Vertical and Horizontal Foreign Direct Investments in Transition Countries

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List of Abbreviations

BEA	Bureau of Economic Analysis
CEE	Central and Eastern Europe
CIS	Commonwealth of Independent States
EBRD	European Bank for Reconstruction and Development
EU	European Union
IMF	International Monetary Fund
IUI	Institute of Industrial Economics
HFDI	Horizontal foreign direct investment
FDI	Foreign direct investment
FOE	Foreign owned enterprise
GDP	Gross Domestic Product
KC	Knowledge Capital-Model
MNE	Multinational enterprise
NBER	National Bureau of Economic Research
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
R&D	Research and Development
ULC	Unit Labour Costs
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
US	United States
VFDI	Vertical foreign direct investment
WIIW	Wiener Institut für Internationale Wirtschaftsvergleiche

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The empirical part of the thesis is based on a firm survey of German multinational enterprises which have invested in Central and Eastern Europe. Therefore, I am deeply indebted to all the firms that found the time to answer

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Chapter 1

Introduction

The world economy has experienced several waves of globalisation in its history. Each wave led to a growing interdependence among countries through increasing amounts of foreign trade, cross-border financial flows and migration. One of the main features of the globalisation at the end of the 20th century was the rapid increase of foreign direct investment (FDI). Multinational enterprises conducted FDI to serve foreign markets or to exploit differences in production costs among countries.

However, the sharp increase of FDI flows has led to a fierce debate about the effects of globalisation. This debate takes place in academic circles but also on the streets all over the world and illustrates the concerns of many people about the impacts of globalisation.[1] The supporters see FDI as an instrument to reduce poverty and increase the efficiency of the global economy. The opponents argue that FDI leads to an even higher interdependence, and thus to higher risks and more inequality. In particular in the home countries of the multinationals the question arises, whether FDI leads to job destruction and higher unemployment.

At the same time, former planned economies in Central and Eastern Europe (CEE) started transition process towards market economy. Opening of these countries gave multinational enterprises access to new markets and

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[1]See Fischer (2003) for an overview and discussion of the main topics.

cheap production opportunities. Consequently, FDI flows to this region have been continuously growing. The investment flows brought capital, know-how and contributed substantially to a successful transition. However, in the last years a growing number of initial investors are leaving the region due to increasing production costs, while the total amount of FDI inflows is still increasing.[2]

The topic of this thesis is the analysis of foreign direct investments in transition countries of Central and Eastern Europe. The two main questions that will be addressed are:

1. What are the impacts of FDI flows on the host and the home countries of multinational enterprises?

2. How does the pattern of investment flows change over time?

In particular, we will concentrate on the difference between market seeking and cost driven FDI. We will investigate the differences in impacts on the home and host country between these two types of investment. Furthermore we will explore how the share of market seeking and cost driven FDI on total FDI flows into a transition country changes over time.

As a starting point for the analysis, the introduction gives a brief definition and recent trends of FDI, describes the distinctiveness of transition countries, introduces the unique data set used in this thesis and gives an outlook on the structure and the contributions of this thesis.

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[2]See Frankfurter Allgemeine Zeitung (2002) for CEE countries and The Economist (2003) for detailed discussion of similar examples in Mexico.

1.1 Foreign Direct Investments: Definitions and Recent Trends

Before we present some data on FDI flows it will be useful to define the term foreign direct investment and its major types. As illustrated in Figure 1.1, FDI is one of the three components of international capital flows, besides the portfolio investment and other flows like bank loans. The formal definition of FDI makes clear the difference to the other two: "Foreign direct investment reflects the objective of obtaining a lasting interest by a resident entity in one economy ("direct investor") in an entity resident in an economy other then that of the investor ("direct investment enterprise"). The lasting interest implies the existence of a long-term relationship between the direct investor and a significant degree of influence on the management of the enterprise." (IMF, 1993 and OECD, 1996). "Significant degree of influence" and "long term relationship" are the key terms to distinguish FDI from portfolio investments, which are short term activities undertaken by institutional investors through the equity market. A "lasting interest" in foreign entity emphasises the difference to other forms of capital flows and occurs in form of know-how or management-skills transfer.[3] Since a firm becomes multinational by setting up foreign affiliates, the term "multinational enterprise" can be used as synonym for foreign direct investment.

There are two main reasons for firms to go multinational: to serve a foreign market and to get lower cost inputs. This distinction is used to differentiate between two main types of FDI: horizontal and vertical. Horizontal FDI refers to the foreign manufacturing of products and services roughly similar to those the firm produces in its home market. This type of FDI is called "horizontal" because the multinational duplicates the same activities in different countries. Horizontal FDI arises because it is too costly to serve the foreign market by exports due to transportation costs or trade barriers.

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[3]For discussion of FDI concepts see Lipsey (2003).

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│                                                         │
│                     Cross Border                        │
│                     Capital Flows                       │
│                          │                              │
│         ┌────────────────┼────────────────┐             │
│                                                         │
│      Portfolio        Foreign Direct        Other       │
│      Investment        Investment                       │
│                          │                              │
│              ┌───────────┴───────────┐                  │
│                                                         │
│           Vertical            Horizontal                │
│              │                                          │
│         ┌────┴────┐                                     │
│                                                         │
│      Backward      Forward                              │
│      oriented      oriented                             │
│                                                         │
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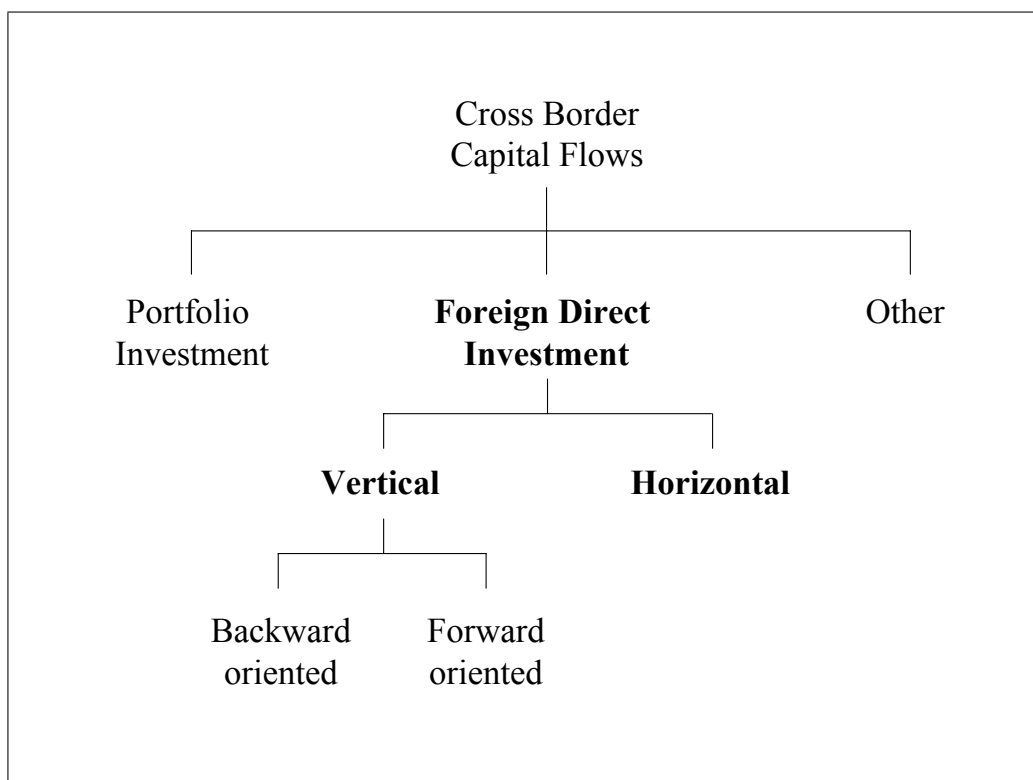
Figure 1.1: Structure of International Capital Flows

Vertical FDI refers to those multinationals that fragment production process geographically. It is called "vertical" because MNE separates the production chain vertically by outsourcing some production stages abroad. The basic idea behind the analysis of this type of FDI is that a production process consists of multiple stages with different input requirements. If input prices varies across countries, it becomes profitable for the firm to split the production chain.

Furthermore, as shown in Figure 1.1, vertical FDI consists of two groups: backward and forward vertical FDI.[4] In case of backward FDI multinational enterprise establishes its own supplier of input goods which delivers inputs to the parent company. Conducting forward FDI, the firm builds up a foreign

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[4]Head (2002).

