial \underline{\varphi}} > 0 \quad ,$$

for foreign firms, while for domestic firms, the transportation costs would still be constant (and equal to one).

The implication of this setup would be increasing efficiency of foreign suppliers, which would have two consequences. First, the sales and the profits of all the foreign suppliers that had already been operating in the market would rise. Second, it would be easier for some new potential foreign suppliers to overcome the cut-off efficiency level and enter the market. This could lead even to a crowding-out effect of some domestic suppliers of intermediate goods, which could outweigh the positive effect of increasing demand.

Technological spillovers

On the other hand, an important stream of literature claims that the presence of multinational firms can lead to technological spillovers towards domestic suppliers of intermediate goods, meaning that the interaction with MNEs can increase the productivity of domestic firms in the downstream sector. In my model, this effect can be represented also using the transportation cost, if I allow them not to be constantly equal to one for domestic producers of intermediate goods, but, on the contrary, to depend inversely on the number of MNEs in the consumer goods sector. This would mean that the more MNEs are operating in this sector, the more the efficiency of the domestic suppliers will increase. In the notation of my model, this would mean that

$$\frac{\partial \tau_i(\underline{\varphi})}{\partial \underline{\varphi}} > 0 \quad ,$$

for domestic firms, while for foreign, the transportation costs would still be constant.

This setup would have opposite implications than the vertical integration, described above. The impact on domestic suppliers would be more favorable compared to foreign suppliers, and it would intensify the positive impact of increasing demand.

My model does not allow to predict which of the two setups (vertical integration or technological spillovers) is more likely to happen, because it depends on the decisions and situation of a particular MNE. However, there is one factor influencing this decision, that can be discussed within my model, as I will show in the subsequent section.

1.4.4 Substitutability of intermediate goods

Already Markusen and Venables (1999) mention that a multinational firm can decide to source from abroad or to source from the domestic market, and in the latter case, it can decide to help its domestic customers to increase their efficiency. The factors in this decision are the transportation costs (which can be lowered thanks to vertical integration), but also the quality of intermediate goods produced by domestic suppliers. This means that if we accept the possibility of having both technological spillovers and vertical integration, the effect of technological spillovers can prevail only if enough MNEs decide to source domestically. This happens when the domestic supplier conditions offered (possibly with some help from the multinational customer) are more favorable than the conditions offered by foreign suppliers (even though these might be more favorable for multinational than for domestic customers).

Javorcik and Spatareanu (2009) mention a survey done among multinational firms operating in the Czech Republic about their attitude towards using domestic suppliers. Most of the firms claim that what matters for their decision to source locally or abroad are the price offered, the transportation costs, and the possible relationship of the MNE with the foreign supplier (vertical integration), which confirms the view presented in Markusen and Venables (1999). However, according to this survey, the quality of the supplied intermediate goods is also a crucial factor influencing the decision of the MNE. Sometimes, the products offered by domestic suppliers are of a rather poor quality as compared to imported goods. If this is the case, multinational firms only source from abroad, and the domestic producers of intermediate goods can benefit neither from an increase of demand nor from technological spillovers. I would like to discuss now that a similar mechanism is predicted by my model.

Theorem 1, which proves the positive impact of the entry of multinational firms on the demand for and hence on the suppliers of domestic goods, assumes that $\theta > \eta$. When we have a look at the proof of this theorem, we see that the larger θ is, the more the demand for intermediate goods increases. If we recall that θ is the degree of substitutability between varieties of the intermediate good, we can think of it as a measure of similarity of the varieties. Hence, the more similar the goods are produced by domestic firms to the goods produced by the foreign firms, the more positive is the impact on the demand. If we think of this similarity as a similar quality in the varieties, we can predict that if the quality of domestic products is comparable to the quality of imported products, the positive impact of the presence of multinational firms on the demand for intermediate goods is larger. This is very similar to the situation described in the above discussed survey.

1.5 Conclusion

In this chapter, I proposed a simple theoretical model describing how the inflow of FDI in a country influences local competitors within the sector, and subsequently, what the impact of this change is on input-supplying firms in the upstream sector. I analyzed whether a new MNE entering the sector of consumer goods has the potential to increase the demand for intermediate goods, and along the way, I derived many other interesting results.

My model is based on the framework set by Markusen and Venables (1999), but it incorporates two significant improvements: trade in intermediate goods and the heterogenous efficiency of firms. The main conclusion is FDI inflow has the potential to increase the demand for intermediate goods even though some of the old customers among the domestic firms are crowded out of the market. This effect is offset by the increased production of MNEs. The increase in demand is more likely to happen and be larger if the varieties of the intermediate good are closer substitutes.

Further, the setup of the model allows me to explain other factors which may play a role in the different potentials for domestic and foreign suppliers of intermediate goods to benefit from the increase of demand. The possibility of vertical integration speaks in favor of foreign suppliers, but lower transportation costs may make domestic suppliers more attractive for the MNEs. A simple representation of possible technological spillovers allows us to understand why, if the MNEs give the domestic suppliers a chance, externalities are created that amplify the positive impact of increasing demand.

1.A Appendix 1

1.A.1 Intermediate goods sector

Basic setup

Domestic firms maximize their profits:

$$\max_{p_{id}} \pi_{id} = \max_{p_{id}} \left(p_{id}x_{id} - x_{id}\nu_{id} - F_{id}\right) \quad .$$

First-order conditions are:

$$\begin{aligned} \frac{\partial \pi_{id}}{\partial p_{id}} = x_{id} + p_{id}\frac{\partial x_{id}}{\partial p_{id}} - \frac{\partial x_{id}}{\partial p_{id}}\nu_{id} &= 0 \\ \left(\frac{\partial x_{id}}{\partial p_{id}}\right)^{-1} x_{id} + p_{id} - \nu_{id} &= 0 \quad . \end{aligned}$$

From (1.1), we have

$$\frac{\partial x_{id}}{\partial p_{id}} = -\theta p_{id}^{-\theta-1} I q_{id}^{\theta} = \theta p_{id}^{-\theta-1} x_{id} p_{id}^{\theta} = -\theta \frac{x_{id}}{p_{id}} \quad .$$

Therefore, we can write FOC as

$$\begin{aligned} \left(-\theta\frac{x_{id}}{p_{id}}\right)^{-1} x_{id} + p_{id} - \nu_{id} &= 0 \\ p_{id}\left(1 - \frac{1}{\theta}\right) &= \nu_{id} \\ p_{id} = \sigma\nu_{id} \quad , \end{aligned}$$

where $\sigma := \frac{\theta}{\theta-1}$.

Equilibrium conditions

- The (PIC) condition is:

$$q_i = \left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi\right)^{\frac{1}{1-\theta}} \quad .$$

The first derivative, therefore, is (using the Leibnitz rule):

$$\frac{\partial q_i}{\partial \psi^*} = \frac{1}{1-\theta}\left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi\right)^{\frac{\theta}{1-\theta}} p^{1-\theta}(\psi^*) \quad ,$$

and since all terms except $\frac{1}{1-\theta}$ are positive and $\frac{1}{1-\theta} < 0$, we have

$$\frac{\partial q_i}{\partial \psi^*} < 0 \quad .$$

The second derivative is:

$$\begin{aligned}
\frac{\partial^2 q_i}{\partial {\psi^*}^2} &= \frac{1}{1-\theta}\frac{\theta}{1-\theta}\left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi\right)^{\frac{2\theta-1}{1-\theta}} \left(p^{1-\theta}(\psi^*)\right)^2 \\
&\quad + \frac{1}{1-\theta}\left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi\right)^{\frac{\theta}{1-\theta}} (1-\theta)p^{-\theta}(\psi^*)\frac{\partial p_i}{\partial \psi^*} \\
&= \frac{\theta}{(1-\theta)^2}\left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi\right)^{\frac{2\theta-1}{1-\theta}} \left(p^{1-\theta}(\psi^*)\right)^2 \\
&\quad + \left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi\right)^{\frac{\theta}{1-\theta}} p^{-\theta}(\psi^*)\sigma\psi^* \quad ,
\end{aligned}$$

and since all terms are positive, we have

$$\frac{\partial^2 q_i}{\partial {\psi^*}^2} > 0 \quad .$$

For what concerns the limits, we can see that

$$\lim_{\psi^*\to\underline{\psi}} \int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi = 0 \quad ,$$

and

$$\lim_{\psi^*\to+\infty} \int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi = \begin{cases} +\infty & \text{if} \quad 1 < \theta < 2 \\ K > 0 & \text{if} \quad \theta \geq 2 \end{cases} \quad ,$$

which means that (since $\frac{1}{1-\theta} < 0$)

$$\lim_{\psi^*\to\underline{\psi}} q_i = \lim_{\psi^*\to\underline{\psi}} \left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi\right)^{\frac{1}{1-\theta}} = +\infty \quad ,$$

and

$$\lim_{\psi^*\to+\infty} q_i = \lim_{\psi^*\to+\infty} \left(\int_{\underline{\psi}}^{\psi^*} p_i^{1-\theta}(\psi)\mathrm{d}\psi \right)^{\frac{1}{1-\theta}} = \left\{ \begin{array}{lll} 0 & \text{if} & 1<\theta<2 \\ K'>0 & \text{if} & \theta\geq 2 \end{array} \right\} = K_1 \geq 0 \quad .$$

- The (ZPC) condition is:

$$q_i = I^{-\frac{1}{\theta}}\sigma(\sigma-1)^{-\frac{1}{\theta}}F_i^{\frac{1}{\theta}}{\psi^*}^{\frac{\theta-1}{\theta}} \quad .$$

The first derivative, therefore, is:

$$\frac{\partial q_i}{\partial \psi^*} = I^{-\frac{1}{\theta}}\sigma(\sigma-1)^{-\frac{1}{\theta}}F_i^{\frac{1}{\theta}}\frac{\theta-1}{\theta}{\psi^*}^{-\frac{1}{\theta}} \quad ,$$

and since all terms are positive, we have

$$\frac{\partial q_i}{\partial \psi^*} > 0 \quad .$$

The second derivative, therefore, is:

$$\frac{\partial^2 q_i}{\partial {\psi^*}^2} = I^{-\frac{1}{\theta}}\sigma(\sigma-1)^{-\frac{1}{\theta}}F_i^{\frac{1}{\theta}}\frac{\theta-1}{\theta}\left(-\frac{1}{\theta}\right){\psi^*}^{-\frac{1+\theta}{\theta}} \quad ,$$

and since all terms except $-\frac{1}{\theta}$ are positive and $-\frac{1}{\theta}<0$, we have

$$\frac{\partial^2 q_i}{\partial {\psi^*}^2} < 0 \quad .$$

For what concerns the limits, we can easily see that since $\frac{\theta-1}{\theta}>0$,

$$\lim_{\psi^*\to\underline{\psi}} q_i = K_2 > 0 \quad ,$$

and

$$\lim_{\psi^*\to+\infty} q_i = +\infty \quad .$$

Properties of the equilibrium

Lemma 1. When the demand for intermediate goods I increases, the price index q_i decreases and the efficiency cut-off level ψ^*increases:

$$\frac{\mathrm{d}q_i}{\mathrm{d}I} < 0 \qquad \text{and} \qquad \frac{\mathrm{d}\psi^*}{\mathrm{d}I} > 0 \quad .$$

Proof.

- Proof that $\frac{\mathrm{d}q_i}{\mathrm{d}I}<0$:

By plugging for p_i from (1.4) in the PIC condition (1.6), we get

$$q_i = \sigma \left(\int_{\underline{\psi}}^{\psi^*} \psi^{1-\theta} \mathrm{d}\psi \right)^{\frac{1}{1-\theta}} \tag{1.15}$$

$$q_i^{1-\theta} = \sigma^{1-\theta} \int_{\underline{\psi}}^{\psi^*} \psi^{1-\theta} \mathrm{d}\psi \quad . \tag{1.16}$$

From the ZPC condition (1.7), we get

$$q_i = I^{-\frac{1}{\theta}} \sigma (\sigma - 1)^{-\frac{1}{\theta}} F_i^{\frac{1}{\theta}} \psi^{*\frac{\theta-1}{\theta}} \tag{1.17}$$

$$q_i^{\frac{\theta}{\theta-1}} I^{\frac{1}{\theta-1}} \sigma^{-\frac{\theta}{\theta-1}} (\sigma - 1)^{\frac{1}{\theta-1}} F_i^{-\frac{1}{\theta-1}} = \psi^* \quad . \tag{1.18}$$

If we denote

$$b(I, q_i) = B q_i^{\frac{\theta}{\theta-1}} I^{\frac{1}{\theta-1}} \quad ,$$

where $B = \sigma^{-\frac{\theta}{\theta-1}} (\sigma - 1)^{\frac{1}{\theta-1}} F_i^{-\frac{1}{\theta-1}} > 0$, we get by plugging for ψ^* from (1.18) into (1.16):

$$q_i^{1-\theta} = \sigma^{1-\theta} \int_{\underline{\psi}}^{b(I,q_i)} \psi^{1-\theta} \mathrm{d}\psi \quad ,$$

and so, we can write an implicit function

$$F(I, q_i(I)) = \sigma^{1-\theta} \int_{\underline{\psi}}^{b(I,q_i)} \psi^{1-\theta} \mathrm{d}\psi - q_i^{1-\theta} = 0 \quad .$$

From the Implicit Function Theorem, we know that

$$\frac{\mathrm{d}q_i}{\mathrm{d}I} = -\frac{\frac{\partial F}{\partial I}}{\frac{\partial F}{\partial q_i}} \quad .$$

First, let us note that

$$\frac{\partial b(I, q_i)}{\partial I} = \frac{1}{\theta - 1} B q_i^{\frac{\theta}{\theta-1}} I^{\frac{2-\theta}{\theta-1}} \quad \text{, and} \quad \frac{\partial b(I, q_i)}{\partial q_i} = \frac{\theta}{\theta - 1} B q_i^{\frac{1}{\theta-1}} I^{\frac{1}{\theta-1}} \quad .$$

Now we can derive, using the Leibniz theorem:

$$\frac{\partial F}{\partial I} = \sigma^{1-\theta} b^{1-\theta}(I, q_i) \frac{\partial b(I, q_i)}{\partial I} = \sigma^{1-\theta} b^{1-\theta}(I, q_i) \frac{1}{\theta - 1} B q_i^{\frac{\theta}{\theta-1}} I^{\frac{2-\theta}{\theta-1}} \quad ,$$

and

$$\frac{\partial F}{\partial q_i} = \sigma^{1-\theta} b^{1-\theta}(I, q_i) \frac{\partial b(I, q_i)}{\partial q_i} - (1-\theta) q_i^{-\theta} = \sigma^{1-\theta} b^{1-\theta}(I, q_i) \frac{\theta}{\theta - 1} B q_i^{\frac{1}{\theta-1}} I^{\frac{1}{\theta-1}} + (\theta-1) q_i^{-\theta} \ ,$$

which gives

$$\frac{\mathrm{d}q_i}{\mathrm{d}I} = -\frac{\sigma^{1-\theta} b^{1-\theta}(I, q_i) \frac{1}{\theta-1} B q_i^{\frac{\theta}{\theta-1}} I^{\frac{2-\theta}{\theta-1}}}{\sigma^{1-\theta} b^{1-\theta}(I, q_i) \frac{\theta}{\theta-1} B q_i^{\frac{1}{\theta-1}} I^{\frac{1}{\theta-1}} + (\theta - 1) q_i^{-\theta}} \ . \tag{1.19}$$

Since all the terms in the numerator and the denominator are positive, and there is a minus sign before the fraction, we can easily see that

$$\frac{\mathrm{d}q_i}{\mathrm{d}I} < 0 \ ,$$

and this concludes the proof.

- Proof that $\frac{\mathrm{d}\psi^*}{\mathrm{d}I} > 0$:

  If we denote $B' := \sigma(\sigma - 1)^{-\frac{1}{\theta}} F_i^{\frac{1}{\theta}} > 0$, we can use equations (1.15) and (1.17) to write

$$\sigma \left(\int_{\underline{\psi}}^{\psi^*} \psi^{1-\theta} \mathrm{d}\psi \right)^{\frac{1}{1-\theta}} = B' I^{-\frac{1}{\theta}} \psi^{* \frac{\theta-1}{\theta}} \ ,$$

  and so, we can write an implicit function

$$F(I, \psi^*(I)) = \sigma \left(\int_{\underline{\psi}}^{\psi^*} \psi^{1-\theta} \mathrm{d}\psi \right)^{\frac{1}{1-\theta}} - B' I^{-\frac{1}{\theta}} \psi^{* \frac{\theta-1}{\theta}} = 0 \ .$$

  From the Implicit Function Theorem, we know that

$$\frac{\mathrm{d}\psi^*}{\mathrm{d}I} = -\frac{\frac{\partial F}{\partial I}}{\frac{\partial F}{\partial \psi^*}} \ .$$

  We can derive, using the Leibniz theorem:

$$\frac{\partial F}{\partial I} = \frac{1}{\theta} B' I^{-\frac{1+\theta}{\theta}} \psi^{* \frac{\theta-1}{\theta}} \ ,$$

  and

$$\frac{\partial F}{\partial \psi^*} = \sigma \frac{1}{1-\theta} \left(\int_{\underline{\psi}}^{\psi^*} \psi^{1-\theta} \mathrm{d}\psi \right)^{\frac{\theta}{1-\theta}} \psi^{* 1-\theta} - \frac{\theta - 1}{\theta} B' I^{-\frac{1}{\theta}} \psi^{* -\frac{1}{\theta}} \ ,$$

which gives

$$\frac{\mathrm{d}\psi^*}{\mathrm{d}I} = -\frac{\frac{1}{\theta}B'I^{-\frac{1+\theta}{\theta}}{\psi^*}^{\frac{\theta-1}{\theta}}}{\sigma\frac{1}{1-\theta}\left(\int\limits_{\underline{\psi}}^{\psi^*}\psi^{1-\theta}\mathrm{d}\psi\right)^{\frac{\theta}{1-\theta}}{\psi^*}^{1-\theta}-\frac{\theta-1}{\theta}B'I^{-\frac{1}{\theta}}{\psi^*}^{-\frac{1}{\theta}}}$$

$$= \frac{\frac{1}{\theta}B'I^{-\frac{1+\theta}{\theta}}{\psi^*}^{\frac{\theta-1}{\theta}}}{\sigma\frac{1}{\theta-1}\left(\int\limits_{\underline{\psi}}^{\psi^*}\psi^{1-\theta}\mathrm{d}\psi\right)^{\frac{\theta}{1-\theta}}{\psi^*}^{1-\theta}+\frac{\theta-1}{\theta}B'I^{-\frac{1}{\theta}}{\psi^*}^{-\frac{1}{\theta}}} \quad ,$$

where all the terms are positive, which concludes the proof.

□

Lemma 2. If the efficiency cut-off level in the sector of intermediate goods increases, the profits of firms operating in this sector rise.

Proof. Let us rewrite the profit of a firm in the sector of intermediate goods given by equation (1.5) as

$$\pi_i = \tilde{\pi}_i - F_i \quad ,$$

where

$$\tilde{\pi}_i = I\sigma^{-\theta}q_i^{\theta}(\sigma-1)\psi^{1-\theta} \quad .$$

This means that $\frac{\partial \pi_i}{\partial \psi^*} = \frac{\partial \tilde{\pi}_i}{\partial \psi^*}$.