Table 1.1: Worldwide FDI and Selected Economic Indicators

	Value at current prices			Annual Growth Rate		
	1982	1990	2001	1986-90	1991-95	1996-01
	Billions of USD			*in Percent*		
FDI Inflows	59	203	735	23.6	20.0	40.1
FDI Outflows	28	233	621	24.3	15.8	36.7
GDP	10,805	21,672	31,900	11.5	6.5	1.2
Total Exports	2,081	4,375	7,430	15.8	8.7	4.2

Source: UNCTAD (2002).
Note: FDI Inflows and Outflows statistics may differ due to differences in computation.

affiliate, which draws inputs from the parent company for own production, thus staying after the parent in the production chain. A detailed description of different types of FDI is given in Chapter 2.

Now we turn to the recent trends in foreign direct investments. The last 10 years have seen an enormous increase in volume and importance of cross border investment flows. FDI flows have grown much faster than trade or income of host countries, as Table 1.1 illustrates. In the second half of the 1990s, world-wide nominal GDP increased at an annual rate of 1.2 percent and world exports by 4.2 percent, while world-wide nominal flows of FDI grew by 40.1 percent. About 70 percent of these flows took place between advanced industrialised countries. However, the share of Central and Eastern European (CEE) transition countries significantly increased during the 1990s. In this period of time FDI flows to CEE rose from 0.1 to 3.7 percent of total FDI flows worldwide.[5] In absolute terms this is an increase from 476 Millions USD in 1990 to 28.7 Billion in 2001. Even in 2001 FDI inflows to CEE continued to grow despite a drop by 50 percent in FDI flows worldwide.

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[5]UNCTAD (2002).

Table 1.2: Foreign Direct Investment in Selected CEE Countries

	Total Inflows								Per Capita*	
	1990	1996	1997	1998	1999	2000	2001	1990-01	2001	1990-01
	Millions of USD								*USD*	
Central Europe										
Czech Republic	132	1,428	1,300	3,718	6,324	4,986	4,916	28,406	477	2,758
Hungary	311	2,275	2,173	2,036	1,970	1,649	2,443	23,726	244	2,373
Poland	10	2,768	3,077	5,130	6,474	8,293	6,995	35,402	181	915
Slovak Republic	18	353	220	684	390	1,925	1,475	6,019	273	1,115
Slovenia	4	174	334	216	107	136	503	2,031	252	1,016
South E. Europe										
Bulgaria	4	109	505	537	819	1,002	694	4,003	86	494
Croatia	-	511	533	932	1,458	1,077	1,512	6,390	336	1,420
Romania	-	263	1,215	2,031	1,041	1,037	1,157	7,715	52	346
Baltic States										
Estonia	-	151	267	581	301	387	542	2,890	387	2,064
Latvia	-	382	521	357	347	410	154	2,639	67	1,147
Lithuania	-	152	355	926	486	379	446	2,886	127	825
CIS										
Russia	-	2,579	4,865	2,762	3,309	2,714	2,469	24,219	17	167
Ukraine	-	521	623	743	496	595	792	4,564	16	93
Kazakhstan	-	1,137	1,321	1,151	1,468	1,278	2,748	11,030	186	745
Total above	**479**	**13,980**	**20,298**	**24,305**	**26,736**	**27,184**	**28,699**	**161,920**	**91**	**511**

Source: UNECE (2003), EBRD (2002) and own computations.
Note: * Weighted average for the total.

However, as illustrated in Table 1.2 there are wide differences among the CEE countries. While Central European countries attracted the largest share of investment flows, most CIS countries experienced only low inflows of FDI. The Czech Republic, Hungary and Estonia received twice as much FDI inflows per capita than other accession countries and three to four times more than other CEE countries. The three largest recipients of cumulated flows account for more than 50 percent of all FDI inflows since 1990. As a consequence of the large FDI inflows, foreign investors play a substantial role in transition countries. Foreign owned enterprises account for 25 percent of employment and more than 50 percent of total assets in the advanced accession countries.[6]

On the investors side, Germany is the largest investor with 19 percent on all FDI inflows into Central and Eastern Europe in 2001.[7] In the Czech Republic and Hungary, the share of German FDI achieves 30 percent on the total FDI stock till 1999.

1.2 The Special Case of Transition Countries

What makes transition countries special for the analysis of vertical and horizontal FDI?

Transition countries emerged in the former planned economies, as they left planning system towards a market economy. Several theories try to explain this process,[8] and a growing part of the literature focuses on transition countries as host countries of FDI.[9] For the analysis of vertical and horizontal FDI their are of interest for several reasons.

First, transition countries possess simultaneously characteristics typical

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[6]See Hunya (2002) and Chapters 3 and 5 for more empirical evidence.

[7]Deutsche Bundesbank (2003) and UNCTAD (2000). See Protsenko and Vincentz (1999) for discussion of different aspects of German FDI in CEE.

[8]For general treatment of transition economies see Roland (2000).

[9]See Mayer (1998) for a survey.

for both, developed and developing economies.[10] This is in particular important for the analysis of vertical and horizontal FDI, since the first is usually observed in developing while the latter in industrialised countries.[11] The second reason is the fast development of transition economy compared to developing or industrialised countries: in a relatively short period of time, a transition country undergoes substantial changes of main economic and political characteristics. Exploring the impact of changing economic environment on investment flows allows a better insight into the mechanism of FDI patterns. Third, Central and Eastern European countries are in particular important for the analysis of vertical FDI because they feature all major conditions necessary for this type of FDI: cheap and well educated labour force and proximity to large markets of Western Europe.[12]

Finally, FDI has a strong impact on the host transition countries. From the perspective of the host country, foreign direct investments are widely seen as one of the main driving forces for successful transition to market economy.[13] FDI brings capital, new technology and managerial know-how and thus increase the competitiveness of the host economy. As mentioned above, foreign owned firms are the largest employers and builders of capital stock in the most of the advanced transition countries. This strong presence of FDI allows for the analysis of impacts of foreign investments on a host country.[14]

In sum, the transition countries of Central and Eastern Europe offer a unique opportunity for the exploration of vertical and horizontal FDI flows and their impacts on the host economies.

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[10]Gros und Suhrcke (2000).

[11]Brainard and Riker (1993) and Markusen (1995).

[12]See Chapter 2 for detailed discussion of conditions necessary for the appearance of vertical FDI.

[13]Kaminsky and Riboud (2000) and Blomström and Kokko (2003).

[14]See Chapter 5 for detailed discussion.

1.3 Survey of German FDI in Eastern Europe

One of the main shortcomings when studying vertical and horizontal FDI has been the lack of empirical data, since official statistics do not differentiate between these types of FDI. Therefore, the empirical part of the thesis is based on a recent survey of German foreign direct investments in Central and Eastern Europe.

The survey was conducted by the Chair for International Economics at the University of Munich and has been funded by the German Science Foundation (DFG) and by the Volkswagen Foundation.[15] For this purpose the author and his colleagues carried out personal interviews with top managers of 461 German investors and collected information about 1,198 investment projects that have been conducted in Central and Eastern Europe during the period from 1989 to 2001.[16]

The surveyed firms have been selected according to the criteria of Deutsche Bundesbank (2001): an investor must hold at least a 20 percent share in a foreign company and investment volume per affiliate must exceed 1 million DEM. An exception was made for service providers with the minimum investment level of 500 thousand DEM. Thus, the data set is comparable to the official statistic, as there are no further restrictions on the firm selection. Total amount of recorded FDI in the survey is 21 billion DEM, which is about 43,7 percent of German FDI in this region in 1999. Measured by other criteria like employment with CEE affiliates the representativity succeeds the level of 58 percent, since the surveyed firms employ 12 million persons in Germany and 0.46 million in Central and Eastern Europe. Thus, the data set is highly representative for German investments in this region.

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[15]German Science Foundation, Grants Prof. Dr. Marin, MA 1823/2-1,-2,-3 and Volkswagen Foundation, Grants Prof. Dr. Marin AZ II/76 944 and AZ II/79351.

[16]Chapters 3 and 4 employ a smaller data set with 1,050 observations because the full data set was not yet available in electronic form at this stage.

The data set contains information on the German investor, its foreign affiliate, motivation for investment and on the relationship between the parent firm and its affiliates. This relationship is described by technology transfer, input-output relationship and decision competency. For each firm the sample includes key indicators like sales, number of employees and balance sheet. In addition, investing firm is described by industry, employed technology, organisational structure and competitive environment. The sample is a cross-section data set, with all numbers from the last available year.