Let us denote the profit of the firm with the cut-off level efficiency ψ^* as π_i^*. As we know,

$$\pi_i^* = \tilde{\pi}_i^* - F_i = 0 \quad ,$$

meaning that $\tilde{\pi}_i^* = F_i$. We can express

$$\frac{\tilde{\pi}_i}{\tilde{\pi}_i^*} = \frac{I\sigma^{-\theta}q_i^{\theta}(\sigma-1)\psi^{1-\theta}}{I\sigma^{-\theta}q_i^{\theta}(\sigma-1){\psi^*}^{1-\theta}} = \frac{\psi^{1-\theta}}{{\psi^*}^{1-\theta}} \quad ,$$

which leads to

$$\tilde{\pi}_i = \psi^{1-\theta}\psi^{*\theta-1}\tilde{\pi}_i^* = \psi^{1-\theta}\psi^{*\theta-1}F_i \quad .$$

Since $\theta - 1 > 0$, it is easy to see that

$$\frac{\partial \tilde{\pi}_i}{\partial \psi^*} > 0 \quad ,$$

which concludes the proof. □

1.A.2 Consumer goods sector

Basic setup

Firms maximize their profits:

$$\pi_c = p_c x_c - x_c \varphi \left(1 - \mu_c + \mu_c q_i\right) - F_c \quad .$$

First-order conditions are:

$$\begin{aligned}
\frac{\partial \pi_c}{\partial p_c} = x_c + p_c \frac{\partial x_c}{\partial p_c} - \frac{\partial x_c}{\partial p_c} \varphi \left(1 - \mu_c + \mu_c q_i\right) &= 0 \\
\left(\frac{\partial x_c}{\partial p_c}\right)^{-1} x_c + p_c - \varphi \left(1 - \mu_c + \mu_c q_i\right) &= 0 \quad .
\end{aligned}$$

From (1.9), we have

$$\frac{\partial x_c}{\partial p_c} = -\varepsilon p_c^{-\varepsilon-1} C q_c^{\varepsilon-\eta} = -\varepsilon p_c^{-\varepsilon-1} x_c p_c^{\varepsilon} = -\varepsilon \frac{x_c}{p_c} \quad .$$

Therefore, we can write FOC as

$$\begin{aligned}
\left(-\varepsilon \frac{x_c}{p_c}\right)^{-1} x_c + p_c - \varphi \left(1 - \mu_c + \mu_c q_i\right) &= 0 \\
p_c \left(1 - \frac{1}{\varepsilon}\right) &= \varphi \left(1 - \mu_c + \mu_c q_i\right) \\
p_c &= \alpha \varphi \left(1 - \mu_c + \mu_c q_i\right) \quad ,
\end{aligned}$$

where $\alpha := \frac{\varepsilon}{\varepsilon - 1} > 1$.

Modeling the inflow of FDI

Proof that for the PIC condition, we have $\frac{\partial q_c}{\partial \underline{\varphi}} > 0$:

$$\begin{aligned}
\frac{\partial q_c}{\partial \underline{\varphi}} &= \frac{\partial}{\partial \underline{\varphi}} \left(\left(\int_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi) \mathrm{d}\varphi \right)^{\frac{1}{1-\varepsilon}} \right) \\
&= \frac{1}{1-\varepsilon} \left(\int_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi) \mathrm{d}\varphi \right)^{\frac{\varepsilon}{1-\varepsilon}} \left(-p_c^{1-\varepsilon}(\underline{\varphi})\right) \\
&= \frac{1}{\varepsilon - 1} \left(\int_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi) \mathrm{d}\varphi \right)^{\frac{\varepsilon}{1-\varepsilon}} p_c^{1-\varepsilon}(\underline{\varphi}) > 0 \quad .
\end{aligned}$$

1.A.3 Demand for intermediate goods

Lemma 3. For all values of the parameters of the model, it always holds that

$$x_c(\varphi^*)\varphi^*\mu_c\frac{\partial\varphi^*}{\partial\underline{\varphi}} - x_c(\underline{\varphi})\underline{\varphi}\mu_c < 0 \quad .$$

Proof. When we plug in for x_c from the equation (1.11), we get

$$x_c(\varphi^*)\varphi^*\mu_c\frac{\partial\varphi^*}{\partial\underline{\varphi}} - x_c(\underline{\varphi})\underline{\varphi}\mu_c = \alpha^\varepsilon\mu^{-\varepsilon}(q_i)Cq_c^{\varepsilon-\eta}\mu_c\left(\varphi^{*1-\varepsilon}\frac{\partial\varphi^*}{\partial\underline{\varphi}} - \underline{\varphi}^{1-\varepsilon}\right) \quad .$$

Since all the terms preceding the parentheses are positive, to prove this lemma, it is sufficient to show that

$$\left(\varphi^{*1-\varepsilon}\frac{\partial\varphi^*}{\partial\underline{\varphi}} - \underline{\varphi}^{1-\varepsilon}\right) < 0 \quad ,$$

which is equivalent to showing

$$\frac{\partial\varphi^*}{\partial\underline{\varphi}} < \frac{\underline{\varphi}^{1-\varepsilon}}{\varphi^{*1-\varepsilon}} \quad .$$

This last inequality is proved in Lemma 4. □

Lemma 4. *For all values of the parameters of the model, it always holds that*

$$\frac{\partial\varphi^*}{\partial\underline{\varphi}} < \frac{\underline{\varphi}^{1-\varepsilon}}{\varphi^{*1-\varepsilon}} \quad .$$

Proof. Let us determine $\frac{\partial\varphi^*}{\partial\underline{\varphi}}$. First, I will use the fact that in equilibrium, the expression for the ZPC and PIC conditions have to be equal. In simplified notation, we have the ZPC condition

$$q_c = A\varphi^{*\frac{\varepsilon-1}{\varepsilon-\eta}} \quad ,$$

where A is a constant, and the PIC condition

$$q_c = \left(\int_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi)\mathrm{d}\varphi\right)^{\frac{1}{1-\varepsilon}} \quad .$$

In the equilibrium, we have

$$A\varphi^{*\frac{\varepsilon-1}{\varepsilon-\eta}} = \left(\int_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi)\mathrm{d}\varphi\right)^{\frac{1}{1-\varepsilon}} \quad ,$$

and so, we can write an implicit function

$$F\left(\underline{\varphi}, \varphi^*(\underline{\varphi})\right) = A{\varphi^*}^{\frac{\varepsilon-1}{\varepsilon-\eta}} - \left(\int\limits_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi)\mathrm{d}\varphi\right)^{\frac{1}{1-\varepsilon}} = 0 \quad .$$

From the Implicit Function Theorem, we know that

$$\frac{\partial \varphi^*}{\partial \underline{\varphi}} = -\frac{\frac{\partial F}{\partial \underline{\varphi}}}{\frac{\partial F}{\partial \varphi^*}} \quad .$$

We can derive:

- $$\frac{\partial F}{\partial \underline{\varphi}} = -\frac{1}{1-\varepsilon}\left(\int\limits_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi)\mathrm{d}\varphi\right)^{\frac{\varepsilon}{1-\varepsilon}} \left(-p^{1-\varepsilon}(\underline{\varphi})\right) = \frac{1}{1-\varepsilon} q_c^{\varepsilon} p^{1-\varepsilon}(\underline{\varphi}) \quad ,$$

- $$\begin{aligned} \frac{\partial F}{\partial \varphi^*} &= \frac{\varepsilon-1}{\varepsilon-\eta} A{\varphi^*}^{\frac{\eta-1}{\varepsilon-\eta}} - \frac{1}{1-\varepsilon}\left(\int\limits_{\underline{\varphi}}^{\varphi^*} p_c^{1-\varepsilon}(\varphi)\mathrm{d}\varphi\right)^{\frac{\varepsilon}{1-\varepsilon}} p^{1-\varepsilon}(\varphi^*) \\ &= \frac{\varepsilon-1}{\varepsilon-\eta} A{\varphi^*}^{\frac{\eta-1}{\varepsilon-\eta}} - \frac{1}{1-\varepsilon} q_c^{\varepsilon} p^{1-\varepsilon}(\varphi^*) \quad . \end{aligned}$$

Hence, we have

$$\frac{\partial \varphi^*}{\partial \underline{\varphi}} = \frac{-\frac{1}{1-\varepsilon} q_c^{\varepsilon} p^{1-\varepsilon}(\underline{\varphi})}{\frac{\varepsilon-1}{\varepsilon-\eta} A{\varphi^*}^{\frac{\eta-1}{\varepsilon-\eta}} - \frac{1}{1-\varepsilon} q_c^{\varepsilon} p^{1-\varepsilon}(\varphi^*)} \quad .$$

Since $\frac{1}{1-\varepsilon} < 0$, the term in the numerator, and both terms in the denominator are positive. This implies that if we omit the first term in the denominator (we make the denominator smaller since we are subtracting a positive term), we make the whole fraction increase:

$$\frac{\partial \varphi^*}{\partial \underline{\varphi}} < \frac{-\frac{1}{1-\varepsilon} q_c^{\varepsilon} p^{1-\varepsilon}(\underline{\varphi})}{-\frac{1}{1-\varepsilon} q_c^{\varepsilon} p^{1-\varepsilon}(\varphi^*)} = \frac{p^{1-\varepsilon}(\underline{\varphi})}{p^{1-\varepsilon}(\varphi^*)} \quad .$$

By plugging in from (1.10), we get

$$\frac{p^{1-\varepsilon}(\underline{\varphi})}{p^{1-\varepsilon}(\varphi^*)} = \frac{\left(\alpha\underline{\varphi}\mu(q_i)\right)^{1-\varepsilon}}{\left(\alpha\varphi^*\mu(q_i)\right)^{1-\varepsilon}} = \frac{\underline{\varphi}^{1-\varepsilon}}{{\varphi^*}^{1-\varepsilon}} \quad .$$

This allows us to write

$$\frac{\partial \varphi^*}{\partial \underline{\varphi}} < \frac{\underline{\varphi}^{1-\varepsilon}}{{\varphi^*}^{1-\varepsilon}} \quad ,$$

and thus concludes the proof.

□

Theorem 1. When the elasticity of substitution among the varieties of intermediate goods is larger than the elasticity of demand for consumer goods, then the entry of new multinational firms in the sector of consumer goods will raise the demand for intermediate goods:

$$\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} < 0 \qquad \text{if} \qquad \theta > \eta \quad .$$

Proof. The demand for intermediate goods is given by the expression (1.13). To see exactly how the different parts of it depend on $\underline{\varphi}$, let us plug in for x_c from (1.11):

$$I = \int_{\underline{\varphi}}^{\varphi^*} \alpha^{\varepsilon} \varphi^{-\varepsilon} \mu^{-\varepsilon}(q_i) C q_c^{\varepsilon-\eta} \varphi \mu_c \mathrm{d}\varphi = \alpha^{\varepsilon} \mu^{-\varepsilon}(q_i) C q_c^{\varepsilon-\eta} \mu_c \int_{\underline{\varphi}}^{\varphi^*} \varphi^{1-\varepsilon} \mathrm{d}\varphi \quad . \tag{1.20}$$

Further, we can plug in expression (1.8) for the price p_c from (1.10), obtaining

$$q_c = \left(\int_{\underline{\varphi}}^{\varphi^*} \left(\alpha\mu(q_i)\varphi\right)^{1-\varepsilon} \mathrm{d}\varphi \right)^{\frac{1}{1-\varepsilon}} = \alpha\mu(q_i) \left(\int_{\underline{\varphi}}^{\varphi^*} \varphi^{1-\varepsilon} \mathrm{d}\varphi \right)^{\frac{1}{1-\varepsilon}} \quad ,$$

which we plug into (1.20):

$$\begin{aligned} I &= \alpha^{\varepsilon} \mu^{-\varepsilon}(q_i) C \alpha^{\varepsilon-\eta} \mu^{\varepsilon-\eta}(q_i) \left(\int_{\underline{\varphi}}^{\varphi^*} \varphi^{1-\varepsilon} \mathrm{d}\varphi \right)^{\frac{\varepsilon-\eta}{1-\varepsilon}} \mu_c \int_{\underline{\varphi}}^{\varphi^*} \varphi^{1-\varepsilon} \mathrm{d}\varphi \\ &= K \mu^{-\eta}(q_i) \left(\int_{\underline{\varphi}}^{\varphi^*} \varphi^{1-\varepsilon} \mathrm{d}\varphi \right)^{\frac{1-\eta}{1-\varepsilon}} \quad , \end{aligned} \tag{1.21}$$

where $K = \alpha^{2\varepsilon-\eta} C \mu_c$.

Now, we have to realize that the cut-off level φ^* is a function of $\underline{\varphi}$, and the price index q_i is a function of I, which we formally represent as

$$I = K \mu^{-\eta}\left(q_i(I)\right) \left(\int_{\underline{\varphi}}^{\varphi^*(\underline{\varphi})} \varphi^{1-\varepsilon} \mathrm{d}\varphi \right)^{\frac{1-\eta}{1-\varepsilon}} \quad .$$

The derivative then will be:

$$\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} = K\left(\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}\frac{\mathrm{d}}{\mathrm{d}\underline{\varphi}}\mu^{-\eta}\left(q_i\right)+\mu^{-\eta}\left(q_i\right)\frac{\mathrm{d}}{\mathrm{d}\underline{\varphi}}\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}\right) \quad .$$

We can express the terms separately, keeping in mind that the price index q_i is a function of I, and the cut-off level φ^* is a function of $\underline{\varphi}$. The first term is (using the chain rule):

$$\frac{\mathrm{d}}{\mathrm{d}\underline{\varphi}}\mu^{-\eta}\left(q_i\right) = -\eta\mu^{-\eta-1}\left(q_i\right)\frac{\mathrm{d}\mu(q_i)}{\mathrm{d}q_i}\frac{\mathrm{d}q_i}{\mathrm{d}I}\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} \quad .$$

Since

$$\mu(q_i) = 1-\mu_c+\mu_c q_i \quad ,$$

we have

$$\frac{\mathrm{d}\mu(q_i)}{\mathrm{d}q_i} = \mu_c \quad ,$$

and so the first term becomes

$$\frac{\mathrm{d}}{\mathrm{d}\underline{\varphi}}\mu^{-\eta}\left(q_i\right) = -\eta\mu^{-\eta-1}\left(q_i\right)\mu_c\frac{\mathrm{d}q_i}{\mathrm{d}I}\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} \quad .$$

The second term is (using the chain rule and the Leibniz rule):

$$\frac{\mathrm{d}}{\mathrm{d}\underline{\varphi}}\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}} = \frac{1-\eta}{1-\varepsilon}\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{\varepsilon-\eta}{1-\varepsilon}}\left(\varphi^{*1-\varepsilon}\frac{\partial\varphi^*}{\partial\underline{\varphi}}-\underline{\varphi}^{1-\varepsilon}\right) \quad .$$

Hence, we obtain

$$\begin{aligned}\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} \quad = \quad & -K\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}\eta\mu^{-\eta-1}\left(q_i\right)\mu_c\frac{\mathrm{d}q_i}{\mathrm{d}I}\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} \\ & +K\mu^{-\eta}\left(q_i\right)\frac{1-\eta}{1-\varepsilon}\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{\varepsilon-\eta}{1-\varepsilon}}\left(\varphi^{*1-\varepsilon}\frac{\partial\varphi^*}{\partial\underline{\varphi}}-\underline{\varphi}^{1-\varepsilon}\right) \quad ,\end{aligned}$$

and by taking all the terms containing $\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}}$ on the left-hand side and dividing the whole equation, we get

$$\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} = \frac{K\mu^{-\eta}\left(q_i\right)\frac{1-\eta}{1-\varepsilon}\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{\varepsilon-\eta}{1-\varepsilon}}\left(\varphi^{*1-\varepsilon}\frac{\partial\varphi^*}{\partial\underline{\varphi}} - \underline{\varphi}^{1-\varepsilon}\right)}{1+K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}\eta\mu^{-\eta-1}\left(q_i\right)\mu_c\frac{\mathrm{d}q_i}{\mathrm{d}I}} \quad .$$

All the terms in the numerator preceding the parentheses are positive. From Lemma 4, we know that the expression in parentheses is negative. Hence, we can state that

$$\frac{\mathrm{d}I}{\mathrm{d}\underline{\varphi}} < 0 \quad \Longleftrightarrow \quad 1+K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}\eta\mu^{-\eta-1}\left(q_i\right)\mu_c\frac{\mathrm{d}q_i}{\mathrm{d}I} > 0 \quad . \tag{1.22}$$

When we look at the expression

$$K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}\eta\mu^{-\eta-1}\left(q_i\right)\mu_c\frac{\mathrm{d}q_i}{\mathrm{d}I} \quad ,$$

we notice that all the terms, except $\frac{\mathrm{d}q_i}{\mathrm{d}I}$, are positive, and we know from Lemma 1 that $\frac{\mathrm{d}q_i}{\mathrm{d}I} < 0$. Hence, we can state that

$$K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}\eta\mu^{-\eta-1}\left(q_i\right)\mu_c\frac{\mathrm{d}q_i}{\mathrm{d}I} < 0 \quad .$$

The question now is if

$$-1 < K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}\eta\mu^{-\eta-1}\left(q_i\right)\mu_c\frac{\mathrm{d}q_i}{\mathrm{d}I} < 0 \quad , \tag{1.23}$$

and if this was true, we would still claim that the inequality in (1.22) holds.