In contrast to previous surveys and official statistics the data set includes information on intra-firm trade between parent company and affiliates in CEE. This information allows to differentiate between vertical and horizontal FDI and conduct the empirical analysis for each type of FDI separately.

1.4 Contributions of the Thesis: Interaction and Impacts of Vertical and Horizontal FDI

This thesis contributes to the existing theoretical and empirical literature on foreign direct investment in several ways. It provides the first empirical differentiation between vertical and horizontal FDI with firm level data, explores the interaction between the two types of investments and describes the impacts of different types of FDI on host and home country.

As a starting point, Chapter 2 summarises the existing theoretical and empirical literature on vertical and horizontal FDI. In addition, it discusses different ways of defining vertical and horizontal FDI and presents closely related terms used in the literature on multinational activity.

Chapter 3 examines the composition of investment flows into a transition country during the catching-up process. The chapter documents that there

is a "FDI Life Cycle" in the way that the share of vertical FDI in total FDI inflows to a host country falls over time, while the share of horizontal FDI increases. To explain this pattern Chapter 3 develops a partial equilibrium model which has closed form solutions.[17] The model illustrates how FDI flows affect host country characteristics, which in turn influence the composition of investment flows. Thus, it explains the interaction between vertical and horizontal FDI, while the recent literature has analysed the appearance of the two types of FDI separately. In a second step, Chapter 3 provides empirical evidence for the idea of a "FDI Life Cycle" by looking at the time pattern of vertical and horizontal FDI in transition countries of Central and Eastern Europe. The empirical analysis distinguishes for the first time between different types of foreign direct investment to a particular host country.

Both Chapters 4 and 5 examine the impacts of vertical and horizontal FDI on host and home countries. Chapter 4 explores how vertical and horizontal FDI affect employment of multinational enterprises in different locations. The main focus is on the interaction between parent company and its vertical and horizontal affiliates. Chapter 4 develops a small theoretical model that illustrates cross border labour demand for vertical and horizontal multinational enterprises. Then, the cross border labour demand is empirically estimated for each type of FDI separately. The empirical evidence clearly demonstrates the importance of differentiating between vertical and horizontal FDI when studying the employment effects of FDI: Horizontal affiliates have no cross border interdependency in their labour demand, while vertical affiliates are mutually dependent. Thus, this is a contribution to the prior empirical studies, which only explored home country effects of FDI flows as a whole. Furthermore, Chapter 4 compares in detail three different procedures to distinguish vertical and horizontal FDI empirically, using firm level data on intra-firm trade and the geography of affiliate sales.

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[17]The model of Markusen et al. (1996) which incorporates both types of FDI can only be solved by computer simulations.

Chapter 5 further explores the effects of vertical and horizontal FDI on host economies, concentrating on the Czech Republic as one of the largest recipients of FDI in Central and Eastern Europe. The main focus is on technology spillovers from foreign affiliates to local firms in the manufacturing sector. The contribution of this chapter is to distinguish between the technology spillovers from different types of FDI. It shows that spillovers from vertical and horizontal FDI affect local firms in different ways. In particular, Chapter 5 provides empirical evidence that vertical export oriented FDI has positive effects on the productivity of local firms, while horizontal FDI has a negative impact. This difference in impacts is a possible explanation for the contradictory findings of previous literature on technology spillovers. Overall, the results from Chapters 4 and 5 show that the approach of the previous literature to analyse the impacts of FDI flows as a whole masks important differences in the impact of different types of foreign direct investments.

Finally, Chapter 6 summarises the results and concludes.

Chapter 2

Vertical and Horizontal FDI: Theories and Empirical Evidence

As a starting point for further analysis, this chapter provides an overview of the theories of vertical and horizontal FDI that have been accumulated so far. In order to do so we will look at definitions, intuition, previous literature and implications of each type of FDI. Finally the empirical findings will be discussed. The literature on FDI and multinational firms in general is well documented and is not the focus of this chapter.[1]

2.1   Theoretical Background

The development of theories of the multinational enterprise occurred in three stages. The first models of multinational firms emerged from the traditional literature on international trade with competitive, constant-return models. Early analysis viewed multinational activities as a part of the theory of capital flows (Caves, 1971). This theory generated clear results that headquarter activities should be placed in capital-abundant countries with subsidiaries in

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[1]See Dunning (1977, 1981) and Caves (1996) for theories of the multinational firm.

capital-scarce countries. Thus, there was no motive for FDI to occur between identical countries. This was in contrast to empirical observations and led in the next stage to the "new trade theory", which incorporated the idea of increasing returns to scale and imperfect competition to the traditional models. Subsequently, the theory of the multinational enterprise was split into two parts. In the first, the theory of "vertical" FDI emerges, when the firm geographically separates the stages of production. It builds on the theory of capital flows, where direct investment was essentially a foreign production branch. The other strand consists of "horizontal" FDI models, where the firm produces the same goods or services in different locations. In the third stage the new models tried to combine the two branches. The respective theory was called the "Knowledge Capital" model (KC). Before moving to the results of the mentioned models, it is helpful to introduce the most prominent definitions for vertical and horizontal FDI used in the literature.

Four main definitions of vertical and horizontal FDI have been used in the previous literature. The first definition is based on the motivation of investment. Here, FDI is classified to be vertical or horizontal depending on the motive for affiliate operations. Thus, vertical FDI is conducted in order to benefit from factor price differences between countries (Hanson et al., 2003). The second way to discriminate between the two types of FDI was proposed by Brainard (1993a), who uses the term "factor proportion" in order to explain foreign activities of MNE. This methodology is derived from the empirical estimation of international trade flows. The third definition employs the geographical distribution of sales of the foreign affiliate (Brainard, 1993b, 1997, and Lankes and Venables, 1997). Finally, Markusen (1995) defines vertical FDI as a geographical separation of the production process by stages, which is very similar to fragmentation.[2] The present thesis uses the common feature of these alternative definitions and speaks of

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[2]Chapter 4 relies on these alternatives and proposes several ways to differentiate empirically between vertical and horizontal FDI.

vertical FDI as a geographical separation of production while horizontal FDI is mentioned when the multinational enterprise duplicates the same activity in different countries.

Indeed, a clear separation between horizontal and vertical FDI is not possible, because in case of horizontal FDI affiliates draw some headquarter services from the parent company, even when the firm duplicates the same production activity in several countries. Thus, each horizontal MNE has some vertical traits.[3]

Closely related to the term vertical FDI is the literature on outsourcing and fragmentation. These terms are more general and include often the geographical separation of production that takes place outside the firm. Furthermore, different prominent researchers refer to geographical separation of production in different ways. Feenstra (1998) calls it "disintegration of production", Krugman (1996) prefers "slicing the value chain" and Leaner (1996) refers to it as "delocalisation".

Another term related to vertical multinational activities is "export platform FDI", which has gained attention in recent studies. It is defined as production in a host country, with the output sold to a third market and not in the parent or local market. Thus, such a definition incorporates the features of vertical and of horizontal FDI as well. Here the foreign affiliate serves a large integrated market as a horizontal investment. But at the same time the location within the region is chosen on the basis of cost considerations, which is typical for vertical FDI (Ekholm et. al., 2003). However, empirical findings by Hanson et al. (2001) suggest a more closer relationship to vertical FDI, since this type of investment is strongly cost driven and depends negatively on the size of the foreign market.

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[3]This could explain the emergence of theories of vertical and horizontal FDI from the same source of Heckscher-Ohlin model, where Helpman (1984) explains the existence of vertical FDI and Markusen (1984) uses a similar approach with several foreign affiliates to show the existence of horizontal FDI.

2.1.1 Horizontal FDI

Horizontal multinationals are firms that produce the same good or services in multiple plants in different countries, where each plant serves the local market from the local production. Two factors are important for the appearance of horizontal FDI: presence of positive trade costs and firm-level scale economies. The main motivation for horizontal FDI is to avoid transportation costs or to get access to a foreign market which can only be served locally.[4] The horizontal models predict that multinational activities can arise between similar countries.

The intuition behind horizontal FDI is best described in form of an equation with costs on the one side and benefits on the other side. Establishing a foreign production instead of serving the market by exports means additional costs of dealing with a new country. Moreover, there are production costs, both fixed and variable, depending on factor prices and technology. The plant-level economies of scales will increase the costs of establishing foreign plants. On the other side of the equation, there are cost savings by switching from exports to local production. The most obvious are transport costs and tariffs. Additional benefits arise from the proximity to the market, as shorter delivery and quicker response to the market becomes easier. Thus, if benefits outweigh the costs a multinational enterprise will conduct a horizontal FDI.