To prove that inequality (1.23) holds if $\theta > \eta$, we rewrite it as

$$-\frac{1}{\eta\mu_c K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}} < \mu^{-\eta-1}\left(q_i\right)\frac{\mathrm{d}q_i}{\mathrm{d}I} < 0 \quad . \tag{1.24}$$

The expression for $\frac{\mathrm{d}q_i}{\mathrm{d}I}$ has been derived as (1.19) in the proof of Lemma 1:

$$\frac{\mathrm{d}q_i}{\mathrm{d}I} = -\frac{\sigma^{1-\theta}b^{1-\theta}(I,q_i)\frac{1}{\theta-1}Bq_i^{\frac{\theta}{\theta-1}}I^{\frac{2-\theta}{\theta-1}}}{\sigma^{1-\theta}b^{1-\theta}(I,q_i)\frac{\theta}{\theta-1}Bq_i^{\frac{1}{\theta-1}}I^{\frac{1}{\theta-1}} + (\theta-1)q_i^{-\theta}} \quad .$$

Since $(\theta-1)q_i^{-\theta} > 0$, the denominator of the fraction decreases if we omit this term, which (because of the minus sign) decreases the whole expression, which then simplifies substantially:

$$-\frac{\sigma^{1-\theta}b^{1-\theta}(I,q_i)\frac{1}{\theta-1}Bq_i^{\frac{\theta}{\theta-1}}I^{\frac{2-\theta}{\theta-1}}}{\sigma^{1-\theta}b^{1-\theta}(I,q_i)\frac{\theta}{\theta-1}Bq_i^{\frac{1}{\theta-1}}I^{\frac{1}{\theta-1}} + (\theta-1)q_i^{-\theta}} > -\frac{\sigma^{1-\theta}b^{1-\theta}(I,q_i)\frac{1}{\theta-1}Bq_i^{\frac{\theta}{\theta-1}}I^{\frac{2-\theta}{\theta-1}}}{\sigma^{1-\theta}b^{1-\theta}(I,q_i)\frac{\theta}{\theta-1}Bq_i^{\frac{1}{\theta-1}}I^{\frac{1}{\theta-1}}} = -\frac{1}{\theta}\frac{q_i}{I} \quad ,$$

which proves that

$$\frac{\mathrm{d}q_i}{\mathrm{d}I} > -\frac{1}{\theta}\frac{q_i}{I} \quad ,$$

and so that

$$\mu^{-\eta-1}(q_i)\frac{\mathrm{d}q_i}{\mathrm{d}I} > -\mu^{-\eta-1}(q_i)\frac{1}{\theta}\frac{q_i}{I} \quad .$$

The term on the right-hand side can be further extended by plugging in for I from equation (1.21):

$$\begin{aligned}
-\mu^{-\eta-1}(q_i)\frac{1}{\theta}\frac{q_i}{I} &= -\mu^{-\eta-1}(q_i)\frac{1}{\theta}\frac{q_i}{K\mu^{-\eta}(q_i)\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}} \\
&= -\frac{1}{\theta}\frac{q_i}{\mu(q_i)}\frac{1}{K\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}} \quad .
\end{aligned}$$

Further, we can show that since $\mu_c < 1$, we have

$$\frac{q_i}{\mu(q_i)} = \frac{q_i}{1-\mu_c+\mu_c q_i} < \frac{q_i}{\mu_c q_i} = \frac{1}{\mu_c} \quad ,$$

which allows us to state

$$-\mu^{-\eta-1}(q_i)\frac{1}{\theta}\frac{q_i}{I} > -\frac{1}{\theta}\frac{1}{\mu_c}\frac{1}{K\left(\int_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}} \quad .$$

Ultimately, if $\theta > \eta$, we can write

$$-\frac{1}{\theta\mu_c K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}} > -\frac{1}{\eta\mu_c K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}} \quad .$$

Thus, we have shown so far that

$$\mu^{-\eta-1}\left(q_i\right)\frac{\mathrm{d}q_i}{\mathrm{d}I} > -\frac{1}{\eta\mu_c K\left(\int\limits_{\underline{\varphi}}^{\varphi^*}\varphi^{1-\varepsilon}\mathrm{d}\varphi\right)^{\frac{1-\eta}{1-\varepsilon}}} \quad ,$$

which verifies condition (1.24) and thus concludes the proof.

$\square$

Chapter 2

The Impact of FDI on the Host Economy

2.1 Introduction

The theoretical model presented in the previous chapter predicts that FDI can have both a positive and a negative impact on domestic firms in the target economy: It improves the overall productivity in the market, but this is done at the cost of crowding out some less efficient firms from the market. In general, FDI has been welcomed by domestic governments because the presence of a foreign firm is considered to have strong potential to improve domestic economic conditions. Instead of confirming this common expectation, however, empirical studies draw rather ambiguous conclusions as to whether the consequences of FDI are indeed as significant and as positive as it is believed.

As Meyer (2004) explains, this question is highly relevant for policymakers and for the MNEs themselves. Host country governments often try to attract foreign investors with substantial economic incentives, such as tax holidays, free acquisition of real estate, and enhanced infrastructure. Such expedients to attract FDI can be very costly, and it is therefore crucial to know if the entry of a foreign investor does indeed have the desired impact that would warrant the costs — both for the governments, which decide whether to promote FDI or not and for the MNEs, which need to know their bargaining power in negotiations over the conditions of investment.

Following the existing literature, my research focuses in particular on the impact of FDI on the performance of domestic firms. In doing so, I leave aside the impact FDI has on the performance of the firm into which the investment is made, since this question does not induce any contradictions in the academic literature, there being strong evidence of positive effects on individual firms (Konings (2001), Sgard (2001)). The focus of this chapter is on the impact of FDI on other firms in the same industry, complementing the research that has been done in this field, which is very extensive but which still leaves many questions without clear and definitive answers. My work addresses some of the issues that seem to be problematic in existing analyses.

Many papers examine the consequences of FDI on the performance of firms in CEE countries during transition. However, the conclusions are surprisingly contradictory, given that these studies deal with relatively comparable countries and comparable time periods, as well as basically using the same methodology — the Total Factor Productivity (TFP) approach. The point of my research is certainly not to increase the variance of results by adding another study that would consider the issue of FDI using exactly the same methodology. Therefore, although my approach is also inspired by the TFP model, I complement it by a novel estimation strategy that allows me to consider aspects of the impact of FDI on the host economy that have not been identified in previous studies and that might explain some of the discrepancies among the existing literature.

This estimation strategy is based on a comparison of the competition caused by the presence of MNEs in the local market as opposed to the competition induced by international trade. This approach helps to disentangle the influence FDI might have through direct spillovers between an MNE and domestic firms from the effect that FDI has on the demand which domestic firms face. To my knowledge, none of the existing studies use a similar approach, which is why they usually fail to identify clearly the different and often contradictory impacts of FDI on the host economy in their results. The purpose of my research is to filter out the spillover effect of FDI to see if the physical presence of foreign MNEs in a country causes some advantages for the host economy compared to the situation where the country is just exposed to international trade.

2.2 Literature review

Although the existing empirical literature concerning the impact of FDI on the performance of firms in CEE countries is very rich, the particular issues it addresses are not very heterogeneous. The main concern is the technological transfer related to FDI. This technological transfer is represented by spillover effects, which may be of two types: horizontal and vertical. Horizontal spillovers concern transfers within the industry that the

MNE entered, i.e., among its local competitors. Vertical spillovers concern either upstream (backward spillovers) or downstream (forward spillovers) domestic firms, i.e., the suppliers or the customers of the MNE respectively. A common belief is that technological transfer should occur because a technologically more advanced MNE enters into an environment where firms were stagnating under a centrally planned economy, and gives them a positive example that they can follow: they can copy the technologies, they can hire workers or managers that have had experience in this foreign company, and so on. This should increase the domestic firms' performance by improving their efficiency and, thus, create the positive impact on the domestic economy for which FDI is so valued by governments.

However, empirical research suggests that in reality the situation might not be as favorable as expected. There is a large discrepancy among the papers concerning both the results and the interpretation of these results. Often horizontal spillovers are found to be insignificant or negative and forward spillovers insignificant, whereas backward spillovers are found to be significant and rather positive[1]. The explanation for this is usually that whereas MNEs have no interest in improving the performance of their customers and have strong incentives not to improve the performance of their competitors, they might tend to help their own suppliers to improve performance and also the quality of the intermediate goods produced. The significance of backward spillovers make them a very compelling topic, and since they were introduced for the first time by Javorcik (2004), special attention has been paid to them in the majority of most recent studies. Yet, even here the results differ. While Gorodnichenko, Svejnar, and Terrell (2007) find backward spillovers significantly positive, Stančík (2007) provides evidence to the complete contrary.

Hence, the most striking observation concerning the review of literature relevant to CEE countries is how conflicting the conclusions can be. One could argue that the disparity arises from the fact that the papers deal with different countries and different time periods. Evidently, as Javorcik and Spatareanu (2005) point out, different CEE countries have experienced different transition paths, which have resulted in different economic conditions and made some of these countries more attractive for foreign investors. Nevertheless, in the same article, where they compare Romania and the Czech Republic, the authors themselves come to the conclusion that the disparity of results is more likely due to methodological issues than to differences between the countries studied. This is a very sound observation because, in fact, even in studies concerning the

[1] For a detailed survey, see Hanousek, Kocenda, and Maurel (2011).

same country, one can find different results (cf. Stančík (2007) and Kosova (2010) who both study the Czech Republic, but use different methodological approaches).

A possible explanation for these differences can be found in Kosova (2010), who studies the impact of a foreign presence on the growth and survival of domestic firms. The main contribution of her paper is in distinguishing between short-run and long-run effects and thus setting the issue in a dynamic context. Kosová's model is based on Jovanovic (1982), who describes how the efficiency of firms (included as a factor that determines the firms' cost function) influences their growth and survival in a competitive market. In Kosová's modification, the model is complemented by the presence of the foreign firm, which captures a share of demand, so reducing even further the domestic firms' output and making their survival even harder. This is an exogenous competition shock which changes the market conditions in the short run. The short-run effects of FDI are thus characterized as competition effects, given by the entry of an efficient foreign firm into the domestic economy, which is at that point in time in a certain equilibrium. This equilibrium is distorted by the new entrant, and the domestic firms either leave the market (this is described as a crowding out effect) or adapt to the situation. Therefore, in the short run, we observe a decline in efficiency given by firms that are being crowded out (but still present in the data with very poor business results), which is the negative effect of FDI. As for the firms which are not crowded out and which manage to survive the negative short-run effect, they can adjust to the situation by increasing their efficiency in the long run. In Kosová's model, there are positive technological shocks due to the presence of the foreign firm that accumulate over time and reduce the cost function of domestic firms in the long run, representing the technological spillovers that offset the short-run competition effect.

Kosová's paper clearly shows that if we do not separate the short run and the long run, we might measure the competition effect and the spillover effect simultaneously, without being able to understand exactly what the role is of each of them. As a result, we can misinterpret the overall effect as being positive, negative, or insignificant because we just do not see that it is composed of two opposite effects, and we do not distinguish which one is offsetting the other in the given time period.

The models used in the majority of papers (with the exception of Kosová) are based on the Total Factor Productivity approach, where the augmented production function is estimated. Unfortunately, these models allow only an overall analysis of the issue without identifying various effects that may play a role in the process of adjustment of the domestic economy to the entry of a foreign firm. Dobrinsky, Dochev, and Markov (2001) say apropos this issue: “The operationalization of the analysis of the determinants of firm level efficiency requires in principle to define a structural efficiency model. This is still a rather blank field in economic theory and most empirical studies rely on partial models that allow to estimate reduced form equations (p. 6).”

The fact that Kosová offers a clear structural model that explains the different roles of competition effects and of technological spillovers is therefore very important because it allows us to understand better the mechanisms that are hidden when the standard TFP model is used. It has to be said, though, that she studies only horizontal effects and focuses solely on the Czech Republic without taking into account regional factors, which represents an important limitation since the Czech Republic is too small and open an economy to be considered outside the regional context.

My own approach to the question of the impact of FDI on the host economy uses the basic structure of a TFP model, but the identification of the effect studied stems from the theoretical predictions of Kosova (2010) and others. I thus contribute to the literature by separating the competition effect from the spillover effects within a reduced form model using a novel identification strategy. To make my methodology clear, I present the traditional approach used in the literature in the following section; then, I show why this approach fails to identify correctly the spillover effect, and I explain why my methodological approach remedies this issue. Afterwards, I describe the data I use for the analysis, I provide my econometric specification, and I present the results including robustness checks and extensions.

2.2.1 Current estimation methodology

The main focus of the empirical literature studying the impact of FDI lies in estimating the production function. This method refers to the Solow model and the standard neoclassical production function

$$F = AK^{\alpha}L^{1-\alpha} \quad ,$$

where A is an index of the level of technology, called Total Factor Productivity (TFP). Models derived from this representation generally use variations of the Cobb-Douglas production function and after taking logarithms and denoting the log of output by y and the vector of logs of inputs by $\mathbf{x}$, the models proposed for studying firms’ productivity take the general form

$$y = \boldsymbol{\beta}'\mathbf{x} + TPF + \varepsilon \quad .$$

Furthermore, Total Factor Productivity (which is just the logarithm of the technological efficiency index) is supposed to depend linearly on some variables $\mathbf{z}$, which results in the final estimated equation

$$y = \boldsymbol{\beta}'\mathbf{x} + \boldsymbol{\delta}'\mathbf{z} + \varepsilon \quad .$$

The TFP approach, or more generally the representation of a firm's efficiency as its productivity, is very common and the production function estimation is the most widespread technique in empirical studies applied in this field. One of the seminal papers here is Nickell (1996), where the author's main purpose is to assess the impact of competition on corporate performance. Nickell regresses the output (measured as sales) on the inputs (number of employees for labor and tangible assets for capital), on the cyclical component (measured by overtime hours of workers) and on the variables of interest that represent the market competition. These variables should drive the changes in Total Factor Productivity and thus in the technical efficiency of the firm. Following the same logic, those authors who study the impact of FDI on firms' productivity use as the variable $\mathbf{z}$ some measure of the foreign presence in the industry in question, coming to the specification

$$y = \boldsymbol{\beta}'\mathbf{x} + \delta \cdot FDI + \varepsilon$$

and asking about the sign and significance of δ.

There are several problems with the production function estimation. One is, according to the underlying economic theory, TFP measures the productivity of a firm only if the factors are efficiently allocated. However, as Bartelsman and Doms (2000) explain, this might not always be the case, meaning that the firm might not be able to optimize its inputs so quickly. In empirical papers such as Nickell (1996), this problem is accounted for by including the lagged output in the regression, which might help to obtain more precise estimates of the coefficients of the model. This is the approach I follow as well.

The second problem stems from a slight but important disparity between the underlying theoretical model of a production function and empirical studies performed on real data. The dependent variable of the theoretical model is the physical output of a firm, but such a variable is often unavailable to researchers. It is most usually proxied by the revenues (or sales) of the firm, i.e., the output multiplied by the price, but then the measured efficiency of the firm is influenced also by the price and demand components. In this case, the production function estimation might be problematic because, as Melitz (2000) and Foster, Haltiwanger, and Syverson (2005) show, this method does not allow one to separate the demand and the productivity shocks, or, in other words, the profitability and the technical efficiency described above.

To make this issue clearer, in the following section, I propose my own illustration of how using sales as a proxy for physical output influences the estimation of the impact of FDI in the production function framework. It is only a simplified demonstration, and a deeper analysis as well as empirical proof can be found in the two previously cited papers, but in my opinion, it is necessary to further discuss my identification strategy.

2.2.2 Problem of the dependent variable

When we come back to the Cobb-Douglas production function

$$F = AK^{\alpha}L^{1-\alpha} \quad ,$$

we can write the revenues of the firm as

$$R = P \cdot F = PAK^{\alpha}L^{1-\alpha} \quad ,$$

where P is the price of the good produced by the industry (in this simplified model, I consider the price to be constant over all firms in the industry and exogenous in the sense that each of the firms is supposed to be too small to affect the price in the industry).

After taking logarithms and denoting the log of revenues by $\widetilde{y}$ and the vector of the logs of inputs by $\mathbf{x}$, the model to be estimated takes the form

$$\widetilde{y} = \boldsymbol{\beta}'\mathbf{x} + \widetilde{TPF} + \varepsilon \quad ,$$

similar to the above, but now the $\widetilde{TPF}$ term includes both logarithms of the price, P and of the technical efficiency, A.

Now suppose we claim, similarly as in the previous section, that $\widetilde{TPF}$ linearly depends on some measure of the foreign presence in the industry in question and use the specification

$$\widetilde{y} = \boldsymbol{\beta}'\mathbf{x} + \delta \cdot FDI + \varepsilon \quad . \tag{2.1}$$

In this case, what does the coefficient δ tell us? It encompasses at the same time the effect of the foreign presence on the price for the industry and on the technical efficiency of the firm. It is therefore important to determine the sign of the effects we expect to obtain.

The theory of technological spillovers predicts that the impact of FDI on the technical efficiency of the domestic firms should be positive for the reasons I explained in the introduction to this chapter. The question of how FDI impacts the price is addressed by Kosova (2010), who models the entry of an MNE in a domestic industry as the entrance of a dominant firm in a competitive environment. This means that the dominant foreign firm can affect the price so that its marginal revenues are equal to its marginal costs and the domestic firms (the competitive fringe) have to take this price as given. This new price will be lower than the price set in the competitive environment, and so, we should expect the impact of FDI to be negative on the price for the industry.

The above reasoning is obviously very simplified, but it shows why the impact of FDI, when estimated within the framework of the equation (2.1), is ambiguous in nature: we can reasonably expect this impact to be a composite of two opposite effects. One effect is the technological transfer from MNEs to domestic firms, which is positive. The second effect is the competition effect given by decreasing prices, which is negative.

If the purpose of an analysis of the impact of FDI on the host economy is to decide upon the role of technological spillovers (which is the case in the majority of empirical papers), the applied methodology must allow for the identification of such spillovers by disentangling them from the competition effect. A similar concern was already raised by Javorcik and Spatareanu (2005), who claimed that the spillover effect cannot really be observed properly if we do not control for the competition effect, and who criticized the fact that many authors do not, be it explicitly or implicitly, incorporate competition effects into their models. As I discussed in the previous section, it is in fact hardly possible to control for the competition effect under the model that is prevalently used for the analysis of the impact of FDI in the current literature: The δ coefficient in equation (2.1) reflects both the competition effect and the spillover effect. If the spillover effect prevails, δ is positive, whereas if the competition effect prevails, δ is negative. The two effects may also cancel each other out, in which case δ is insignificant. Therefore, within the specification described above, the spillover effect cannot be identified. This is why I propose a new estimation strategy to deal with this problem, which is described in the following section.

2.3 Sources of identification of the spillover effect

The motivation for my estimation strategy stems from a theoretical model proposed by Helpman, Melitz, and Yeaple (2004), who study the conditions under which a firm decides to export or to invest abroad. This decision is known as a "proximity-concentration trade-off": When a firm wants to serve a foreign market, it can either undertake an investment in the country in question (by buying a local enterprise or by founding a new one) or it can export. Helpman, Melitz, and Yeaple (2004) discuss the aspects of this decision from the point of view of the investing/exporting firm, which is not in the scope of my research, but the existence of this trade-off provides me with the argument that foreign competition on the domestic market, i.e., the competition given by foreign MNEs, can be of two sources. It can come from foreign firms that are located abroad through imports or from foreign firms that are established in the country through FDI.

In both cases, we can still assume that foreign firms are more efficient than domestic firms: as Melitz (2003) shows, it is only the most efficient firms that engage in FDI or in exporting, and so, we can assume that these firms have competitive advantages over firms that serve only the local market. Hence, the competition effect is present in both cases (although it might be less pronounced in more developed markets where local firms may be closer in efficiency to MNEs). On the other hand, if the MNE is located abroad, there is smaller scope for technological spillovers, which should be stronger if domestic firms are in close contact with the MNEs[2]. Therefore, the idea of my estimation strategy is to compare how industrial sectors are influenced by imports and by the presence of MNEs in the country. Using this approach, I will be able to filter out the competition effect, and if I find that firms in the sector with a higher foreign presence are more efficient, I can conclude that it is due to positive spillover effects.

To illustrate this reasoning formally, we should return to the equations presented in Section 2.2.2. Suppose we add a variable representing the share of imports in equation (2.1):

$$\widetilde{y} = \boldsymbol{\beta}'\mathbf{x} + \delta_{FDI} \cdot FDI + \delta_{Imports} \cdot Imports + \varepsilon \quad .$$

When we suppose that δ_{FDI} represents the sum of competition and spillover effect, and $\delta_{Imports}$ represents the competition effect only, then the spillover effect should be filtered

[2]This issue is discussed in many papers: Keller (2004) sees international trade also as a source of technological spillovers, but Markusen and Venables (1999) claim that such spillovers need a face-to-face interaction with MNEs, similar to Morita and Nguyen (2012) for whom FDI is the only or major source of spillovers.

out by taking the difference of the two coefficients. Therefore, if we find

$$\delta_{FDI} - \delta_{Imports} > 0 \quad ,$$

we can conclude there is a positive spillover effect.