The models of horizontal FDI predict, that given the existence of trade costs and economies of scale at plant and firm level, investment flows can arise between similar countries (see Table 2.1).[5] In order to explain the intuition behind the models we look at the counter-example with two countries

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[4]This is very similar but not identical to high transportation costs, since there are many other obstacles for exports, for example legal requirements in the insurance sector.

[5]Firm-level economies of scale appear due to some common input such as R&D that can be spread among any number of production facilities without losses. Plant-level economies of scale occur when concentrating the production in one plant lowers the unit costs.

which are different in either size or in relative factor endowments. In both situations we assume moderate transportation costs. In the first case, the appearance of horizontal multinationals is unlikely, because they will have a disadvantage relative to the national firm with headquarter and production plant in the larger country. The multinational has to bear fixed costs for the plant in the smaller market, while the national firm in the larger country faces trade costs for the small amount of exports to the smaller country. In the second case the countries are similar in size but different in factor endowments. The horizontal multinational has a disadvantage again, since it places the production in both countries, also in the more expensive, factor-scarce country. The national firm located in the country which is factor-abundant (for example with labour force) conducts the complete production in the low cost country. The presence of transportation costs is thereby important, since otherwise the foreign markets will be served by exports and the firm uses only the scale effects by setting the complete production in one plant.

Theoretical models of horizontal FDI are based on the trade-off between additional fixed costs from setting up a new plant and the saving of variable costs from avoiding tariffs and transportation. One of the earliest models on horizontal FDI is Markusen (1984) with firm-level scale economies as a driving force. A two-plant firm has fixed costs that are less than double the ones of a single plant firm, thus creating a motivation for multi-plant production. Extensions and refinements of this model can be found in Horstman and Markusen (1987, 1992). Markusen (1995) provides a discussion on horizontal MNE as an alternative to trade and local firms and discusses the internalisation problem. A survey of literature and an overview of empirical finding can be found in Markusen and Maskus (2001).

In a more general model Brainard (1993) discusses the role of scale effects at the firm and plant level in relation to transportation costs. The intuition is that horizontal FDI appears as an alternative to exports, if the trade costs are larger than the fixed costs from establishing a new plant, which is also known

under the term "proximity-concentration approach". The driving force here is the trade-off between the advantages of being near to the market to avoid transportation costs (proximity) and scale effects in case of production in one plant (concentration). Scale effects occur because of fixed costs when building a new plant. The model predicts two situations when horizontal FDI will dominate over exports or crowd them out completely. The first is when the transportation costs are large in comparison to the plant fixed costs, while the second occurs when firm-level scale effects are larger than plant-level scale effects. This means that the incentive for horizontal multinationals increases the greater are transport costs relative to fixed plant costs and the greater are increasing returns at the firm level relative to the plant level.

Further developments of the horizontal model were conducted by Markusen and Venables (1998, 2000). Markusen and Venables (1998) extended the aforementioned models to a full multi-country framework, allowing for the mix of multinational and local firms in each country. In the former, multinationals dominate in countries that are similar in size, factor and technology endowments. In the latter, the authors show that dissimilarity in relative factor endowments reduce the horizontal activity of MNE.

Table 2.1 summarizes the conditions necessary for the appearance of horizontal multinationals: countries similar in size and factor endowments, presence of transportation costs and economies of scale at the firm level.

The findings from the models of horizontal FDI can explain a variety of features of FDI flows. First, horizontal FDI reduces trade flows, since the market is served through local production instead of exports. Second, horizontal FDI takes place if the costs of importing are high relative to costs of investing. Third, horizontal FDI is more likely to occur in large foreign markets, which allows to spread fixed costs for the new plant over a large volume of production. Finally, the value of local production may exceed the simple calculation of net costs from the described trade-off, when establishing a local production plant may have a strategic value. Given an oligopolistic

Table 2.1: Conditions for the Existence of Vertical and Horizontal FDI

Vertical and Horizontal FDI exist if	Vertical	Horizontal
Country characteristics:		
Absolute market size	small	large
Relative Market Size	-	similar
Relative factor endowment	different	similar
Trade costs/barriers	low	moderate/high
Tariff barriers	low	high
Economies of scale:		
Firm level	-	large
Plant level	-	low

market, sales of each firm depend on the marginal costs of all other competitors. By conducting horizontal FDI the firm reduces its marginal costs, what may induce the other firms to reduce their sales. Setting up a new plant is also a commitment to supply the local market, and this commitment may change the behaviour of competitors.

2.1.2 Vertical FDI

Vertical FDI takes place if the MNE geographically fragments its production by stages. The fragmentation of production occurs in order to exploit differences in relative factor costs. It is call vertical since the production stages in different countries are conducted one after another. The modelling of this type of FDI is based on the idea, that different parts of the production process have different input requirements. Since the input prices vary across countries it becomes profitable to split production, conducting for example labour intensive production stages in countries with low labour costs.

Similar to the intuition of the horizontal models, the decision to conduct vertical FDI can be described as a trade-off between costs and benefits. The benefits arise from the lower production costs in the new location. The production chain consists of several stages, often with different factors required for each stage. A difference in factor prices makes it then profitable to shift particular stages to the countries, where this factor is relatively cheaper. This is only profitable as long as the costs of fragmentation are lower than the cost savings. The costs of splitting the production process emerge in form of transportation costs, additional costs for acting in a new country, or of having different parts of production in different countries.

The theoretical modelling of vertical FDI was typically driven by differences in factor endowments. Models of this sort of FDI date back to the studies by Helpman (1984, 1985) and Helpman and Krugman (1985). The initial studies explain the expansion across borders in terms of factor proportion differences, where the firm´s headquarter is geographically separated from the production. These models were based on the extended Heckscher-Ohlin trade theory with two factors of production and two sectors, one perfectly competitive with constant returns to scale and the other producing differentiated products under increasing returns to scale. In the former, Helpman (1984) explains the appearance of vertically separated production by cost savings for MNE, if it separates the high-skilled labour intensive headquarter activities and low-skilled labour intensive production activities. These two activities have different factor intensities and can be split geographically. The model was constructed with no tariffs and transportation costs so that the firm will open only one foreign plant.[6] The driving force of the model was the absence of Factor-Price-Equalisation (FPE). If otherwise the difference in relative endowments of countries is not sufficiently large, trade in goods will lead to the equalisation of factor prices between countries. Then, there will be no

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[6] This is the main difference to the modelling of horizontal FDI conducted by Markusen (1985).

incentive for the firm to separate headquarter and production activities and FDI will not occur. If, however, the difference in relative factor endowments is large, one country for example has a much higher endowment of labour relative to capital, then trade does not equalize factor prices. Here it is profitable for the firm to split activities, locating the labour-intensive part of production (e.g. assembling) in the labour-abundant country. Consequently, vertical FDI arises if this separation occurs by setting up an own affiliate. Thus, the focus of Helpman (1984) was to show that multinational firms have an incentive to fragment the production geographically and this separation arises only if the countries differ sufficiently in relative factor endowments.

The literature on vertical FDI is closely related to the models of outsourcing, where the vertical separation of production occurs without multinationals. Vertical FDI can be seen as a subset of this fragmentation, since parts of the production chain are also conducted abroad but by other firms.[7] Recent studies analyse the decision of MNE between outsourcing and FDI. Grossman and Helpman (2002) explore the choice between outsourcing and integration through FDI as a trade-off between incomplete contracts in arm´s length relationship versus less-efficient integration within a multinational enterprise. While Antràs and Helpman (2003) show how the productivity of the firm affects the decision to source the inputs from external suppliers or from the firm´s own affiliate abroad.

The implications of vertical FDI have not gained much attention so far. The literature mentions only the impact on international trade flows, as for example Markusen et al., (1996) and Markusen and Venables (2000). Vertical FDI is seen to be trade creating, since products at different stages are shipped between different locations.[8] On the other hand, trade costs have a negative impact on the location of vertical FDI (Shatz and Venables, 2000), making for example the Central and Eastern European countries especially interesting

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[7]See for example Deardorff (2001) and Feenstra (1998).

[8]See Yi (2003).

for this sort of FDI from Western Industrialised countries. At the same time Zhang and Markusen (1999) argue that the size of the host market has a negative impact on vertical FDI because the fixed costs for the new plant can be sooner covered in a larger market.

Table (2.1) summarizes the criteria necessary for the appearance of vertical FDI. It can be seen that differences between country characteristics are the driving force for this type of FDI. Finally, trade costs and tariff barriers must be low in order to make the separation more valuable.