This estimation strategy requires variation in the composition of foreign competition: to be able to estimate both δ_{FDI} and $\delta_{Imports}$, I need to compare sectors that have a similar degree of foreign competition but have different shares of imports versus the production of local MNEs, which means that one sector has to have relatively more FDI presence, and the other one has to have relatively more imports. Of course, the sectors should also be similar in other characteristics so that there are no other sources of variation. To be able to ensure such a source of variation, I will rely on the time and the cross-country dimensions of my analysis taking into account European countries between the years 2001-2007. My assumption is the composition of foreign competition in these countries during this time period varies for different reasons. It might be that the countries were more attractive targets for FDI in later years rather than at the beginning of the period. Second, some countries might, for political reasons, encourage FDI rather than open to imports and vice versa. As an example, the variations of FDI presence and of imports are presented in Figure 2.1 for the countries of the Visegrad group.

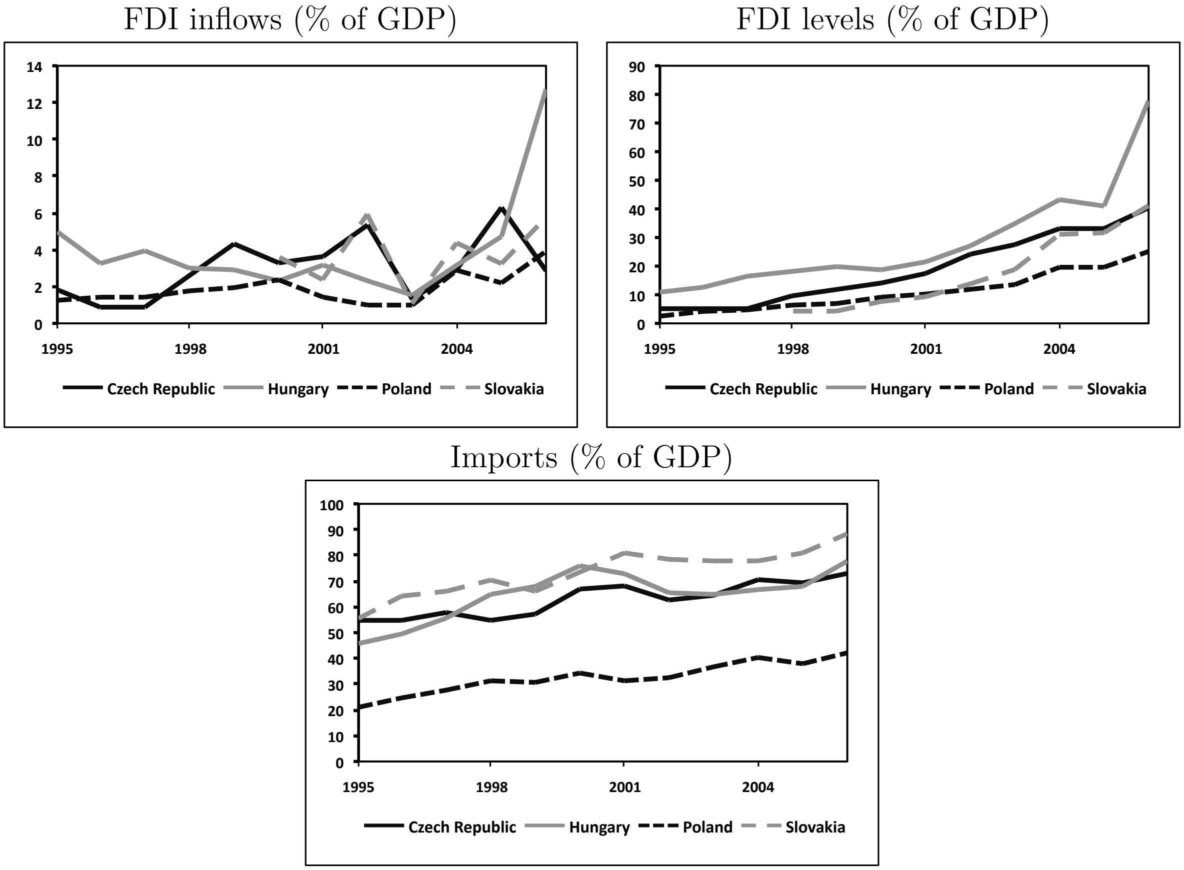
Such an estimation strategy requires a specific dataset: I need not only the information about domestic and foreign firms, but also about imports in particular industries. The following section describes the data used for the analysis.

2.4 Data description

2.4.1 Geographic and time coverage

The analysis covers the time period 2001 – 2007 and focuses on European countries, which are considered to be either *Western* or *Eastern* countries. The Western countries are the countries of the EU15 (Luxembourg being joint with Belgium) plus Iceland, Norway, and Switzerland. The Eastern countries are the countries that joined the EU in 2004 or 2007. The analysis was performed on both groups separately to see the differences between fully developed countries and those who had just undergone the transition period. Special attention was paid to the countries of the Visegrad group, for which the analysis

Figure 2.1: FDI and imports



Source: OECD and World Bank

is provided separately. The list of countries and their classification in groups can be found in Table 2.1.

2.4.2 Data sources

I used the AMADEUS database to obtain information about firms operating in the chosen countries: their performance, their financial and organizational characteristics, their ownership structure (especially if they are domestic or foreign), and their industry classification expressed by the three-digit NACE code (Rev. 1.1). I link this database with information from UN COMTRADE data about international trade, which covers international exports and imports between the selected countries and their trade partners in the studied time period, disaggregated to the four- and five-digit SITC level (Rev. 3)[3].

[3] I use the same dataset as Frensch and Gaucaite-Wittich (2009).

Table 2.1: Analysed countries and their classification

Western countries	*Eastern countries*	*Visegrad group*
Austria	Bulgaria	the Czech Republic
Belgium	Cyprus	Hungary
Denmark	the Czech Republic	Poland
Finland	Estonia	Slovakia
France	Hungary	
Germany	Latvia	
Greece	Lithuania	
Iceland	Poland	
Ireland	Romania	
Italy	Slovakia	
the Netherlands	Slovenia	
Norway		
Portugal		
Spain		
Sweden		
Switzerland		
the United Kingdom		

2.4.3 Aggregation on industry level

Unlike in other papers concerning the subject of FDI, my analysis is aggregated at the industry level. It is still inspired by the estimation of the production function, but all the characteristics are aggregated at the industry level in a way that will be described below. The motivation for this approach is simple: First, I am not interested in the impact of the foreign presence on particular firms but rather on the average efficiency of domestic firms in an industry; and second, both FDI and trade are sectoral variables and so there is no individual source of variation in these variables at the firm level. The aggregation implicitly assumes that the parameters of the production function are constant across firms, but in this regard, my approach is not different from the standard estimation of production functions at the firm level with constant coefficients, such as in Nickell (1996) and others.

Aggregating and merging the two data sources that I use first requires the choice of the same level of aggregation and also the harmonization of the two coding systems. I work on the SITC four- and five-digit level, in which the trade data are coded, and I aggregate the data to this level within each country and year[4].

The first step in preparing my dataset was thus to harmonize the SITC Rev. 3 codes with the NACE Rev. 1.1 codes and to transform the AMADEUS database into this new coding. I used for this purpose correspondence tables that can be downloaded from the United Nations Statistics Division[5]. There is no direct correspondence between these two coding systems, but I managed to link them by means of other coding systems for which the correspondence tables are available. I used macros programmed in VBA for this purpose, and I inspected manually the final correspondence table for potential errors.

Firms data

In these data, I aggregate the firms' characteristics within each SITC industry for domestic firms by using the weighted averages over all firms in the industry, where weights represent the shares of domestic owners in the given firm. Hence, when I am interested in characteristic X of domestic firms in industry i and at time t, I obtain it as

$$\overline{X}_{it}^{domestic} = \frac{1}{N_{it}} \sum_{j=1}^{N_{it}} d_{ijt} X_{ijt} \quad ,$$

where N_i is the number of firms in industry i, X_{ij} is the given characteristic of the j-th firm in industry i, and d_{ij} is the share of domestic owners in the j-th firm in industry i (all in time t). The upper bar denotes that I am considering a weighted average[6], and the superscript *domestic* reminds us of the fact that I use the share of domestic ownership as weights. I focus on domestic firms only because these are the subject of my research question; this is the standard approach used in the literature, which also focuses solely on a sub-sample of domestic firms.

Apart from basic characteristics, I use the firms' data also to construct a measure of FDI in the industry, a variable that I will denote as FDI. Its construction is slightly

[4]Minimum, average, and maximum number of firms in an industry resulting from this aggregation can be found in Appendix 2.A.1.

[5]`http://unstats.un.org/unsd/cr/registry/regot.asp?Lg=1`

[6]Note that, strictly speaking, the weights do not sum to one; more precisely, the sum of weights is smaller or equal to one. This simply reflects the fact that only the domestic part of production is taken into account. By construction, the variable still reminds us of an average and that is why I use such notation.

more complicated and will be presented after the specification of my regression model.

Trade data

With regards to trade data, to obtain imports and exports at the SITC industry level, I summed over all importers in the case of imported goods and over all export destinations in the case of exported goods. I thus obtained for each industry in the four- and five-digits SITC classification the value of goods that were imported and exported. Then, I linked these data with those created from the AMADEUS database.

Resulting dataset

By aggregating and joining the two data sources, I obtained a unique dataset of approximatively 250 000 observations. It has the structure of an unbalanced panel of industries in the above mentioned countries over the period 2001 – 2007[7].

2.5 Specification

2.5.1 Estimation at the industry level

As explained in the previous section, my analysis is performed at an industry level. It is still very similar to other papers dealing with the issue of FDI since it is performed for the share of industry represented by domestic firms only, and it is inspired by the production function estimation. My specification is thus

$$\ln\left(\overline{Y}_{it}^{domestic}\right) = \boldsymbol{\beta}' \ln\left(\overline{\mathbf{X}}_{it}^{domestic}\right) + \boldsymbol{\delta}'\mathbf{Z}_{it} + \varepsilon_{it} \quad ,$$

where i is the industry index and t the time index. Further, Y denotes output, $\mathbf{X}$ denotes factor inputs, and $\mathbf{Z}$ stands for other covariates, related to the foreign presence on the domestic markets (FDI and imports). The logarithmic specification stems from the form of a production function. The construction of the variables $\mathbf{Z}$ is yet to be explained, but to understand the notation, one should remember that they are industry specific rather than firm specific, which is why they are not limited to the domestic share of firms only.

[7]The number of observations for each year can be found in Appendix 2.A.1.

My choice of variables Y, $\mathbf{X}$, and $\mathbf{Z}$ as well as the assumptions about the error term ε will be specified below. Before that, several aspects of the industry level approach should be stressed.

First, let me repeat that in my specification, I estimate the production function of the whole industry, not those of individual firms, which is in line with the purpose of my research — to evaluate the impact of FDI on the domestic industry as a compact and dynamic structure.

Second, let me stress that the aggregation does not affect the covariates that represent the foreign presence, which are sectoral in principle and which are defined as such even in papers that focus on a firm-level analysis.

Third, the aggregation before estimation makes me lose, of course, some source of variation (on the within-industry level) making my estimates less efficient than estimations at the firm level. On the other hand, the aggregation may help to reduce the measurement error bias, which is very likely to occur in firm level data, and this might outweigh the efficiency loss.

2.5.2 Choice and definition of variables

Following the seminal paper by Nickell (1996), I choose sales (*Sales*) to proxy the output variable Y and tangible fixed assets (*Assets*) and the number of employees (*Employment*) to proxy the factor inputs $\mathbf{X}$. Moreover, I include in my specification the lagged values of output to account for the imperfect allocation of factor inputs. The descriptive characteristics of these variables can be found in Appendix 2.A.1.

Concerning variables that indicate the foreign presence, I use the variable FDI to account for the FDI presence and *Imports* to account for the foreign presence given by import flows. To explain the construction of these variables, I need to recapitulate my identification strategy for the spillover effect of FDI.

I claim that the overall impact of FDI, especially when estimated within the framework of a production function with sales as the dependent variable, is ambiguous since it is composed of two contradictory effects: the competition effect and the spillover effect. Domestic firms are competing with foreign-owned firms in sales on the market (and so their sales may be lowered), but they can supposedly benefit from the presence of foreign-owned firms by technology spillovers.

To identify the possible spillover effect, I want to compare the effect of FDI to the effect of competition given by international trade: I claim that domestic firms compete also with foreign firms that serve the domestic market through imports and that this can be comparable to the competition given by foreign-owned firms established in the country. The difference is there should not be technology spillovers in this case because of the geographical barrier between domestic and foreign firms.

Therefore, my aim is to compare the impact of FDI with the impact of imports, and if the difference between the two is positive, it could be attributed to the existence of technological spillovers. Yet, for this comparison to be possible, both variables should be defined in line with the underlying heuristic presented above.

Since the effect of competition that I am trying to filter out is channeled through the sales of firms, my definition of the two variables, FDI and $Imports$, is based on these. Basically, I define the foreign presence given by FDI as the ratio of the sales of foreign-owned firms in a given industry to the sales of all firms operating in that industry (in a given country), and the foreign presence given by imports as the ratio of the volume of imported goods in an industry to the sales of all firms operating in that industry (in a given country). This is quite a simple definition, but there are two issues that have to be taken into account.

First, I have to deal somehow with the timing of FDI. I do not really expect the spillover effect, if there is such, to take place instantaneously. In my opinion, even if domestic firms could benefit from the presence of FDI, they would need some time to adjust and to incorporate possible technological improvements into their production. Therefore, when I say that I define the foreign presence given by FDI as the ratio of the sales of foreign-owned firms in a given industry to the sales of all firms operating in that industry, I should add that it is, in fact, the sales of foreign-owned firms that are already foreign-owned in the previous year, which I use in the numerator of this ratio. More precisely, my definition is as follows:

$$FDI_{it} = \frac{\sum_{j=1}^{N_{it}} f_{ijt-1} Sales_{ijt}}{\sum_{j=1}^{N_i t} Sales_{ijt}} \quad ,$$

where t is time, N_i is the number of firms in industry i, $Sales_{ij}$ are the sales of the j-th firm in industry i, and f_{ij} is the share of foreign owners in the j-th firm in industry i.

Note that this definition is the same as in Javorcik (2004), the only difference being I use the lagged and not the current share of foreign owners. Note also that this variable is not a lagged variable in the usual sense because it still represents the share of current sales of foreign-owned companies that are operating in the market, only the companies that have just been created or purchased by a foreign owner in the current year are not included. The only assumption that has to be made here is that companies which were foreign-owned in the previous year are still foreign-owned in the current period, or, at least, even if they were sold again to a domestic owner, they have mantained the efficiency level they had under the foreign owner. I believe such an assumption is realistic. The descriptive characteristics of FDI and their evolution over the studied period can be found in Appendix 2.A.1.

The foreign presence given by FDI, the measure of which I have just defined, is compared to the foreign presence given by imports. My definition of imports is the following:

$$Imports_{it} = \frac{ImpVol_{it}}{\sum_{j=1}^{N_{it}} Sales_{ijt}} \quad ,$$

where $ImpVol$ is the value of imported goods in industry i, and otherwise, the notation is the same as for the definition of FDI. In other words, in my definition, imports represent the volume of imported goods normalized by the size of the industry. The descriptive characteristics of $Imports$ can be found in Appendix 2.A.1.

At this point, we can consider the second issue that has to be solved before the variables FDI and $Imports$ can be used to identify the potential spillover effect. We have to realize that whereas by construction, the variable FDI is from the interval $[0,1]$, the variable $Imports$ can have any positive value. The reasons are that first, there is nothing that prevents imports from being larger than domestic production; and second, whereas from the UN COMTRADE, I have complete information about international trade, from the AMADEUS database, I only have a representative (even though very large) sample of firms. So, I do not capture the entire domestic production. This implies that the two variables are measured in very different units. As is usual in such cases, I standardize both variables by dividing them by their standard deviation to have them on a comparable scale.

2.5.3 Econometric specification

I run two different specifications. In the first one, I account only for the influence of FDI, whereas in the second one, I account for both the influence of FDI and of imports. In both specifications, I use time and industry fixed effects (the industry being, in fact, an industry-state unit because I aggregate over firms in industries only within countries, not across).

Hence, my first specification is

$$\begin{aligned}\ln(Sales_{it}) &= \beta_0^{(1)} + \beta_1^{(1)} \ln(Sales_{it-1}) + \beta_2^{(1)} \ln(Assets_{it}) + \beta_3^{(1)} \ln(Employment_{it}) + \\ &\quad + \delta_{FDI}^{(1)} FDI_{it} + \gamma_i + \gamma_t + u_{it} \quad ,\end{aligned}$$

and my second specification is

$$\begin{aligned}\ln(Sales_{it}) &= \beta_0^{(2)} + \beta_1^{(2)} \ln(Sales_{it-1}) + \beta_2^{(2)} \ln(Assets_{it}) + \beta_3^{(2)} \ln(Employment_{it}) + \\ &\quad + \delta_{FDI}^{(2)} FDI_{it} + \delta_{Imports}^{(2)} Imports_{it} + \gamma_i + \gamma_t + u_{it} \quad .\end{aligned}$$

Every estimation is run twice: first on the whole sample of industries in the given geographical region, and second on industries that are not oriented to exporting. The estimation on the whole sample is presented basically for the sake of completing my analysis. My identification strategy that is based on filtering out the competition effect can work only when we talk about the competition in the domestic market because I compare imported goods (which are obviously sold only in the domestic market) to sales of firms operating in the industry. If a significant part of the production of the domestic firms goes for export, then my identification strategy cannot really work.

In reality, most of the industries have both import and export flows because they are industries with differentiated products. Hence, I cannot really find an industry that would be purely import-oriented and as a consequence, my identification strategy is not flawless. However, I can at least focus on industries that are less export-oriented than others, which is why I run a second estimation for each geographical region only on a sub-sample of industries where the exports (normalized by total sales) are below the median for the whole sample. This is the estimation that I focus on when evaluating my research hypotheses, which are presented in the following section.

2.5.4 Hypotheses

The literature on spillover effects claims that if these are present, the coefficient δ_{FDI} should be positive. However, if only the first specification is used (as is in the existing literature on this issue), it is often found insignificant or negative. I argued throughout this chapter that this might be because in this specification, the variable FDI influences output in two opposite ways: by inducing the negative competition effect and the positive spillover effect at the same time. Hence, I have a priori no hypothesis about the coefficient $\delta^{(1)}_{FDI}$; I introduce this specification basically only to compare my results with studies made at firm level.

To account for the foreign competition, I introduce in the model the $Imports$ variable, which should also represent the negative competition effect but no positive spillover effect. To verify this, I test if the coefficient $\delta^{(2)}_{Imports}$ is negative:

Hypothesis 1:

$$H_0: \ \delta^{(2)}_{Imports} \geq 0 \quad \text{vs} \quad H_A: \ \delta^{(2)}_{Imports} < 0 \ .$$

In my second specification, I can compare the coefficients δ_{FDI} and $\delta_{Imports}$, and if their difference is positive, I can conclude that there is a positive spillover effect present:

Hypothesis 2:

$$H_0: \ \delta^{(2)}_{FDI} - \delta^{(2)}_{Imports} \leq 0 \quad \text{vs} \quad H_A: \ \delta^{(2)}_{FDI} - \delta^{(2)}_{Imports} > 0 \ .$$

Hence, the rejection of H_0 in the first hypothesis justifies my identification strategy, and the rejection of H_0 in the second hypothesis proves the presence of positive spillover effects of FDI.