2.1.3 Knowledge Capital Model

The theoretical literature described so far contains mostly separate theories of MNE, concentrating on either vertical or horizontal FDI. In an attempt to combine the approaches of vertical and horizontal FDI, Markusen et al. (1996) and Markusen (1997) develop the "Knowledge Capital" model. It nests in one model factor costs and market access as the driving forces for vertical and horizontal FDI. Thus, depending on country characteristics both types of FDI can arise endogenously within the single model. It is called "Knowledge Capital" (KC) model because knowledge is geographically mobile and serves as a joint input to multiple production plants, independent of the type of FDI.

The KC-model consists of three firm types within a two-good, two-factor and two-country framework. One type is horizontal MNE, which duplicates the same activity in the foreign country. The second type is vertical FDI, which fragments the production chain and locates the high-skilled labour intensive headquarter in the high-skilled labour abundant home country and the low-skilled labour intensive production in the low-skilled labour abundant host country. The third type are firms from the home country which serve the foreign market by exports. The main results are illustrated in Fig-

ure 2.1.[9] Figure 2.1 is an Edgeworth-box with country endowments of skilled and unskilled labour on the vertical and horizontal axis respectively. The origin of the home country is in the South-West corner and of the host country in the North-East corner.[10] In this situation, vertical FDI is dominating if the countries have different endowments. Thus, we see vertical FDI in both corners. If, in contrast, the countries are very similar, there is no incentive to fragment the production chain so there is no vertical FDI. At the same time, in the presence of transportation costs it is more attractive to set up a local horizontal affiliate instead of serving the market by exports. Thus, in the middle field there is only horizontal FDI. The white area in between illustrates the mixed presence of multinationals and firms serving the foreign markets by exports. Overall, these results are consistent with the previously described models of vertical and horizontal FDI.

Since the KC-model combines already known results for vertical and horizontal FDI, it has the same implications described in the previous sections. The solution of the model by simulation does not allow for a broad analysis of FDI effects, however, it serves as a basis for empirical studies of multinational activities. In the theoretical literature this framework was used by Zhang and Markusen (1999) to explore the effect of the market size on FDI. Markusen (1997) argues with help of the KC-framework that trade and investment liberalisation have different impacts on the host country. For empirical studies, the simulations results of the KC-model generate testable implications, relating different types of multinational activities to country characteristics. These empirical finding are presented in the next section.

Again, the results of the KC-model are summarised in the Table 2.1: Horizontal FDI takes place between large, similar countries, whereas vertical FDI arises between a high-cost country and a low-cost country. Trade

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[9]See Markusen (1997) and Markusen et al. (1997) for the formal algebraic description.

[10]The picture is showing the simulation for medium transportation costs.
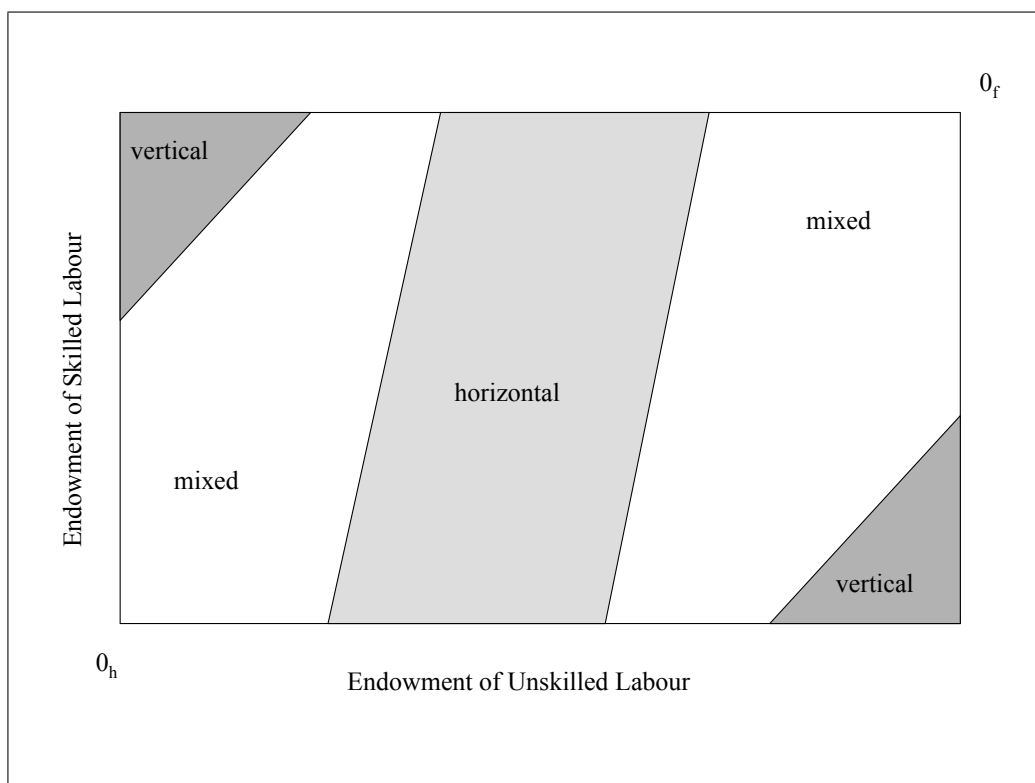
Figure 2.1: Vertical and Horizontal FDI in the KC-model

costs make horizontal FDI more attractive while they are discouraging vertical FDI. Both types of FDI have a positive impact on welfare by avoiding the duplication of headquarter activities and by making the global production more efficient. They differ, however, in the impact on wages. Vertical FDI reduces the absolute wage differences between countries and increase the relative wages within countries. In contrast, horizontal FDI increases the income in each country, without necessarily changing the distribution.

2.2 Empirical Evidence

The purpose of this section is to survey the empirical evidence on vertical and horizontal FDI that has been accumulated to date. The section concentrates on the empirical evidence of the theories presented in the previous section.[11] The empirical evidence is very mixed, as the overview in Table 2.2 on page 26 highlights. Therefore in the following sections we will explain such a variety of results, the difficulties that cause them and recent trends. In a first step we introduce the data sources, in the second step we look in more detail on the results for vertical, horizontal and KC models.

Data sources and main measurements methods

One of the main difficulties in estimating the theories of vertical and horizontal FDI is the lack of empirical data. Official FDI statistics do not distinguish between vertical and horizontal FDI, thus making empirical studies only possible with firm level data. The two sources for empirical studies so far were the BEA data base with US foreign investments and the survey of Swedish multinational enterprises. The former contains annual data on production of the foreign affiliates of US firms and is collected by the US Department of Commerce, Bureau of Economic Analysis.[12] The latter is a survey of multinational activities of Swedish manufacturers, conducted about every four years by Institute of Industrial Economics in Stockholm.[13] In recent studies Blonigen et al. (2002) and Braconier et al. (2003) extend the BEA data with OECD statistics in order to measure the amount of FDI flows and the value of the foreign production.

Initially, there were two groups of empirical literature on vertical and horizontal FDI. The first tried to explain the total amount of FDI, stock or flow, between two particular countries, using criteria for the each type in the esti-

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[11]For an extensive overview of general equilibrium models of MNE and their empirical evidence see Markusen and Maskus (2001).

[12]See www.bea.doc.gov.

[13]For more details see Ekholm and Hasselman (2000).

Table 2.2: Empirical Evidence for Vertical and Horizontal FDI

	Sample (Source)	Measurement	Evidence for		
			VFDI	HFDI	KC
Brainard (1993)	US Inward and outward FDI (BEA)	local sales, exports	Mixed	-	-
Brainard (1997)	ibid	affiliate sales	No	Yes	-
Markusen and Maskus (2001)	ibid	affiliate sales, exports	No	Yes	Mixed
Markusen and Maskus (2002)	ibid	affiliate sales	No	Yes	No
Carr et al. (2001)	ibid	affiliate sales	-	-	Yes
Hanson et al. (2001)	US outward FDI (BEA)	share exports on sales	Yes	Mixed	-
Blonigen et al. (2002)	US inward and outward FDI (BEA), (OECD)	affiliate sales, FDI stock	No	Yes	No
Davies (2002)	ibid	affiliate sales, FDI stock	Yes	No	Yes
Braconier et al. (2002)	US, Swedish outward FDI (BEA), (IUI)	exports, affiliate sales	Yes	-	Yes
Mathä (2002)	Swedish FDI in EU (IUI)	affiliate production, exports	Yes	Yes	-
Braconier et al. (2003)	FDI 56 home, 85 host cntr. (OECD)	affiliate sales, FDI Stock	-	-	Yes

mation equation. If the criteria of one type of FDI fitted well, all investment flows between these two countries were interpreted to be of this type (Carr et. al., 2001, Markusen and Maskus, 2001). The second group estimates the share of exports in total sales of the affiliate with respect to relevant country characteristics (Hanson et al., 2001). Such an estimation technique measures the extent of export orientation or the interaction between the parent and the affiliate company.