2.6 Results

All regression tables with results can be found in Appendix 2.A.2[8], and there are several observations that can be made based on these.

First, it has to be said that in all specifications and sub-samples, the effect of FDI (when measured solely by the coefficient on this variable) is estimated as negative. This is

[8] They are presented in separate tables first for Western countries, then for Eastern countries, and finally for the Visegrad group. The results of the estimation over the whole sample can be found in the first three columns; the results for the sub-sample of non-export oriented industries are in the the last three columns.

in line with the metaanalysis proposed by Hanousek, Kocenda, and Maurel (2011), and it shows that even if my definition of foreign presence given by FDI inflow is slightly different from other studies and even if my estimation runs at the industry level rather than at the firm level, I come to comparable results. Hence, if my findings differ from those already published, it is not because of the construction of my dataset nor my variables, but only because of my identification strategy.

Second, in all specifications and all sub-samples, the effect of $Imports$ is negative and significant. I can reject the null of *Hypothesis 1* and conclude that imports really induce a negative competition effect on domestic firms, supporting thus the assumption upon which my estimation is based.

Third, the results for both FDI and $Imports$ differ in the estimation performed over the whole dataset as compared to the estimation over the sub-sample of non-export oriented firms. In line with my expectations, in the latter one, the negative effect of imports is more pronounced: in this sub-sample, domestic firms serve the domestic market and compete with imported goods. On the other hand, the effect of FDI is less negative for the sub-sample, and this result is consistent over all geographic regions. One possible explanation could be the following. In export oriented industries, both domestic and foreign-owned firms compete in the domestic market as well as abroad — their target market should be approximatively the same because of the same geographical constraints. We could expect that competing on markets abroad might be more difficult for domestic firms because foreign-owned firms might have some support from an international network created by MNEs, and so export oriented, domestic firms might suffer more from the competition than firms that sell their production in the domestic market, where the advantage of having a foreign owner is not that strong.

2.6.1 Main results and tests

As I have already explained, it is the sub-group of non-export oriented firms that is more suitable for my identification strategy, and hence, I focus on the results coming from the estimation over this sub-sample to answer my research question on the presence of positive spillovers. I present these results separately in Table 2.2.

We can see in this table that the coefficient on FDI is consistently less negative than the coefficient on $Imports$, and so, it may seem that I can reject the H_0 of *Hypothesis 2* presented in Section 2.5.4. I test this hypothesis formally using a one-sided t-test of the

Table 2.2: Overview of the main results

	Western countries	Eastern countries	Visegrad group
FDI	-0.103***	-0.058***	-0.058***
	(0.005)	(0.004)	(0.007)
Imports	-0.148***	-0.126***	-0.246***
	(0.032)	(0.031)	(0.088)
Lagged Sales	0.012***	0.008*	0.009*
	(0.004)	(0.004)	(0.005)
Tangible fixed assets	0.433***	0.520***	0.694***
	(0.010)	(0.007)	(0.010)
Employment	0.285***	0.311***	0.133***
	(0.010)	(0.010)	(0.010)
Year effects	Yes	Yes	Yes
R^2	0.517	0.744	0.797
Observations	86737	38691	18331

The table presents the results from the FE estimation of the main specification for different sub-groups of countries, where only the sub-sample of non-export oriented industries is taken into account.
The dependent variable is Sales. Sales, Assets, and Employment are in logarithms.
Clustered standard errors are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

difference of the two coefficients. The results of this test for each of the three regions are presented in Table 2.3[9], and they confirm that I can reject the H_0 at the 95% confidence level for Eastern countries and the countries of the Visegrad group, whereas for Western countries, the statistical significance is a little bit less strong (but still valid at the 90% confidence level).

To sum up, I can reject the null-hypothesis that the effect of FDI is more negative than the effect of imports: I find the difference of these two effects to be positive. This result supports the theory that there might be positive spillover effects stemming from FDI, and thus it answers my main research question, but it merits further comment.

[9]Note that due to the number of observations, I use the standard normal distribution as an asymptotic approximation of the t-distribution to determine the p-values.

Table 2.3: Hypothesis testing

	Western countries	Eastern countries	Visegrad group
t-statistic	1.407	2.152	2.121
p-value	0.080	0.016	0.017

The table presents the results of the test of positive difference between the effect of FDI and of Imports. The null-hypothesis is that this difference is negative.
The results are presented for different subgroups of countries and only the sub-sample of non-export oriented industries is taken into account.
Note: p-values of the asymptotic one-sided test are based on standard normal distribution.

2.6.2 Regional difference

It is interesting to compare the estimation results for the three geographical regions. If we define the spillover effect as the difference between the coefficients on FDI and on $Imports$, we see it is the largest for he Visegrad group of countires and relatively smaller for both Eastern countries as a whole and Western countries. This result can be interpreted in line with other papers analyzing the effect of FDI: It is hypothesized that to internalize the spillover effect, domestic companies should not be too inferior in terms of efficiency to the MNEs because if the efficiency gap is too wide, domestic companies are not able to "catch up". Hence, the spillover effect is a U-shaped function of domestic firms' efficiency. If domestic firms' efficiency is very small compared to MNEs, the spillover effect is weak because of the inability to internalize; if the domestic firms' efficiency is similar to the efficiency of MNEs, the spillover effect is also weak because there is little scope for improvement; if the gap between domestic firms and MNEs is significant but moderate, the spillover effect is the strongest[10].

If we assume that domestic firms in Western countries are the closest to MNEs in terms of efficiency, we should not be surprised that there is no significant spillover effect present — there is little to learn from the point of view of domestic firms. Further, when we inspect the descriptive statistics of the data, we notice that firms from the Visegrad group are closer in their characteristics to Western firms than the mean of Eastern firms. This signals that within the group of Eastern countries, the Visegrad group are rather above the average, and they are then also closer to MNEs in terms of efficiency even though the gap is still very significant. This observation together with the theory of the U-shaped effect presented above could explain the differences we observe among regions.

[10] For more details, see Smeets (2008).

2.6.3 Evaluation of the impact

Not only do we have to conclude that the countries of the Visegrad group seem to benefit the most from FDI spillovers, we can also see (from the descriptive statistics presented in Appendix 2.A.1) that the presence of MNEs in these countries is above the average for Eastern Europe, reinforcing the economic significance of the estimated positive effect. It is interesting to see how important the spillovers from FDI are in the three regions when we take into account not only the estimated coefficients, but also the change in the presence of MNEs.

To assess the importance of the effect of FDI, I evaluate the following expression:

$$Effect = (\delta_{FDI} - \delta_{Imports}) \cdot \Delta FDI \quad , \tag{2.2}$$

where δ_{FDI} and $\delta_{Imports}$ are the estimated coefficients from Table 2 and ΔFDI is the difference of the average foreign presence between the years 2002 and 2007. Because of the semi-logarithmic specification of the regression equation, one unit change of FDI induces a change of domestic firms' sales by one percent, and the effect of FDI is, thus, measured as a percent change.

In Figure 2.2, I visualize the values of the expression (2.2) separately for the three regions together with its 95% confidence interval[11].

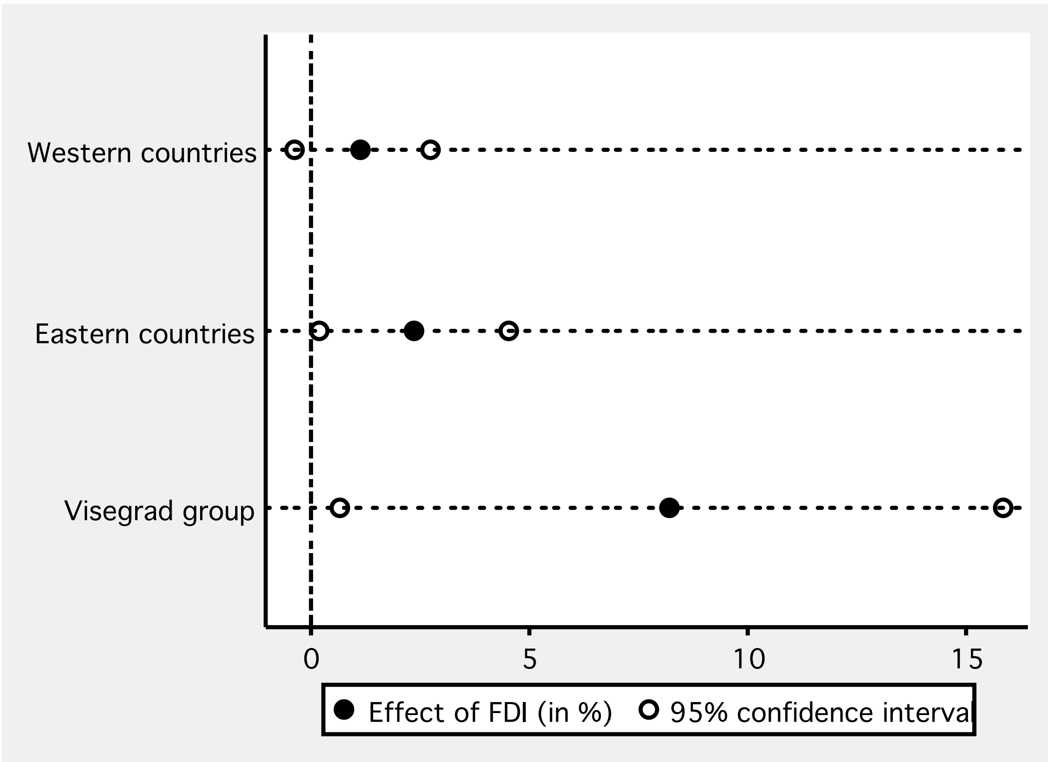
In this figure, we observe (in line with results presented above) that the effect is significant for Eastern countries and for the Visegrad group. For the Visegrad group, it is much larger than for Eastern countries as a whole, which is given both by the size of the estimated effect and by the large increase of foreign presence in these countries.

2.6.4 Alternative explanation of the positive spillover

My conclusion that there is a positive spillover effect stemming from FDI is based upon the assumption that we may proxy the increase in competition due to FDI by a comparable increase in international trade (imports). This assumption is in line with theoretical models such as Melitz (2003) or Markusen and Venables (1999), but for the completeness of my analysis, one has to accept that in the real world, this assumption might be violated. A company that enters a market via FDI may have different long-term objectives and, therefore, different strategic (pricing) behavior than a foreign exporter whose goods are

[11] To obtain the measure of the effect in percents, I multiply all values by 100.

Figure 2.2: Effect of FDI



imported to the market. Such difference can also lead to the positive difference between the two coefficients that I interpret as a positive spillover effect. Therefore, if the main assumption about the comparable effects of the two types of foreign competition does not hold, the positive effect of FDI as compared to imports should not be interpreted as a technological spillover. However, from a policy point of view, it still confirms that foreign investment can be more beneficial for domestic firms than foreign imports.

2.7 Robustness checks

2.7.1 Alternative control variables

It is true that the validity of the results presented depends on how well the chosen variables proxy the control variables of the theoretical model, especially labor and capital. In my estimation, I choose total fixed assets and the number of employees because these are often used in the stream of literature to which I am relating my analysis. However, some authors also suggest using working capital as a measure of capital used for production and staff costs as a measure of labor.

To see how the different choices of proxies for control variables affect my results, I performed the same estimation with different combinations of proxies for capital and labor. The results for the Visegrad group countries are presented in Appendix 2.A.3, where we can observe a consistent positive difference between the coefficients on FDI and on $Imports$ for non-export oriented industries, signaling the presence of a positive spillover effect from FDI in line with the results discussed above.

2.7.2 Spillovers vs. technological intensity

The analysis I performed brings information only about the average impact of FDI on domestic industries. However, I am aware of the fact that all industries are not the same, and the way in which they respond to the foreign presence can be very heterogenous, also because the channels of potential spillovers are very diverse including: copying new technologies, benefiting from a better trained workforce or managers due to labor turnover, and getting access to higher quality intermediate products. Each of these channels may play a different role, especially if the industries differ in the intensity with which they use technologies or in their capital to labor ratio.

This is why I extend my analysis by taking into account the degree of technological intensity, relying on the official OECD classification, according to which industries in manufacturing can be divided into four categories: high-technology industries, medium-high-technology industries, medium-low-technology industries, and low-technology industries[12]. Based on this classification, I divide the industries in my dataset into two groups: The first group contains high and medium-high technology industries, and the second group contains the rest. I estimate my model over the two groups separately.

The results of the analysis (for non-export oriented industries only) are reported in Appendix 2.A.4. Comparing the coefficients on FDI and $Imports$, we can see that for Western countries, the impact of FDI seems to be more accentuated in the case of high and medium-high technology industries, whereas in Eastern countries, including those in the Visegrad group, it is the other way around. This observation is somehow limited by the fact that for Eastern countries, the coefficient on $Imports$ for the first group of industries is not significant [13], yet it suggests that mechanisms through which the

[12]The details of the classification by 3-digit NACE codes can be found in OECD (2001).

[13]Due to the size of the standard error, compared to previous estimations, I would say that this is due to low variation in imports in this particular sub-sample.

spillovers from FDI are channelled may be substantially different in Western and Eastern countries.

2.7.3 Industries containing a low number of firms

Table 4 suggests that the minimum number of firms in an industry is one. Since the precision of the industry-level measures could vary with the number of firms per industry and industries with a low number of firms can be noisy, as a robustness check, I repeated the analysis focusing only on industries where the number of firms in the industry is larger than 10 (these industries represent 95% of the sample). The results were not significantly different from those presented here.

2.8 Conclusion

In this work, I contributed to the literature concerning the impact of FDI on the host economy by presenting a new identification strategy for the horizontal spillover effect. I explained why this effect is not correctly identified in papers that take into account only the presence of firms with foreign owners in the domestic market. I pointed out that the positive spillovers might be outweighed by a negative competition effect if the competition environment is not controlled for. My strategy for the identification of spillovers is to compare the effect induced by foreign firms that import on the domestic market with the effect induced by foreign firms that actually operate in the domestic economy: The difference between these effects should be attributed to potential spillovers. I performed the analysis on a large panel of industries in European countries in the period 2001–2007.

To study the effect of FDI on data at industry level is a novel approach by itself, but, as I explain and as I show by applying it to the traditional specification that is used with firm level data, it does not change the very principle of the analysis, it just improves some of its statistical properties. The key contribution of my work lies in the comparison of the two sources of foreign competition which enables me to isolate properly the spillover effect and to confirm its positive impact on the performance of domestic firms. I support my results by a robustness check of the quality of the proxies for my control variables, and I extend them while discussing regional and technological differences between industries.

I find an economically significant positive effect of FDI on the performance of domestic firms especially for the countries of the Visegrad group. The effect is the strongest for industries with lower technological intensity, where it is consistently significant across all specifications.

2.A Appendix 2

2.A.1 Descriptive statistics

Table 2.4: Number of firms per industry

	# of firms
Min	1
Median	74
Max	13289

Table 2.5: Number of observations per year

	# of observations
2001	34763
2002	39161
2003	42063
2004	46656
2005	47132
2006	47030
2007	33551

These numbers correspond to the set of all countries.

Table 2.6: Descriptive statistics of explanatory and control variables

	Western countries	Eastern countries	Visegrad group
Sales	40.380	5.844	9.753
	(156.124)	(19.565)	(27.542)
Tangible fixed assets	6.656	2.451	4.058
	(22.472)	(10.088)	(13.987)
Employment	88	83	114
	(280)	(122)	(153)
Observations	197996	92361	42389

Means of the variables are presented. Standard errors are in parentheses.
Sales and tangible fixed assets are in millions of current EUR.
Employment is measured as the number of employees.

Table 2.7: Descriptive statistics of FDI

Year	Western countries	Eastern countries	Visegrad group
2002	19.50	20.91	24.31
	(21.48)	(27.25)	(28.52)
2003	22.45	28.85	37.81
	(21.95)	(29.11)	(27.98)
2004	24.35	28.47	41.74
	(22.99)	(29.69)	(26.53)
2005	23.24	39.81	39.12
	(21.78)	(28.49)	(27.54)
2006	26.98	37.74	42.49
	(24.16)	(28.87)	(28.16)
2007	24.46	31.83	32.02
	(24.32)	(35.76)	(40.08)

The mean of the share of foreign owners is presented.
Standard errors are in parentheses.
The variable is measured in percents.

Table 2.8: Descriptive statistics of imports

Year	Western countries	Eastern countries	Visegrad group
2002	51050	11822	14669
	(339953)	(51452)	(54691)
2003	50316	9849	16058
	(343837)	(46573)	(61404)
2004	53004	9873	17575
	(366435)	(46092)	(66339)
2005	52889	10293	17611
	(373335)	(45076)	(62587)
2006	59024	12492	21936
	(414975)	(61843)	(83513)
2007	59199	8898	18634
	(361961)	(38253)	(57631)

The mean of the volume of imported goods is presented.
Standard errors are in parentheses.
The variable is measured in millions of current EUR.