Finally, the amount of vertical FDI was estimated using intra-firm trade and general trade in components.[14] Hanson et al. (2003), for example, examined the factors of international division of production from the perspective of trade in input goods between US firms and their foreign affiliates.

Recent Evidence for Vertical FDI

Empirical studies on vertical FDI can be grouped in two stages: early studies that reject this type of multinational activities and recent studies that widely confirm the theoretical predictions.

Early empirical work on multinational activities came to the conclusion that most FDI flows in the world economy are horizontal, while the share of vertical FDI is very small. Therefore, the models of vertical FDI were rejected for several reasons. The first reason is the reliance on export statistics. As proposed by Brainard (1993), vertical FDI is measured by exports from the affiliate to the home country. This narrow definition means, however, that the scope for vertical separation of production is small, given the small share of exports in total affiliate sales. The second reason to reject the models of vertical FDI comes from the fact, that the relative labour endowments between the home and the foreign country, measured as ratio of skilled to unskilled workers, has no significant effect on the sales of foreign affiliates. From this point of view, several authors conclude (Carr et al. 2001, Markusen

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[14]For example Yeats (1998) estimates, that about 30 percent of world trade in manufacturing goods is trade in components. Another approach was used by Hummels et al. (2001) who measures trade flows that cross borders multiple times.

and Maskus, 2001, 2002, and Blonigen et al., 2001), that differences in factor endowments between countries cannot explain the activities of MNE. Since this is the basis for the appearance of vertical FDI, the vertical decomposition of production was denied. A third reason to regard the scope of vertical FDI as limited is the overwhelming share of FDI flows between similar rich industrialised countries (Markusen, 1995, Lipsey, 2003). This type of investment locates new production in similar high-wage economies, which supports the models of horizontal FDI. More recently, the theory of vertical FDI was also rejected by Blonigen et al. (2001) as a result of estimating the KC-model.

However, three recent studies show that the role of vertical FDI has been widely underestimated for several reasons. The first improvement was the employment of new measurement techniques. Braconier et al. (2002) use a new approach to estimate the differences between countries. They employ the difference in relative wage premium and not the relative factor endowments, measured by ratio of skilled to unskilled workers, as proposed by Carr et al. (2001) and Markusen and Maskus (2002). The authors argue, that factor prices are the prime force behind the decision of MNE and not factor endowments. As a result, they found a larger share of vertical FDI than previously estimated, in particular if exports to third countries are considered. Combining US and Swedish data they found strong support for vertical FDI in particular in countries with relatively cheap unskilled labour.

While the previous studies took into the account only the exports back into the home countries, Hanson et al. (2001) employ more recent data on multinational activities of US firms and show that patterns of multinational activities in the 1990s were much richer than before. Introducing additional FDI types as, for example, whole sale and export platforms the authors argue that vertical FDI plays an important role for US multinationals. Following Brainard (1997) they estimate the share of exports in total sales of the foreign affiliate, using GDP per capita as a skill measure. As a result, Hanson et al. (2001) found strong evidence for vertical FDI and for export platform

FDI.[15] An additional and very important result was the strongly increasing role of vertical FDI for US multinationals in the 1990s. They also show that local sales are more attractive in larger markets and that affiliates in smaller markets are oriented toward exports more than toward local sales. Affiliate imports for further processing are higher in economies that are larger, have higher average income and are closer to the US. Finally, Davies (2002) found empirical evidence for vertical FDI, estimating the KC-model.[16]

Thus, the last three studies argue that vertical FDI has been underestimated in the earlier empirical attempts. Besides more sophisticated measurement methods, recent empirical findings indicate a growing role of vertical FDI in the world economy in the recent years. Shatz and Venables (2000) show an increasing importance of vertical FDI among the outward FDI from US, Europe and Japan. Hanson et al. (2001) introduce a variety of vertically related activities of US multinationals in the 1990s. And Marin et al. (2002) provide empirical evidence for the substantial share of vertical FDI among German investments in CEE. Finally, Eckholm and Hasselman (2000) show a growing share of the exports from the foreign affiliate of Swedish multinationals back to Sweden since the middle of 1990s, which provides evidence for outsourcing and vertical separation of production.

In sum, although initially rejected, more support for vertical FDI arose in recent years mainly for two reasons: better measurement of criteria responsible for vertical investment and an increasing share of vertical fragmentation in the world economy.

Clear Evidence for Horizontal FDI

As Table 2.2 on page 26 highlights, the empirical evidence for horizontal FDI has been far less controversial than the one on vertical FDI. Most studies found strong empirical support for horizontal FDI between similar counties, as predicted by the theoretical models.

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[15]This type of FDI is closely related to vertical FDI, as discussed in the previous section.

[16]See last part of this section for a detailed discussion of this study.

In the primary empirical study of horizontal FDI Brainard (1997) found strong evidence for the proximity-concentration approach. She showed that the share of local sales by affiliates is increasing in trade costs and trade barriers. In addition, the sales of foreign affiliates of US firms are higher in countries with higher transport costs and tariffs. Thirdly, the US multinationals serve the foreign market more through FDI and less through exports, the larger is the scale of corporate operations relative to the scale of production. Here scale economies in headquarters are stronger relative to scale economies in production, which also supports horizontal FDI. These results confirm the main characteristics of horizontal FDI to be used as market access in remote markets.

Using the same data as in Carr et al. (2001), Markusen and Maskus (2001) employ the KC-model in order to analyze the impact of market size and factor differences on the pattern of affiliate production. They found strong support for horizontal and only little support for vertical FDI. The Knowledge-capital model is empirically supported, however, it can not be distinguished from the horizontal model.

A further empirical evidence for horizontal FDI was found by Mathä (2002) and Markusen and Maskus (2002). Shatz and Venables (2000), Markusen (1995) and Lipsey (2003) also argue that horizontal FDI represents by far the largest share of world investment flows. Despite this, some studies tend to reject horizontal models in favour of the KC-model.

Mixed Evidence for the KC-Model

Recent studies employ the KC-model as an alternative hypothesis for the models of vertical and horizontal FDI, even if it formally includes both types of FDI. In such cases the authors look for evidence which of the three models can better explain multinational activity.

Carr et al. (2001) employ the 1986-1994 panel data on US multinational sales and find support for the Knowledge Capital model. In contrast to the previously mentioned studies, the authors test the KC-model that allows for

both, vertical and horizontal FDI, to arise endogenously depending on country size and factor endowments. Thus they get findings similar to Brainard (1993, 1997) for each type of FDI. However, the estimation is closely related to the KC-model, since they employ total market size of two countries, market size differences and differences in factor endowments as explanatory variables. Carr et al. (2001) provide strong support for the KC-model, finding that affiliate sales increase in total size of the host and home country and in skill differences, while dissimilarities lead to lower affiliate sales. The last result is also supported by Markusen and Venables (2000). An additional result is that affiliate sales are larger, if the home country of the MNE is small and skilled labour abundant at the same time.

However, Markusen and Maskus (2001) find a negative relation between affiliate sales and skilled labour abundance in the home country when looking at outward US FDI only. And Markusen and Maskus (2002) reject the KC-model as well as the vertical model in favour of the horizontal model as explanation for the multinational activities investigating investment outflows from US multinationals. Blonigen et al. (2002) argue that these contradicting results are based on the incorrect empirical specification of the non-linear form in the skill difference term. They correct for misspecification by using the absolute values of factor endowments. Employing the same data set as Carr et al. (2001), Blonigen et al. (2002) show falling multinational activities between two countries, if the absolute difference in skilled-labour abundance and size increases. With this result the authors reject the knowledge capital model in favour of the horizontal FDI. Blonigen et al. (2002) also strongly reject the vertical FDI feature of the KC-model, where MNE should have more activities with greater skill differences.

Moreover, Davies (2002) argues that the KC-model was rejected in favour of horizontal models because of incomplete specification. By extending the specification and allowing KC-model a richer specification than the simple linear relationship between FDI and skill differences in the horizontal model,

he found evidence for vertical FDI measuring FDI stocks and rejected horizontal model in favour of KC-model. Strong empirical evidence for the knowledge capital model was found also by Braconier et al. (2003), who used other measurements for skill differences and a significantly larger data set. In contrast to Carr et al. (2001), they use a geometric difference for the measurement of size and factor endowment differences.