2.A.2 Main results

Table 2.9: Western countries

	All industries		Non-export oriented	
	(1)	(2)	(1)	(2)
FDI	-0.129***	-0.138***	-0.102***	-0.103***
	(0.004)	(0.004)	(0.005)	(0.005)
Imports		-0.100***		-0.148***
		(0.004)		(0.032)
Lagged Sales	-0.018***	-0.015***	0.012***	0.012***
	(0.003)	(0.003)	(0.004)	(0.004)
Tangible fixed assets	0.388***	0.377***	0.435***	0.433***
	(0.007)	(0.007)	(0.010)	(0.010)
Employment	0.336***	0.330***	0.286***	0.285***
	(0.007)	(0.006)	(0.010)	(0.010)
Year effects	Yes	Yes	Yes	Yes
R^2	0.479	0.489	0.516	0.517
Observations	173480	173480	86737	86737

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.10: Eastern countries

	All industries		Non-export oriented	
	(1)	(2)	(1)	(2)
FDI	-0.059***	-0.066***	-0.057***	-0.058***
	(0.003)	(0.003)	(0.005)	(0.004)
Imports		-0.051***		-0.126***
		(0.005)		(0.031)
Lagged Sales	-0.010***	-0.014***	0.009*	0.008*
	(0.003)	(0.003)	(0.005)	(0.004)
Tangible fixed assets	0.504***	0.498***	0.522***	0.520***
	(0.005)	(0.005)	(0.007)	(0.007)
Employment	0.297***	0.299***	0.310***	0.311***
	(0.007)	(0.007)	(0.010)	(0.010)
Year effects	Yes	Yes	Yes	Yes
R^2	0.710	0.712	0.744	0.744
Observations	81392	81392	38691	38691

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.11: Visegrad group

	All industries (1)	All industries (2)	Non-export oriented (1)	Non-export oriented (2)
FDI	-0.056***	-0.062***	-0.056***	-0.058***
	(0.004)	(0.004)	(0.007)	(0.007)
Imports		-0.038***		-0.246***
		(0.006)		(0.088)
Lagged Sales	-0.007*	-0.008**	0.010*	0.009*
	(0.004)	(0.004)	(0.005)	(0.005)
Tangible fixed assets	0.570***	0.565***	0.696***	0.694***
	(0.007)	(0.007)	(0.010)	(0.010)
Employment	0.209***	0.209***	0.133***	0.133***
	(0.007)	(0.007)	(0.010)	(0.010)
Year effects	Yes	Yes	Yes	Yes
R^2	0.736	0.737	0.797	0.797
Observations	36803	36803	18331	18331

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

2.A.3 Alternative control variables

Table 2.12: Working capital

	All industries		Non-export oriented	
	(1)	(2)	(1)	(2)
FDI	-0.051***	-0.057***	-0.059***	-0.061***
	(0.003)	(0.003)	(0.005)	(0.005)
Imports		-0.042***		-0.242***
		(0.005)		(0.076)
Lagged Sales	0.004	0.003	0.034***	0.034***
	(0.003)	(0.003)	(0.005)	(0.005)
Working capital	0.572***	0.570***	0.649***	0.647***
	(0.006)	(0.006)	(0.011)	(0.011)
Employment	0.224***	0.222***	0.189***	0.189***
	(0.006)	(0.006)	(0.009)	(0.009)
Year effects	Yes	Yes	Yes	Yes
R^2	0.749	0.750	0.788	0.789
Observations	36036	36036	18112	18112

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.13: Staff costs

	All industries		Non-export oriented	
	(1)	(2)	(1)	(2)
FDI	-0.087***	-0.090***	-0.096***	-0.098***
	(0.004)	(0.004)	(0.007)	(0.007)
Imports		-0.016***		-0.196***
		(0.005)		(0.071)
Lagged Sales	-0.085***	-0.085***	-0.080***	-0.080***
	(0.004)	(0.004)	(0.005)	(0.005)
Tangible fixed assets	0.532***	0.531***	0.682***	0.682***
	(0.009)	(0.009)	(0.010)	(0.010)
Staff costs	0.320***	0.318***	0.227***	0.226***
	(0.008)	(0.008)	(0.008)	(0.008)
Year effects	Yes	Yes	Yes	Yes
R^2	0.770	0.770	0.819	0.819
Observations	38619	38619	19045	19045

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.14: Working capital & Staff costs

	All industries		Non-export oriented	
	(1)	(2)	(1)	(2)
FDI	-0.082***	-0.088***	-0.092***	-0.094***
	(0.003)	(0.003)	(0.005)	(0.005)
Imports		-0.037***		-0.302***
		(0.004)		(0.098)
Lagged Sales	-0.074***	-0.074***	-0.046***	-0.046***
	(0.004)	(0.004)	(0.005)	(0.005)
Working capital	0.482***	0.481***	0.616***	0.615***
	(0.009)	(0.009)	(0.010)	(0.010)
Staff costs	0.323***	0.319***	0.219***	0.218***
	(0.008)	(0.008)	(0.009)	(0.009)
Year effects	Yes	Yes	Yes	Yes
R^2	0.734	0.736	0.784	0.785
Observations	37859	37859	18832	18832

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

2.A.4 Spillovers vs. technological intensity

Table 2.15: Results by technological intensity

	High and medium-high			Low and medium-low		
	West	East	Vis	West	East	Vis
FDI	-0.095***	-0.049***	-0.034***	-0.100***	-0.052***	-0.056***
	(0.007)	(0.005)	(0.009)	(0.006)	(0.008)	(0.012)
Imports	-0.169**	-0.010	-0.153	-0.114***	-0.138***	-0.316***
	(0.068)	(0.090)	(0.176)	(0.032)	(0.021)	(0.118)
Lagged Sales	0.000	0.038***	0.048***	0.022***	-0.025***	-0.031***
	(0.007)	(0.007)	(0.009)	(0.004)	(0.006)	(0.007)
Tangible fixed assets	0.598***	0.436***	0.680***	0.279***	0.581***	0.699***
	(0.012)	(0.010)	(0.018)	(0.012)	(0.010)	(0.012)
Employment	0.165***	0.408***	0.183***	0.451***	0.241***	0.087***
	(0.013)	(0.013)	(0.018)	(0.011)	(0.013)	(0.013)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.579	0.761	0.825	0.498	0.744	0.782
Observations	39408	16433	8456	47329	22258	9875

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Chapter 3

Sourcing patterns of FDI activity[1]

3.1 Introduction

In the first chapter of my dissertation, I presented a theoretical model which predicts that under some conditions, FDI can increase the demand for intermediate goods supplied by domestic firms from upstream industries. I showed that this happens only if the MNEs have the same need for intermediate goods as the domestic firms that have been crowded out or when they offset their relatively lower need for supplies by increasing production. I also mentioned that MNEs may tend more towards purchasing their supplies from abroad or from other MNEs operating in the country, which would then have an adverse effect on domestic suppliers.

The purpose of the third chapter of my dissertation is to shed more light on these issues by empirically analyzing one of the aspects of the presence of MNEs in the domestic market — their relationship with suppliers of intermediate goods. I study whether the inflow of FDI increases the demand for intermediate goods and what the channels are through which these goods are provided. I focus especially on the question whether MNEs purchase intermediate goods from domestic suppliers, from suppliers that have foreign owners, or whether they import them from abroad.

[1] **An earlier version of this work has been published in Nikolovová, P. 2013. "Sourcing Patterns of FDI Activity and their Impact on the Domestic Economy."** ***Finance a úvěr - Czech Journal of Economics and Finance*** **63 (3): 288–302.**

3.2 Literature review

The inter-industry relationship (also called vertical linkage), which I am studying in this chapter, is one of the two dimensions of the impact of FDI that the literature usually distinguishes. The second one is the intra-industry (or horizontal) level, which concerns the interaction between MNEs and their local competitors within the same industry. Both on vertical and horizontal levels, there are two main channels of interaction between the MNE and other firms in the economy: market structure and technological transfers. The entry of a highly efficient MNE significantly changes the competition environment and market conditions for domestic firms; at the same time, domestic firms can potentially benefit from productivity spillovers, which are externalities created by the presence of the MNE in the market. Researchers assume that a technologically more advanced MNE represents a positive example which domestic firms can follow by copying new technologies, by hiring workers or managers that have had experience in the foreign company, and so on.

Both the market structure change and the productivity spillovers given by the entry of a highly efficient MNE in the domestic market are described in the theoretical model of Markusen and Venables (1999), who compare three different scenarios: 1) the goods in the domestic market are produced by domestic firms, 2) the goods are produced by MNEs operating in the domestic market, and 3) the goods are imported from abroad. The conclusion of the authors is that whereas the second and third scenarios increase competition within the industry and may thus threaten domestic firms, the second scenario also boosts the demand for intermediate goods across industries and may bring profit to domestic suppliers. In addition, the second scenario, as opposed to the third one, provides scope for productivity spillovers, assuming that these need a face-to-face interaction between the two parties (domestic firms and MNEs), a hypothesis also supported by Ethier (1986).

The Markusen and Venables (1999) model has one significant drawback — it does not allow for imports of intermediate goods and so foreign subsidiaries have to source all their imports locally[2]. This assumption accords poorly with the data in a way that can matter importantly for behavior: we know that FDI is closely related to inter-sectoral trade and

[2] The Markusen and Venables (1999) model is one of two theoretical models that study the impact of MNEs on local suppliers of intermediate goods. The second model by Rodríguez-Clare (1996) is not very suitable for my study since it is tailored to the situation in underdeveloped countries. In this model, domestic firms and MNEs are producing different types of goods because there are not enough suppliers of sophisticated intermediate goods in the country, and domestic firms cannot import them. I do not think such assumptions are realistic in EU countries.

vertical integration of the production chain, as shown in theoretical models (e.g. Helpman (1984)) and documented by empirical work (Lanz and Miroudot (2011)). In reality, the potential increase in demand for intermediate goods given by FDI inflow and related enhanced industrial activity (as predicted by Markusen and Venables (1999)) is not always covered by domestic firms. MNEs can prefer to purchase the intermediate goods from abroad, and so the overall impact on domestic suppliers can be finally even negative. In the first chapter of this thesis, I explain how the interaction between MNEs and their local or foreign suppliers can be modeled. In this chapter, I will test it empirically.

As Jordaan (2011) states, it is usually not tested empirically whether foreign subsidiaries use domestic suppliers more or less intensively than domestic firms, but the general perception is that the share of domestically sourced goods is generally lower in the case of foreign subsidiaries. There is some mixed evidence on this issue, but it seems to depend on the country in question: Whereas Jordaan (2011) finds in the case of Mexico that foreign subsidiaries use local suppliers to the same extent as domestic firms, Javorcik and Spatareanu (2005) find different in the case of the Czech Republic and Lithuania — MNEs operating in these countries prefer to import their supplies. Whereas Javorcik and Spatareanu (2005) claim that the insufficient quality of locally supplied intermediate goods is the main reason for which MNEs source from abroad, Jindra, Giroud, and Scott-Kennel (2009) explain that the choice of local or foreign supplier depends also to a great extent on the type of foreign subsidiary.

In any case, whether links between MNEs' subsidiaries and local suppliers are established or not is a question of crucial importance because only then can potential productivity spillover materialize. These spillovers may further improve the efficiency of domestic firms and amplify the positive effect of increasing demand, and they are thus a highly desired externality emanating from MNE activity (see UNCTAD (2001)). As such, they are widely studied in the current empirical literature related to FDI.

Unfortunately, this empirical literature fails to reflect the issue of spillovers related to sourcing patterns of MNEs in their complexity. First, empirical analyses are usually focused rather on productivity spillovers only and omit the issue of changing market structure and increasing demand, and second, they take into account the interaction between FDI activities and international trade flows only very rarely.

Smeets (2008) revises empirical evidence of the impact of FDI and clearly illustrates that the majority of studies published in this field concern technological transfers. An even more detailed survey of these papers can be found in Hanousek, Kocenda, and

Maurel (2011), who show that horizontal spillovers are often found to be insignificant or negative, whereas vertical spillovers are found to be significant and rather positive. However, this evidence is very mixed and depends usually on the country and time period over which the analysis was performed. Many of the papers are limited by their geographical and industrial scope, focusing on one country and/or one industry only (Dries and Swinnen (2004)), which gives certainly an interesting insight, but which is hard to further generalize.

A second important drawback of existing empirical literature is the fact that it usually ignores or at least underestimates the role of international trade and its interaction with FDI activities. Keller (2010) shows that although there are studies of the impact of international trade as well as of the impact of FDI, no study focuses on both aspects at the same time with the same intensity. For example, Jurajda and Stančík (2012) perform their analysis of horizontal and vertical FDI spillovers separately for import and export oriented industries, and Lesher and Miroudot (2008) include trade variables at the country level in their sectoral regressions; however, these approaches, even if they confirm that the international trade flows matter for the impact of FDI, still do not fully exploit their variation at the sectoral level. Hence, there is a large gap in the existing empirical literature, given probably by the fact that it is not very easy to link data on firms or industries with data on international trade, at least not at a sufficiently disaggregated level. Traded goods are classified under different coding than the one used for the classification of industries, and no direct correspondence table is available.

3.3 Motivation and research questions

In my analysis of FDI sourcing patterns and its impact on the domestic economy, I address the previously mentioned drawbacks of existing empirical literature in the context of vertical interactions between MNEs and domestic firms. I do not leave aside the question of backward productivity spillovers, but my main focus is on a more fundamental question — whether the links between foreign subsidiaries and local suppliers are indeed established as a result of inward FDI. As explained in the previous section, these links are a necessary condition for potential technological transfer and, unfortunately, they do not have to materialize in all cases.

The empirical analysis proposed in this chapter uses both the variation in industry production and the variation in international trade flows, which allows me to investigate the impact of FDI on the host economy along the vertical axis (between industries) in much greater detail than any of the existing empirical analyses. I can see not only whether the demand for intermediate goods rises, but I can also determine to what extent it is covered by domestic firms as opposed to imported goods. I thus assess with better precision what is the impact of FDI on local suppliers, which allows me to derive important policy implications from my findings. I focus on CEE countries in the period 2001-2007, and I compare them to the countries of Western Europe in the given period. Such large geographical coverage allows me to incorporate the effect of international industrial linkages.

I am asking the following questions: How does FDI shape inter-industry allocations on national and international levels? Do MNEs purchase intermediate goods from domestic suppliers, or do they prefer to import these from abroad? Alternatively, do MNEs purchase these goods from other multinationals in the domestic downstream sector? Further, once we control for the changing sourcing patterns, do we observe any productivity spillovers from MNEs towards their domestic suppliers?

The analysis of these questions brings findings that are of a great importance from the academic point of view, providing answers that were not yet ascertained by the otherwise thriving field of research dedicated to the issue of FDI. Moreover, these findings are crucial for policy makers, who should understand what the real effects of FDI are in order to decide if it pays off to encourage foreign investors to enter the domestic market. An increase in demand for intermediate goods leading to higher profits of domestic suppliers or the attraction and presence of positive productivity spillovers may represent a sufficient motivation for policies in favor of FDI.

3.4 Methodology

3.4.1 Theoretical predictions

In this chapter, my aim is to analyze whether FDI inflow increases the sales of domestic producers of intermediate goods. I follow the theoretical model that I have presented in the first chapter, where I show that under certain circumstances, the increased activity of multinational firms in the downstream sector should increase the demand for intermediate goods. This increase is driven by the assumption that the MNEs are more efficient than domestic firms, which increases production in the sector of consumer goods, and in turn drives up the demand for these goods. On the other hand, I also assume in my model that intermediate goods can be imported, which would decrease the demand for locally produced intermediate goods. Formally, this means that I assume the sales of intermediate goods (SI) to be a function of FDI in the downstream sector (FDI) and of imports of intermediate goods (II), which are themselves a function of FDI in the downstream sector: $SI = f\left((FDI, II(FDI)\right)$.

My model is derived under the assumption that the total demand for the goods produced in the downstream sector is fixed and that intermediate goods are not exported. Such assumptions do not affect the validity of the theoretical predictions of my model, which concerns the partial equilibrium with some fixed parameters, but I am aware of the fact that in reality they do not have to be true and that I have to control for the level of production in the sector of final goods and for exports of intermediate goods. It is therefore more realistic to see the sales of intermediate goods (SI) as a function of FDI, sales of consumer goods (SC), imports of intermediate goods (II), and exports of intermediate goods (EI): $SI = f(FDI, SC, II, EI)$. Moreover, according to my model and other models described in Section 3.2, it has to be expected that the production of consumer goods as well as imports of intermediate goods are also a function of FDI in the downstream sector, which leads to the following model:

$$SI = f\left(FDI, SC(FDI), II(FDI), EI\right) \quad .$$

Further, we have to realize that locally produced intermediate goods do not have to be produced by domestic firms only: In reality, MNEs can also enter this sector. I want to estimate the impact of downstream FDI on the sales of domestically produced intermediate goods, which is only a part of total sales. When I denote the domestically produced[3] intermediate goods SI^D and those produced by MNEs operating in the intermediate goods sector SI^M, I can write

$$\begin{aligned} SI = SI^D + SI^M = SI^D \left(\frac{SI^D + SI^M}{SI^D}\right) &= f\left(FDI, SC, II, EI\right) \\ SI^D &= \frac{SI^D}{SI} \cdot f\left(FDI, SC, II, EI\right) \quad . \end{aligned}$$

[3]By domestically produced goods, I mean goods produced by domestically owned firms.

This implies that

$$\frac{\mathrm{d}SI^D}{\mathrm{d}FDI} = \frac{\mathrm{d}(SI^D/SI)}{\mathrm{d}FDI} \cdot f(FDI, SC, II, EI) + \frac{SI^D}{SI} \cdot \frac{\mathrm{d}f(FDI, SC, II, EI)}{\mathrm{d}FDI} \quad , \tag{3.1}$$

where

$$\begin{aligned}\frac{\mathrm{d}f(FDI, SC, II, EI)}{\mathrm{d}FDI} = & \frac{\partial f(FDI, SC, II, EI)}{\partial FDI} + \frac{\partial f(FDI, SC, II, EI)}{\partial SC} \cdot \frac{\mathrm{d}SC}{\mathrm{d}FDI} + \\ & + \frac{\partial f(FDI, SC, II, EI)}{\partial II} \cdot \frac{\mathrm{d}II}{\mathrm{d}FDI} + \\ & + \frac{\partial f(FDI, SC, II, EI)}{\partial EI} \cdot \frac{\mathrm{d}EI}{\mathrm{d}FDI} \quad .\end{aligned} \tag{3.2}$$

Plugging back $f\,(FDI, SC, II, EI) = SI$, we obtain:

$$\frac{\mathrm{d}SI^D}{\mathrm{d}FDI} = \frac{\mathrm{d}(SI^D/SI)}{\mathrm{d}FDI} \cdot SI + \frac{SI^D}{SI} \cdot \left(\frac{\partial SI}{\partial FDI} + \frac{\partial SI}{\partial SC} \cdot \frac{\mathrm{d}SC}{\mathrm{d}FDI} + \frac{\partial SI}{\partial II} \cdot \frac{\mathrm{d}II}{\mathrm{d}FDI} + \frac{\partial SI}{\partial EI} \cdot \frac{\mathrm{d}EI}{\mathrm{d}FDI} \right) \quad . \tag{3.3}$$

This expression is rather complex, but it can be schematized in the following way:

$$\frac{\mathrm{d}SI^D}{\mathrm{d}FDI} = \Delta_1 + \Delta_2 + \Delta_3 + \Delta_4 + \Delta_5 \quad , \tag{3.4}$$

where the Δ's stand for five different channels through which downstream FDI can influence sales of intermediate goods by domestic firms. Their economic interpretation is as follows:

- $\Delta_1 = \frac{\mathrm{d}(SI^D/SI)}{\mathrm{d}FDI} \cdot SI$ captures the impact of downstream FDI through the changing proportion of intermediate goods supplied by domestic producers, as compared to multinational firms operating in the country. We may expect this impact to be negative for at least two reasons. First, according to Javorcik and Spatareanu (2005), especially in less developed countries domestic suppliers often do not meet the standard required by MNEs in the downstream sector, who then prefer to source from foreign suppliers. Further, according to Cohen (2007), it is very likely that these foreign suppliers will be present in the country through FDI in the upstream sector as the presence of MNEs in one sector often attracts further FDI in related sectors.

- $\Delta_2 = \frac{SI^D}{SI} \cdot \frac{\partial SI}{\partial FDI}$ captures the direct impact of downstream FDI on the sales of intermediate goods. The derivative contained in this term can be interpreted as the pure spillover effect since it represents the direct effect of FDI on sales that is not driven by any other channel. Based on empirical studies such as Stančík (2007) or Javorcik and Spatareanu (2009), we can expect this impact to be positive: MNEs have motivation to help their local suppliers to improve.