Mathä (2002) undertakes the most advanced discrimination between vertical and horizontal FDI. He tests the predictions of vertical and horizontal models, without employing the KC framework. Using sophisticated data on intra-firm trade of the Swedish multinationals with their affiliates in the EU, he differentiates between the two sorts of FDI by multiplying each explanatory variable with interaction variables. These variables describe the extent to which affiliate and Swedish parent are tied through forward or backward trade in input goods. He found that Swedish FDI in the EU can be explained to a larger extend by the proximity-concentration approach and only to some extent by the factor-proportion approach. Estimating each type of FDI separately at the sectoral level, he found evidence for the idea of vertical FDI.

To outline the results of the empirical findings, the first empirical tests have shown little evidence for vertical FDI and strong evidence for horizontal FDI, while the support for KC-model was mixed. However, recent studies give strong support to vertical FDI and to the KC-model due to improved measurements of key characteristics like factor and size differences. Recent studies also show the growing importance of vertical FDI in the global FDI flows in the last 10 years.

2.3 Conclusion

The literature on horizontal and vertical FDI emerged in the mid 1980s from the Heckscher-Ohlin-model of international trade. Models of horizontal FDI explain the appearance of multinationals from a proximity-concentration

trade-off, while the vertical models explain FDI flows as a possibility to exploit factor price differences between countries. Recently, the Knowledge Capital model nests the two motives within one model. However, all models explore the appearance of a particular FDI type for given country characteristics, while the question of impacts is still widely unanswered. Empirically, distinguishing between the two types of FDI was a substantial progress in the analysis of MNE activities, since aggregating over the activities of foreign affiliates may mask the presence of different types of FDI and give an incomplete picture of the range of operations performed by multinationals abroad. Recent studies attempt to solve these problems. Initially vertical FDI has been underestimated and only horizontal FDI found empirical support. The situation changed in the last few years, as new studies with extended data sets and more sophisticated measurements of country differences appeared. Hence, latest studies show strong empirical evidence for vertical FDI as well as for the KC-model.

Although, as the chapter makes clear, several questions are still open. On the theoretical side there is only one model (KC-model) which captures both types of FDI. Unfortunately, it can only be solved by computer simulation, thus making the analysis of single effects very difficult. Secondly, the existing models describe the appearance of a particular type of FDI, leaving the question of impacts on the host and home countries open. The empirical differentiation between vertical and horizontal FDI is also not clear cut. One plant may serve both markets and low production costs are also an important motivation for horizontal firms. However, the measurement of vertical investments is crucial for the empirical analysis of effects of each FDI type.[17] The following chapters will try to answer some of these questions.

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[17]Mathä (2002) shows for Swedish multinationals that depending on what relationship of total exports, intermediate exports and affiliate sales is used, the extent of vertical multinational activities of Swedish firms comes out to be very different.

Chapter 3

FDI Life Cycle in Transition Countries

3.1 Introduction

Since the fall of the Iron Curtain, transition economies of Central and Eastern Europe (CEE) have experienced continuously growing inflow of foreign direct investment (FDI). At the same time these countries have seen rapid changes in their main economic characteristics like per capita income, cost of production and quality of infrastructure. Have these changes of country characteristics had an impact on the type of FDI inflows besides the absolute amount? Can these changes explain the fact, that some of initial investors are leaving this region while the total amount of FDI inflows is still growing? To answer these questions, this chapter explores the time pattern of vertical and horizontal FDI in CEE transition countries.

Vertical FDI occurs when a multinational enterprise (MNE) fragments the production process internationally, locating production stages in countries where it can be conducted at the lowest costs. Horizontal FDI takes place when a MNE undertakes the same production in different countries, locating the production near to the customer. An explanation for the former is given by Helpman (1984), Helpman and Krugman (1985) and for the latter by

Markusen (1984) and Markusen and Venables (1998, 2000).

This chapter builds on two results from the previous literature: First, countries with different characteristics attract different types of FDI.[1] Horizontal FDI occurs in large foreign markets, while vertical FDI arises if there are differences in factor prices. Second, the characteristics of transition countries change relatively fast over time.[2] These two observations lead to the conclusion, that the transition countries must experience different types of FDI inflow over time. Empirically this can be observed as a change in the composition of foreign investments.

The intuition behind the changes in the composition of FDI flows is as follows. After the opening of transition countries their markets were characterised by low input prices, in particular a cheap labour force. At this stage cost seeking vertical FDI enter the market and increase local wages and the income of the host country. During the catching-up process, higher purchasing power makes the host country more attractive for the market seeking horizontal FDI. Higher inflows of horizontal FDI lead to a further increase of wages and income. At the same time higher wages reduce the comparative advantage of the host country. The market is not attractive for vertical FDI anymore, which in turn falls or even even leads to a reallocation of existing production to cheaper locations.[3] Despite a decrease of vertical FDI, wages in the host country are still growing, as more horizontal FDI flows into the country than vertical FDI leaves.[4] Thus, at the end of the catching up process horizontal FDI should dominate the investment inflows.

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[1]See for example Markusen et. al. (1996), and Markusen and Maskus (2003).

[2]UNCTAD (2001) and Gros and Suhrcke (2001).

[3]For example 300 US manufacturing plants were relocated in 1999 and 2000 from Mexico to China due to lower labour costs (The Economist, 2003). For similar examples from China and India see Patibandla (2001).

[4]Empirical studies show a dominant role of horizontal FDI in the world economy, see Hanson et al. (2001) for discussion.

Previous related literature can be grouped in two parts. In the first, the rise of a particular type of FDI is explained by relevant country characteristics. However, only a few studies incorporate vertical and horizontal multinational activities simultaneously. The first integration of the theories of vertical and horizontal multinationals was conducted by Markusen et al. (1996). The authors provide a theoretical model in which both types of MNE arise endogenously depending on country characteristics. The simulated results of the general equilibrium model show the dominance of vertical FDI if countries differ significantly in relative factor endowments. Horizontal FDI dominates when countries are similar in size and relative factor endowments. Using the same general equilibrium model Zhang and Markusen (1999) refine the role of market size and labour force composition for FDI inflows. The model covers the appearance of vertical FDI in relation to domestic firms and derives two results relevant for this chapter: The inward investment to GDP ratio is falling in country size, and the relationship between FDI and differences in relative factor endowments between home and host countries has an inversed U-shaped form.

The second group of the literature explores the impact of FDI on the host country.[5] The list of possible impacts includes growth, wages and input prices in the host country. Of particular interest is Glass and Saggi (2001), who argue that incoming horizontal FDI increases the price of the local intermediate good. Furthermore, analysing the decision of MNE between exports and horizontal FDI for serving the foreign market, the authors found a positive impact of the country size on the investment flow.

On the empirical side, several studies found evidence for vertical and horizontal FDI. Markusen and Maskus (2002) nest the two types of investments within the knowledge-capital model and test all three models empirically. The results give strong support to the horizontal FDI model and reject the vertical FDI model. Carr et al. (2001) show that FDI flows are related

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[5]See Lipsey (2002), Blomström and Kokko (2003) and Chapter 5 for an overview.

to different country characteristics. In particular, outward investment is increasing in the sum of economic size of both countries and their similarity in size the relative skilled-labour abundance of the parent nation.

Finally, estimating the determinants of FDI in China, Sun et al. (2002) found changes in motivation of the FDI inflows through time. Before 1991, wages have had a positive relationship with FDI but a negative relationship subsequently. Size of the market, as measured by the regional GDP did not play a role in the 1980s at all, but became highly significant in the 1990s.

Changing time pattern of FDI was also addressed in the business literature. Moran (2000) presents a similar link between product life cycle and the FDI strategy of a firm. Patibandla (2001) gives some examples for China and India, when changes in the set of determinants for FDI affect the pattern of FDI inflows.

In this chapter, the FDI Life Cycle is described from the perspective of a host transition country. In contrast, the composition of FDI outflows from industrialised countries follow another time path: the horizontal FDI dominates in the beginning and loses the importance in favour of vertical FDI.[6]

The rest of the chapter is organised as follows. The next section presents a theoretical model, which describes the dynamic interaction between vertical and horizontal FDI. Section 3 explores the empirical evidence of FDI Life Cycle, concentrating on FDI composition on one side and country characteristics on the other. Section 4 provides empirical tests of the composition of FDI inflows to major CEE countries. Finally, section 5 concludes.