- $\Delta_3 = \frac{SI^D}{SI} \cdot \frac{\partial SI}{\partial SC} \cdot \frac{\mathrm{d}SC}{\mathrm{d}FDI}$ captures the impact of downstream FDI through sales of intermediate goods that is given by 1) a change in sales of consumer goods driven by FDI (the term $\frac{\mathrm{d}SC}{\mathrm{d}FDI}$) and 2) a change in the sales of intermediate goods given by change in sales of consumer goods (the term $\frac{\partial SI}{\partial SC}$). The first component of this impact is supposed to be positive since many studies, such as e.g. Jurajda and Stančík (2012), predict that FDI inflow is correlated with productivity in the given sector. The second component of the impact is naturally supposed to be positive as well — increasing production of consumer goods should go in hand with increasing production of intermediate goods that serve as inputs. It has to be noted that quantitatively, this relation may depend on the level of FDI in the downstream sector: For example, Markusen and Venables (1999) suppose that MNEs may use intermediate goods more intensively than domestic firms. Studies that deal with horizontal spillovers (see e.g. Hanousek, Kocenda, and Maurel (2011)) provide opposite arguments — more efficient MNEs may be able to produce more output with less input as compared to domestic firms. Hence, even if the production of consumer goods increases due to FDI, the positive effect on demand for intermediate goods may be offset by the capacity of MNEs to save on inputs. For this reason, effect Δ_3 captures both the potential increase of production in the downstream sector and the consequent increase of demand for intermediate goods, and also the correction of such an increase given by the intensity in which MNEs source the inputs.

- $\Delta_4 = \frac{SI^D}{SI} \cdot \frac{\partial SI}{\partial II} \cdot \frac{\mathrm{d}II}{\mathrm{d}FDI}$ captures the impact of downstream FDI on the sales of intermediate goods that is given by 1) a change in imports driven by downstream FDI (the term $\frac{\mathrm{d}II}{\mathrm{d}FDI}$) and 2) a change in sales of intermediate goods given by the change in imports (the term $\frac{\partial SI}{\partial II}$). Based on a survey described in Javorcik and Spatareanu (2005), the first component of this impact is supposed to be positive because MNEs are more likely to import their inputs from abroad than domestic firms. The second component of the impact is clearly negative if we assume that domestic and imported intermediate goods are substitutes and their suppliers compete. For this reason, the overall effect Δ_4 is supposed to be negative.

- $\Delta_5 = \frac{SI^D}{SI} \cdot \frac{\partial SI}{\partial EI} \cdot \frac{\mathrm{d}EI}{\mathrm{d}FDI}$ captures the impact of downstream FDI on the sales of intermediate goods that is given by 1) a change in exports driven by downstream FDI (the term $\frac{\mathrm{d}EI}{\mathrm{d}FDI}$) and 2) a change in sales of intermediate goods given by the change in exports (the term $\frac{\partial SI}{\partial EI}$). This term is the most difficult to interpret. Both components can be positive or negative based on circumstances. All depends on whether local producers of intermediate goods (domestic or with foreign owners) benefit from the presence of MNEs in the downstream sector and become more efficient and thus also more likely to export. Further, it also depends on whether the firms exploit this hypothetical potential to export and whether their exports are proportional or not to domestic sales. Hence, the overall impact given by Δ_5 is hard to predict. Since I am rather interested in the question of where the intermediate goods come from and not where they are going, I use exports purely as a control variable, not as my main variable of interest.

3.4.2 Empirical model

The purpose of my analysis is to describe how FDI in the downstream sector influences the sales of domestic suppliers and whether this effect is in line with theoretical predictions presented in Section 3.4.1. Since I do not have a model that would predict the functional form of $f(.)$ from this presented section, I propose a semi-logarithmic specification as a first approximation, which allows me to include all variables of interest and to interpret most of the coefficients as elasticities. I structure it as a panel data model with industry and time fixed effects in all specifications.

In my main specification, I study the impact of downstream FDI on sales by domestic firms in the intermediate goods sector (denoted SI^D):

$$\begin{aligned}\ln(SI^D_{it}) = &\beta_0 + \beta_1 \frac{SI^M_{it}}{SI_{it}} \cdot FDI_{it} + \beta_2 FDI_{it} + \beta_3 \log(SC_{it}) \cdot FDI_{it} + \\ &+ \beta_4 \ln(II_{it}) \cdot FDI_{it} + \beta_5 \ln(EI_{it}) \cdot FDI + \\ &+ \beta_6 \ln(SI^M_{it}) + \beta_7 \ln(SC_{it}) + \beta_8 \ln(II_{it}) + \beta_9 \ln(EI_{it}) + \alpha_i + \eta_t + \varepsilon_{it} \quad , \quad (3.5)\end{aligned}$$

where all variables are denoted in the same way as in Section 3.4.1, α_i is the industry-specific fixed effect, η_t is the time-specific fixed effect, and ε_{it} is the idiosyncratic error term. The main variable of interest is FDI, the presence of multinational firms in the downstream industry, and its interaction terms. The control variables are chosen in line with the above presented theoretical reasonings. The industry-specific fixed effects allow me to control for time-invariant industry characteristics, and time-specific fixed effects control for aggregate shocks to the economy due to business cycles.

The indices of parameters β follow the notation used in the schematic representation (3.4), meaning that β_j corresponds to the effect related to Δ_j even though for some of them, the correspondence is not so straightforward.

Parameter β_1 describes the effect on the sales of intermediate goods driven by the fact that foreign firms coming into the downstream sector tend to source their supplies from other multinational firms rather than from domestic suppliers. Its interpretation is based on the interaction between variables $\frac{SI^M}{SI}$ representing the foreign presence and, thus, the activity of multinational firms in the given sector, and FDI, which stands for FDI in the downstream sector. If β_1 is negative (which is what I expect), it means that foreign firms in the downstream sector prefer to source their inputs from multinational suppliers, which decreases the sales of domestic producers of intermediate goods.

Parameter β_2 represents the pure spillover effect since all other channels through which downstream FDI influences the sector of intermediate goods (according to theoretical predictions) are controlled for.

Parameter β_3 represents changing intensity with which foreign firms in the downstream sector use intermediate goods, which corresponds only to one component of the factor Δ_3 in schematic representation (3.4). It does not really capture the overall effect of downstream FDI through sales of final goods: as explained in the previous section, this one is twofold. First, it is assumed that increased FDI presence in the downstream sector increases the level of production and only then comes the question whether this means that the demand for intermediate goods will really increase proportionally since some authors expect that multinational firms are more efficient in the use of inputs and therefore do not need such large supplies. Since I have to control for the level of sales of final goods in the equation, I cannot really assess the first effect, and therefore parameter β_3 gives me information only about the sourcing intensity: It simply tells me whether there is a different relation between downstream and upstream sales in sectors with higher levels of downstream FDI. To draw any conclusions about the first effect, I need to perform an auxiliary regression:

$$\ln(SC_{it}) = \delta_0 + \delta_1 FDI_{it} + \alpha_i + \eta_t + \varepsilon_{it} \quad . \tag{3.6}$$

If the coefficient δ_1 in this regression is positive, then the assumption of positive correlation between FDI and increased production in the downstream sector is valid.

Parameter β_4 describes the effect on sales of intermediate goods driven by the fact that foreign firms coming into the downstream sector may tend to import their supplies rather than purchase them from domestic suppliers.

The remaining variables are present in equation (3.5) mainly as control variables — their use is explained in the previous section.

Before we can proceed to the empirical evaluation of these effects, I will specify the data I am using and explain the construction of variables presented in this section.

3.5 Data description

3.5.1 Geographic and time coverage

The analysis covers the time period 2001 – 2007 and focuses on European countries, which are considered to be either *Western* or *Eastern* countries. The Western countries are the countries of the EU15 (Luxembourg being joint with Belgium) plus Iceland, Norway, and Switzerland. The Eastern countries are the countries that joined the EU in 2004 (except for Malta for which I did not have enough information). A complete list of countries is provided in the Appendix (Table 3.4). The main focus is on the Eastern countries, but the analysis is performed for both groups separately to see the differences between fully developed countries and those who had just undergone the transition period. The comparison of these two groups allows me to draw further conclusions about the studied issue.

3.5.2 Data sources

I use the Amadeus database to obtain the level of sales and FDI presence in given industries. This database contains information about firms operating in the chosen countries: their performance, their financial and organizational characteristics, their ownership structure (especially if they are domestic or foreign), and their industry classification expressed by the three-digits NACE code (Rev. 1.1). I link this database with information from UN COMTRADE data about international trade, which covers international exports and imports between the selected countries and their trade partners in the studied time period, disaggregated to the four- and five-digit SITC level (Rev. 3)[4]. Further, I use the EUROSTAT database as an additional source of information about input-output tables of industries (at two-digit NACE, Rev. 1.1).

3.5.3 Data harmonization

Since my main research question concerns the interaction between upstream and downstream industries both in terms of production and trade, I first need to establish the links between these industries, i.e., I need to determine to what industries the producers of intermediate goods supply. For this purpose, I use the input-output tables that can be downloaded from the EUROSTAT database[5] for the years 2001 – 2007 (I use aggregated I-O tables for the EU27 countries since they are available for the whole period, and I assume that the I-O structure of European industries does not vary too much across countries). These tables allow me to construct a matrix with coefficients representing the share of output supplied to different downstream industries, which will be used for the definition of the variables used in my analysis in a way that I will describe later. I present this table in the Appendix.

Since the I-O tables are available at the aggregated two-digit NACE level, I set this aggregation as the baseline industry level of my analysis. This means that I aggregate all data from Amadeus and UN COMTRADE databases to this level. The only problem is that the UN COMTRADE database is coded under the SITC classification system, and so I needed first to harmonize the SITC Rev. 3 codes with the NACE Rev. 1.1 codes and to transform the trade database into the NACE coding. I used for this purpose correspondence tables that can be downloaded from the United Nations Statistics Division[6].

Unfortunately, there is no direct correspondence between these two coding systems. With a lot of effort, I managed to link them by means of other coding systems for which the correspondence tables are available. I linked the data using the following set of transformations: SITC Rev. 3 $\rightarrow$ CPC Ver. 2 $\rightarrow$ ISIC Rev. 4 $\rightarrow$ ISIC Rev. 3 $\rightarrow$ NACE Rev. 1.1. This linking was done partially automatically using VBA programming, but the final tuning and check of all correspondences (in a table of some 4000 rows) were done

[4] I use the same dataset as Frensch and Gaucaite-Wittich (2009).

[5] `http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database`

[6] `http://unstats.un.org/unsd/cr/registry/regot.asp?Lg=1`

manually. The final result is schematically presented in the Appendix, where I display the lists of NACE Rev. 1.1 industries (Table 3.5) and SITC Rev. 4 types of goods (Table 3.4) aggregated at the two-digit level, as well as a table representing which SITC types of goods fall into which NACE Rev. 1.1 categories (Table 3.5). The representation is only schematic in the sense that, in fact, I was linking SITC goods at the five- or four-digit level. In the table presented in the Appendix, it may seem that several SITC goods fall into more than one NACE category, but this is due only to the fact that goods with the same SITC two-digit representation fall into different NACE industries when considered at more disaggregated levels.

Data from all sources are transformed to be measured in millions of euros according to the exchange rates for consecutive years as provided in the Amadeus database.

3.5.4 Definition of variables

In Section 3.4.1, I explained the mechanisms through which FDI in the sector of consumer goods (downstream sector) influences sales in the sector of intermediate goods (upstream sector). This division between consumer and intermediate goods is handy for the presentation of the theoretical model, but in reality, the industry structure is much more complex and each sector can produce goods that are used as intermediaries for another sector as well as final goods. Therefore, I consider in my analysis all sectors to be potential producers of intermediate goods, and I link them to their corresponding downstream sectors to which they supply. For the sake of simplicity, I continue to use the same notation as in section 3.4.1. I limit my analysis only to the industries of agriculture, mining and manufacturing, their complete list is provided in the Appendix (Table 3.5) .

For each sector i at the NACE two-digit level, I define total sales (SI) and sales by domestic firms (SI^D) in the following way:

$$SI_{it} = \sum_{j=1}^{N_{it}} Sales_{ijt} \quad ,$$

$$SI_{it}^{D} = \sum_{j=1}^{N_{it}} d_{ijt} Sales_{ijt} \quad ,$$

where N_i is the number of firms in industry i, $Sales_{ij}$ represent the sales (turnover) of the j-th firm in industry i and d_{ij} is the share of domestic owners in the j-th firm in industry i (all in year t).

Further, I define total sales in the corresponding downstream sectors as a sum over these sectors weighted by coefficients derived from input-output tables:

$$SC_{it} = \sum_{k=1,j\neq i}^{n} \alpha_{ikt} SI_{kt} \quad ,$$

where $n = 32$ is the total number of sectors included in my analysis, and α_{ikt} denotes the share of output of the i-th sector that is sold to the k-th sector in year t according to the I-O table.

Then, I define the share of FDI in each sector as the ratio of the sales of foreign-owned firms in a given industry over the sales of all firms operating in that industry (in a given country). To obtain the overall FDI level in corresponding downstream sectors for each sector i, I weight FDI levels in these sectors again by coefficients derived from I-O tables. The variable is thus computed as

$$FDI_{it} = \sum_{k=1,k\neq i}^{n} \alpha_{ikt} \frac{\sum_{j=1}^{N_{kt}} f_{kjt} Sales_{kjt}}{\sum_{j=1}^{N_k t} Sales_{kjt}} \quad ,$$

where f_{kjt} is the share of foreign owners in the j-th firm in industry k in year t. Note that this definition is the same as used by Javorcik (2004).

For the trade data, I simply sum the imports (II) and exports (EI) at the corresponding level over all importers and over all export destinations, respectively.

3.5.5 Resulting dataset

By aggregating and joining the two data sources, I obtain a unique dataset of approximatively 5 000 observations. It has a structure of a panel of industries in the above mentioned countries over the period 2001 – 2007. Descriptive statistics on all variables are provided in Appendix (Table 3.6). We can see from them that all variables concerning sales are rising over time. The share of FDI is slightly rising in Eastern countries, and it is more constant in Western countries.

3.6 Results

First, I will present the results of my main specification described in Section 3.4.2, in which I study the impact of downstream FDI on domestic sales in intermediate goods sectors:

$$\begin{aligned}\ln(SI_{it}^{D}) =&\beta_0 + \beta_1 \frac{SI_{it}^{M}}{SI_{it}} \cdot FDI_{it} + \beta_2 FDI_{it} + \beta_3 \log(SC_{it}) \cdot FDI_{it} + \\ &+ \beta_4 \ln(II_{it}) \cdot FDI_{it} + \beta_5 \ln(EI_{it}) \cdot FDI + \\ &+ \beta_6 \ln(SI_{it}^{M}) + \beta_7 \ln(SC_{it}) + \beta_8 \ln(II_{it}) + \beta_9 \ln(EI_{it}) + \alpha_i + \eta_t + \varepsilon_{it} \quad . \end{aligned} \tag{3.7}$$

The results of the estimation are presented in Table 3.1 for Eastern and in Table 3.2 for Western European countries.

The results from Tables 3.1 and 3.2 show that downstream FDI has a very different effect in countries of Eastern and Western Europe. Since Eastern countries are my primary group of interest, I present them first.

These results are consistent with almost all hypotheses explained in Section 3.4.1. The negative coefficient on the interaction term between foreign presence in the given sector and downstream FDI shows that foreign firms in the downstream sector tend to replace domestic suppliers of intermediate goods by other multinationals operating in the country. The same holds for the negative coefficient on the interaction between imports and downstream FDI, which shows that domestic suppliers are further replaced by importers as the share of foreign firms among their customers increases. Note here that this effect is not significant in the basic regression, but in my opinion, this is due to high collinearity among variables given by so many interaction terms present in the regression. As soon as the interaction between exports and downstream FDI is omitted, the effect of FDI through imports becomes significant (and nothing else changes in the results, showing that such an omission can be made).

On the other hand, since the coefficient of the interaction between downstream sales and downstream FDI is insignificant, it does not seem that foreign firms would have higher or lower intensity of sourcing of inputs than domestic firms. Hence, if increased production in the downstream sector increases the demand for intermediate goods, it happens independently of whether foreign firms are present in the downstream sector or not. The fact that increased production should increase the demand for intermediate goods is shown by the coefficient on downstream sales, which is not significantly different

Table 3.1: Impact of downstream FDI on domestic sales for Eastern countries

	Domestic sales	Domestic sales
Foreign presence * downstream FDI	-1.835***	-1.843***
	(0.403)	(0.399)
Downstream FDI	2.249*	2.217*
	(1.201)	(1.181)
Downstream sales * downstream FDI	-0.164	-0.162
	(0.181)	(0.178)
Imports * downstream FDI	-0.334	-0.387**
	(0.259)	(0.181)
Exports * downstream FDI	-0.064	
	(0.229)	
Foreign sales	0.000***	0.000***
	(0.000)	(0.000)
Downstream sales	1.094***	1.092***
	(0.052)	(0.051)
Imports	0.287	0.309*
	(0.191)	(0.179)
Exports	0.046	0.027
	(0.116)	(0.097)
Year effects	Yes	Yes
R^2	0.523	0.522
Observations	984	984

All variables except for Downstream FDI and Foreign presence are in logarithms

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The coefficient on Foreign sales is economically insignificant, smaller than the chosen approximation level but statistically significant because of the expected correlation between the two variables.

Table 3.2: Impact of downstream FDI on domestic sales for Western countries

	Domestic sales	Domestic sales
Foreign presence * downstream FDI	-3.769***	-3.668***
	(0.596)	(0.589)
Downstream FDI	-2.794	-1.835
	(2.709)	(2.658)
Downstream sales * downstream FDI	0.241	0.195
	(0.269)	(0.287)
Imports * downstream FDI	-0.308	0.116
	(0.188)	(0.212)
Exports * downstream FDI	0.549*	
	(0.305)	
Foreign sales	0.000**	0.000**
	(0.000)	(0.000)
Downstream sales	0.923***	0.923***
	(0.052)	(0.052)
Imports	-0.007	-0.114
	(0.070)	(0.130)
Exports	-0.116	0.068
	(0.088)	(0.071)
Year effects	Yes	Yes
R^2	0.615	0.612
Observations	2218	2218

All variables except for Downstream FDI and Foreign presence are in logarithms

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The coefficient on Foreign sales is economically insignificant, smaller than the chosen approximation level but statistically significant because of the expected correlation between the two variables.

from 1, meaning that an increase of downstream production by 1 percent implies the same increase of sales of intermediate goods.

Finally, the coefficient on downstream FDI alone is positive and significant at the 90% level, which indicates a positive backward spillover effect: foreign customers really seem to be beneficial for their domestic suppliers, once we abstract from the negative substitution effects of competing multinationals and importers mentioned above. Since FDI is measured as a ratio between 0 and 1, the increase of foreign presence by one percentage point leads to an increase of sales for domestic suppliers due to the pure spillover effect by 2 percent.

In the results for Western countries, we can see that none of the effects we observe in Eastern Europe are present, except for the negative substitution effect implied by the negative coefficient on the interaction between foreign presence in the given sector and downstream FDI. This coefficient shows that foreign firms operating in Western markets tend to source relatively more from other foreign firms operating in the country. This is in line with the theory that FDI in one sector attracts further FDI in related sectors, which should be valid independently of the level of economic development.

On the other hand, in Western countries, we do not observe a negative substitution effect with respect to imports, which signals that foreign firms operating in developed markets find local supplies of sufficiently high quality and do not have to import them, which is in line with my expectations. The same holds for the absence of a positive spillover effect: Since these markets are already developed, there is no reason why there should be any significant improvement given by the presence of multinational firms, which should be comparable with their domestic competitors.

The results have to be complemented by an auxiliary regression that shows an additional effect of downstream FDI — the increase of productivity in the downstream sector:

$$\ln(SC_{it}) = \delta_0 + \delta_1 FDI_{it} + \alpha_i + \eta_t + \varepsilon_{it} \quad . \tag{3.8}$$

The results of this regression are presented in Table 3.3 and show that there is a strong positive correlation between FDI and productivity in the downstream sector. Together with the positive relation between downstream and upward sales proven in the main regression above, we can say that downstream FDI presence indeed should increase the demand for intermediate goods in general, both in Eastern and Western countries.

Table 3.3: Impact of downstream FDI on downstream sales

	Eastern countries Downstream sales	Western countries Downstream sales
Downstream FDI	5.968***	6.706***
	(0.486)	(0.934)
Year effects	Yes	Yes
R^2	0.528	0.343
Observations	1310	2551

Downstream sales are in logarithm
Clustered standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

To sum up, my results confirm that FDI inflow in a sector can have a positive impact on upstream domestic suppliers because this inflow increases the demand for intermediate goods. In Eastern European countries, the interaction with multinational customers can further have a direct positive spillover effect on domestic companies in the upstream sector. On the other hand, these companies have to stand up to stronger competition given by changing sourcing patterns: multinational customers tend to prefer to be supplied by other foreign firms operating in the country and, in the case of Eastern European countries, they also import more of their supplies from abroad, which crowds out the domestic producers of intermediate goods from the market.

3.7 Conclusion

In this chapter, I have shown that FDI inflow has a significant effect on domestic firms in upstream sectors, regarding both changing market structure and productivity improvements. I have shown that because of higher productivity in the sector that hosts incoming multinational enterprises, the demand for intermediate goods rises, which is positive for suppliers of these goods. Unfortunately, the extent to which domestic suppliers benefit from this increased demand is limited by increased competition with other MNEs operating in the sector of intermediate goods, which are preferred by multinational customers and substitute for domestic production. In the countries of Eastern Europe, this substitution effect is further intensified by increased competition with importers. On the other hand, those domestic firms that are able to withstand this double competition receive additional benefits stemming from their interaction with downstream MNEs in the form of productivity spillovers.

3.A Appendix 3

Table 3.4: Analysed countries and their classification

Western countries	*Eastern countries*
Austria	Cyprus
Belgium	the Czech Republic
Denmark	Estonia
Finland	Hungary
France	Latvia
Germany	Lithuania
Greece	Poland
Iceland	Romania
Ireland	Slovakia
Italy	Slovenia
the Netherlands	
Norway	
Portugal	
Spain	
Sweden	
Switzerland	
the United Kingdom	

Table 3.5: List of industries - NACE Rev. 1.1

Code	Name
01	Products of agriculture, hunting and related services
02	Products of forestry, logging and related services
05	Fish and other fishing products; services incidental of fishing
10	Coal and lignite; peat
11	Crude petroleum and natural gas
12	Uranium and thorium ores
13	Metal ores
14	Other mining and quarrying products
15	Food products and beverages
16	Tobacco products
17	Textiles
18	Wearing apparel; furs
19	Leather and leather products
20	Wood and products of wood and cork (except furniture)
21	Pulp, paper and paper products
22	Printed matter and recorded media
23	Coke, refined petroleum products and nuclear fuels
24	Chemicals, chemical products and man-made fibres
25	Rubber and plastic products
26	Other non-metallic mineral products
27	Basic metals
28	Fabricated metal products, except machinery and equipment
29	Machinery and equipment n.e.c.
30	Office machinery and computers
31	Electrical machinery and apparatus n.e.c.
32	Radio, television and communication equipment and apparatus
33	Medical, precision and optical instruments, watches and clocks
34	Motor vehicles, trailers and semi-trailers
35	Other transport equipment
36	Furniture; other manufactured goods n.e.c.
37	Secondary raw materials
40	Electrical energy, gas, steam and hot water

Table 3.6: List of industries - SITC Rev. 3

Code	Name
00	Live animals other than animals of division 03
01	Meat and meat preparations
02	Dairy products and birds' eggs
03	Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates, and preparations thereof
04	Cereals and cereal preparations
05	Vegetables and fruit
06	Sugars, sugar preparations and honey
07	Coffee, tea, cocoa, spices, and manufactures thereof
08	Feeding stuff for animals (not including unmilled cereals)
09	Miscellaneous edible products and preparations
11	Beverages
12	Tobacco and tobacco manufactures
21	Hides, skins and furskins, raw
22	Oil seeds and oleaginous fruits
23	Crude rubber (including synthetic and reclaimed)
24	Cork and wood
25	Pulp and waste paper
26	Textile fibres (other than wool tops and other combed wool) and their wastes (not manufactured into yarn or fabric)
27	Crude fertilizers, other than those of division 56, and crude minerals (excluding coal, petroleum and precious stones)
28	Metalliferous ores and metal scrap
29	Crude animal and vegetable materials, n.e.s.
32	Coal, coke and briquettes
33	Petroleum, petroleum products and related materials
34	Gas, natural and manufactured
35	Electric current
41	Animal oils and fats
42	Fixed vegetable fats and oils, crude, refined or fractionated
43	Animal or vegetable fats and oils, processed; waxes of animal or vegetable origin; inedible mixtures or preparations of animal or vegetable fats or oils, n.e.s.
51	Organic chemicals
52	Inorganic chemicals
53	Dyeing, tanning and colouring materials
54	Medicinal and pharmaceutical products
55	Essential oils and resinoids and perfume materials; toilet, polishing and cleansing preparations

Table 3.3: List of industries - SITC Rev. 4 (continued)

Code	Name
56	Fertilizers (other than those of group 27)
57	Plastics in primary forms
58	Plastics in nonprimary forms
59	Chemical materials and products, n.e.s.
61	Leather, leather manufactures, n.e.s., and dressed furskins
62	Rubber manufactures, n.e.s.
63	Cork and wood manufactures (excluding furniture)
64	Paper, paperboard and articles of paper pulp, of paper or of paperboard
65	Textile yarn, fabrics, made-up articles, n.e.s., and related products
66	Non-metallic mineral manufactures, n.e.s.
67	Iron and steel
68	Non-ferrous metals
69	Manufactures of metals, n.e.s.
71	Power-generating machinery and equipment
72	Machinery specialized for particular industries
73	Metalworking machinery
74	General industrial machinery and equipment, n.e.s., and machine parts, n.e.s.
75	Office machines and automatic data-processing machines
76	Telecommunications and sound-recording and reproducing apparatus and equipment
77	Electrical machinery, apparatus and appliances, n.e.s., and electrical parts thereof (including non-electrical counterparts, n.e.s., of electrical household-type equipment)
78	Road vehicles (including air-cushion vehicles)
79	Other transport equipment
81	Prefabricated buildings; sanitary, plumbing, heating and lighting fixtures and fittings, n.e.s.
82	Furniture, and parts thereof; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings
83	Travel goods, handbags and similar containers
84	Articles of apparel and clothing accessories
85	Footwear
87	Professional, scientific and controlling instruments and apparatus, n.e.s.
88	Photographic apparatus, equipment and supplies and optical goods, n.e.s.; watches and clocks
89	Miscellaneous manufactured articles, n.e.s.
91	Postal packages not classified according to kind
93	Special transactions and commodities not classified according to kind
96	Coin (other than gold coin), not being legal tender
97	Gold, non-monetary (excluding gold ores and concentrates)

Table 3.4: Correspondence between NACE Rev.1.1 and SITC Rev.4 codes

NACE/SITC	00	01	02	03	04	05	06	07	08	09	11	12	21	22	23	24	25	26	27	28	29	32	33	34	35	41	42	43	51	52	53	54	55	56	57	58	59	61	62	63	64	65	66	67	68	69	71	72	73	74	75	76	77	78	79	81	82	83	84	85	87	88	89	96	97
01	x	x			x	x	x	x	x			x		x	x			x	x		x																																												
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Note: The x symbol denotes the row NACE sector in which a given column SITC good is produced.
The representation is only schematical in the sense that in fact I was linking SITC goods at the five- or four-digit level.
It may seem that several SITC goods fall into more than one NACE category, but this is due only to the fact that
goods with the same SITC two-digit representation fall into different NACE industries when considered at a more disaggregated level.

Table 3.5: Input-output table in NACE classification

UP/DOWN	01	02	05	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40
01	—	0.2							94.3	1.4	1.3	0.2	0.3		0.1			0.7	0.6			0.1	0.1		0.1					0.1		0.2
02	1.1	—		0.1	0.1			0.1	0.7		0.1			65.2	24.7	0.4	0.1	0.8	1.5	0.2	0.2	0.6	0.2					0.1	0.1	2.7	0.1	0.7
05	2.2		—						94.7				0.1					1.9					0.1							0.5		0.1
10	1			—	0.2		0.2	0.2	0.9		0.1			0.1	0.8		9.8	2.1	0.1	2.1	10.9	0.4	0.3		0.2			0.1	0.1	0.1	0.1	70.1
11					—				0.3						0.3		66.8	5.7	0.1	0.3	0.7	0.2	0.1		0.1			0.1				25
12	0.9		0.1	1.2	0.1	—		0.1						0.2			80.8	3.7		0.2		0.1	4.8		0.2							7.6
13	0.1			0.1	0.1		—	0.1	0.3						0.5		21.1	6.3	0.3	3.8	54	2.4	0.9		0.4		0.1	0.2	0.1	0.8	0.3	7.9
14	2.8		0.1	0.1			0.1	—	3		0.2	0.2		0.2	3.7	0.1	0.4	12.9	1	61.9	5.3	2	1.1		0.7	0.1	0.4	0.3	0.1	2.1	0.1	1.1
15	68.5	0.1	0.8		0.1			0.1	—	0.1	0.7	0.7	6.9	0.2	1.6	0.4	0.9	13.3	0.5	0.4	0.4	0.5	0.8	0.1	0.3	0.3	0.2	0.5	0.2	0.6	0.2	0.5
16	10.5	0.1		0.1	0.6			0.1	14	—	2.2	2.9	4.5	0.3	21.8	1.8	0.6	13.9	1	1.1	2.4	1.6	8.7	0.6	0.8	1.4	0.5	1.5	2	3.9	0.3	1
17	1		0.6						1.3	0.1	—	52.4	4	0.5	2.4	0.4	0.4	4.1	5.8	0.9	0.5	1.4	1.3	0.1	0.8	0.4	0.7	9.2	1.3	9.9	0.2	0.1
18	2.9	0.8	0.4	0.6	0.7		0.1	0.2	6.9	0.1	27.7	—	12	0.8	1.4	1.4	0.9	2.9	2	2.1	4.9	4.5	5.7	1	1.5	1.3	0.7	8.3	2.8	3	0.4	2.1
19	2.4	0.1	0.2	0.2	0.1			0.1	2.7		4.9	23.1	—	1.6	0.6	1	0.7	1.9	3.2	1.4	2	3.1	3.3	0.2	1.2	0.4	1.6	13.1	1.8	27.9		1.1
20	2.7	0.5	0.1	0.4			0.1	0.4	5.4	0.1	0.6	0.2	0.3	—	6.7	0.8	0.5	2.3	2.7	3.6	1.6	6.1	3.7	0.2	1.5	0.6	0.7	3.7	2.7	50	0.2	1.6
21	1.1							0.3	20.5	1.7	1.5	0.6	0.6	1.7	—	34.8	0.6	9.9	4.1	3.1	1.7	2.1	3.4	0.5	2.1	1.1	1.2	1.5	0.5	2.6	1.4	1
22	1.9	0.4	0.1	0.1	0.1			0.4	12.2	0.7	2	2.4	1	1.5	8.3	—	1.8	12.4	4.2	2.8	2.7	5	8.4	1.5	4.9	3.2	2.8	7.6	2.4	5.2	0.2	3.8
23	10.9	0.6	1.1	0.3	0.3		0.2	1.4	6	0.1	0.7	0.4	0.2	1	1.2	0.8	—	29.1	2.3	4.1	8.9	2.3	2.2	0.2	1.1	0.3	0.5	1.7	0.8	1.1	0.3	19.8
24	9.7	0.1		0.1	0.2		0.1	0.5	5.7	0.1	6	0.6	0.9	2.5	5.3	2.8	7.2	—	25.8	3.8	4.8	4.2	3.7	0.5	2.6	1.3	1.4	5.1	1	2.7	0.3	0.9
25	1.5	0.1	0.1	0.2	0.1			0.2	12.2	0.1	1.1	0.7	1.8	1	2.2	1.3	1.3	8.6	—	1.9	1.4	4.6	11.3	0.7	6.5	2.7	2.8	27.1	2.5	4.9	0.3	0.9
26	3.8	0.1		0.2	0.1		0.2	3.7	15.7		0.9	0.2	0.1	3.2	0.7	0.2	0.6	9.2	4.2	—	9	7.2	6.4	0.7	5.9	2.9	3.9	12.8	1.7	3	0.2	2.9
27	0.1			0.1	0.1		0.1	0.1	0.5		0.2			0.3	0.4	0.5	0.4	2.1	1.8	1.4	—	35.4	18.2	0.4	8.3	1.4	1.8	17.1	3.4	3.9	1.2	0.7
28	1.4	0.1	0.1	0.4	0.6		0.1	0.4	5		0.4	0.2	0.3	1.6	0.5	0.3	0.8	2.7	2.5	1.8	6.6	—	29.3	0.6	6.4	1.9	2.9	20.7	5.4	3.7	1.1	2
29	5.4	0.4	0.1	1.3	0.7		0.4	1.6	5.7	0.1	1.5	0.5	0.3	1.4	2.7	1.4	1.9	5.3	4.1	4.2	6.4	10.1	—	0.3	4.7	1.6	2.8	21	6.7	2.7	0.3	4.8
30	0.4	0.2		0.1	0.1			0.2	4.2	0.1	0.8	0.5	0.4	0.9	1.9	4	1	7.7	3.3	2.3	2.3	5.4	11.1	—	12.8	13.3	11.6	3.1	5.9	1.8	0.2	4.1
31	0.4			0.2	0.2			0.1	0.8		0.2	0.1	0.1	0.2	0.3	0.3	0.6	1.4	1.2	0.9	2.2	4.5	25	2.8	—	11.6	6.3	26.8	3.6	0.9	0.1	9.3
32	0.1							0.1	0.3		0.1			0.1	0.1	0.8	0.3	0.8	1.4	0.4	0.6	1.8	14.6	20.1	23.2	—	17.1	9.5	6.1	1.4		0.9
33	0.1		0.1	0.2	0.1			0.2	1.1		0.2	0.2	0.1	0.2	0.2	0.4	1.6	6.9	1.6	0.9	2.4	4.2	15.1	2.2	8.4	12.8	—	15	20.6	1.2	0.1	4
34	3.7	0.5		0.4	0.1		0.1	0.9	3.5		1	0.2	0.1	0.9	0.5	0.4	1	2.2	6.7	2.7	5.6	11.3	34	0.2	7.7	1.2	2.7	—	5.8	3.6	1.5	1.4
35	0.4	0.6	5.1	0.4	0.7		0.2	0.2	2	0.5	3.2	2.7	0.3	0.5	1.1	1.3	0.2	7.7	2.4	0.6	5.1	6.9	22.7	6.2	5.3	7.3	5.5	8	—	2.2	0.2	0.5
36	1.1	0.2	0.3	0.1	0.1		0.1	0.3	3.8		3.6	2.6	0.6	1.9	0.9	1.5	1.2	3.8	2.6	2	4.8	5.9	10.4	0.6	3.2	1.1	3.3	34.8	3.6	—	0.2	5.4
37							0.1	0.1	0.4		1.2	0.1		0.2	7.3	0.2	0.5	1.5	3.2	3	73.7	4.9	1.4		0.3		0.1	0.4	0.3	0.8	—	0.6
40	5.1	0.2	0.3	1.1	1.1		0.4	1.3	11.8	0.2	3.3	0.8	0.5	2	6.6	2.1	2.7	12.5	4.8	8.5	10.5	5.8	5.3	0.4	2.6	1.1	0.9	4.7	1.4	1.7	0.3	—

Note: Each cell represents the share of upstream row NACE sector that is used in the downstream column NACE sector, in %.
If the cell is empty, the share is smaller than 0.1%.

Table 3.6: Descriptive statistics

		Eastern countries			Western countries		
	year	# of obs.	Mean	Std. Dev.	# of obs.	Mean	Std. Dev.
Domestic sales (SI^D)	2001	163	125	374	468	2799	7942
	2002	166	160	383	484	3244	10066
	2003	203	139	317	489	3494	10539
	2004	221	166	395	491	3854	12218
	2005	210	212	580	491	4623	13534
	2006	210	217	630	493	4505	12328
	2007	209	33	76	491	2079	7557
	year	# of obs.	Mean	Std. Dev.	# of obs.	Mean	Std. Dev.
Downward FDI (FDI)	2001	163	0,400	0,275	468	0,240	0,183
	2002	166	0,458	0,293	484	0,221	0,176
	2003	203	0,514	0,216	489	0,223	0,180
	2004	221	0,510	0,205	491	0,224	0,184
	2005	210	0,575	0,174	491	0,219	0,176
	2006	210	0,560	0,187	493	0,226	0,176
	2007	209	0,423	0,290	491	0,193	0,184
	year	# of obs.	Mean	Std. Dev.	# of obs.	Mean	Std. Dev.
Foreign presence ($\frac{SI^M}{SI}$)	2001	129	0,630	0,367	316	0,323	0,300
	2002	137	0,625	0,347	326	0,286	0,272
	2003	189	0,582	0,341	335	0,276	0,266
	2004	202	0,556	0,330	336	0,285	0,267
	2005	204	0,595	0,326	333	0,291	0,271
	2006	199	0,551	0,348	336	0,306	0,275
	2007	131	0,565	0,368	289	0,283	0,293
	year	# of obs.	Mean	Std. Dev.	# of obs.	Mean	Std. Dev.
Downward sales (SC)	2001	163	590	785	468	7535	13015
	2002	166	1240	1615	484	9037	15452
	2003	203	2258	11008	489	9627	16266
	2004	221	1104	1634	491	10760	17964
	2005	210	1534	2482	491	12633	20570
	2006	210	1569	2548	493	12340	18895
	2007	209	287	459	491	5754	10103
	year	# of obs.	Mean	Std. Dev.	# of obs.	Mean	Std. Dev.
Imports (II)	2001	163	832	1245	468	4482	7452
	2002	166	942	1390	484	4445	7773
	2003	203	838	1354	489	4302	7602
	2004	221	902	1520	491	4518	8037
	2005	210	1046	1669	491	4487	8265
	2006	210	1235	1994	493	5066	9336
	2007	209	1337	2214	491	4934	9231
	year	# of obs.	Mean	Std. Dev.	# of obs.	Mean	Std. Dev.
Exports (EI)	2001	163	679	1066	468	4132	8974
	2002	166	743	1156	484	4141	9673
	2003	203	697	1220	489	3957	9477
	2004	221	681	1292	491	4117	9966
	2005	210	848	1523	491	4206	10636
	2006	210	1030	1899	493	4652	11673
	2007	209	1120	2134	491	4609	12086

Note: All variables except for shares (Downward FDI and Foreign presence) are in millions of EUR.

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