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[6]See Bourguignon et al. (2002). In the 1980s, FDI outflows from developed countries went to other industrialised regions and were mostly horizontal. While in the 1990s vertical FDI to emerging markets of South Eastern Asia and specially China became dominating (Hanson et al., 2002). In a recent study Mathä (2002) shows empirically that large Swedish MNE became to an increasing extent vertically integrated.

3.2 The Model

3.2.1 Economic Environment

Consider two countries, home h and foreign f. A domestic and a foreign firm produce a final good x. Producing one unit of final good x requires one unit of intermediate good y, which is produced by a monopolistic supplier in each country. For simplicity we assume that there is one firm and one supplier in each market in both countries.[7] Demand for the final good x in country i is given by an inverse demand curve

$$P_i = A_i - Q_i, \quad i \in [h, f] \tag{3.1}$$

where P is the price, Q the quantity and A a constant which measures the size of the market in country i. In case of market entry, the firms act under Cournot-competition, choosing quantities for the final good x.[8] Transportation costs for the input good are denoted by t. For the final good we assume for simplicity prohibitive transportation costs, so there is no trade in final goods in the model.

Thus, to serve a foreign market firms have to produce the final good locally. We exclude exports since the decision between exports and FDI was already discussed by Glass and Saggi (2001) and Helpman et al. (2002). Furthermore, incorporation of exports does not contribute to the decision between vertical and horizontal FDI. This proceeding is contrary to the framework of Glass and Saggi (2001), who assume a local content requirement for FDI: if the firm conducts horizontal FDI it has to source the input good from the local supplier. Thus, unlike Glass and Saggi we allow for trade in input goods and exclude trade in final goods, while Glass and Saggi build on trade

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[7]The results of the model also hold in the case of multiple oligopolistic firms in each market. The structure of the model is similar to the models of international trade with two factors of productions. For simplicity it is assumed, that the price for skilled labour is the same in both countries, so we can concentrate on the first factor (unskilled labour).

[8]We obtain similar results in case of Bertrand competition, see Glass and Saggi (2001) for the proof in case of the trade off between horizontal FDI and exports.

in final goods and no trade in input goods.

Following Markusen (1995) we differentiate between vertical and horizontal type of FDI on the basis of the geographical placement of production stages. Vertical FDI occurs in case of geographic separation of production: the input good y is produced in one country, while the final good x in the other country. Horizontal FDI is characterised by duplicating the final stage of production in both countries.[9] Figure 3.1, cases 3 and 4 respectively, illustrates both types in a two country, two stages matrix. This definition of vertical and horizontal FDI does not consider the ownership structure.[10] We also abstract from the modelling of market entry (Greenfield versus Acquisition), thus focusing on the decision of the firm about the location of production.[11]

The economic environment in the model looks as follows. After the opening of their markets, transition countries have a low purchasing power and thus smaller markets in comparison to the industrialised countries. To capture this effect we assume, that in the beginning the foreign market is smaller than the home market:

$$A_h > A_f$$

with the country size measured by the total demand A from the equation (3.1). To reproduce the catching-up process in the transition countries we

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[9]According to Markusen et al. (1996), an alternative definition could be the differentiation on the fact, whether the final good is exported to the home market or is sold locally, given that *both* stages are in the same country.

[10]The foreign firm sets up a 100 percent affiliate that obtains input goods and sells them to the parent firm. For simplicity we abstract from this stage in the model. An alternative explanation could be, that the firms get some minority control of the supplier paying a zero price if it buys input goods from him.

[11]For detailed analysis of the entry mode decision see Müller (2002). It is possible to extend the model in a way, that the firm must buy a supplier in order to draw input goods from him (Acquisition) or to set up a new supplier (Greenfield FDI). However, such extension will give no additional insight in the decision of the firm to source the input good production in the other country.
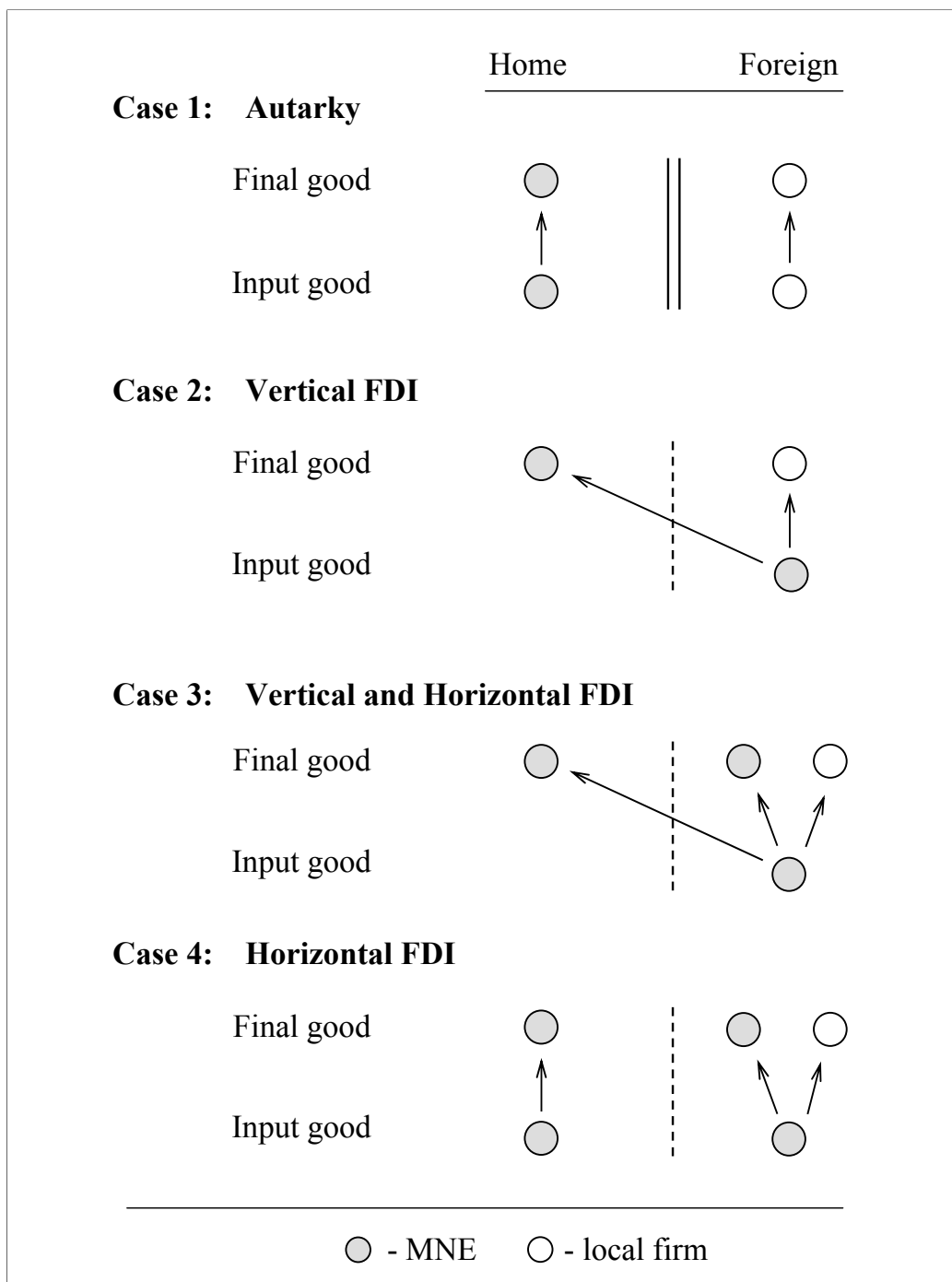
Figure 3.1: FDI Life Cycle: Four Cases

assume that the size of the foreign market is growing faster than in the home country. Thus, the size of the market will change exogenously.[12]

A final good producer faces fixed costs F if it enters a foreign market f. This is a plausible assumption, since the new entrant has to spend a substantial amount for marketing or for product adjustments to satisfy local requirements. In addition we assume, that fixed costs for entering the home market h are prohibitively high.[13] As a result, the model focuses on FDI inflows into the smaller host country f, since the main idea concerns the composition of FDI inflows to the host transition country.

We also assume lower production costs of the input good in the host country than in the home country:

$$c_h > c_f$$

In the production of the final good variable costs are equal to zero, so the only cost the firm has to pay is the price of the input good. And finally we assume for simplicity, that vertically integrated firm can not source the input good in two countries simultaneously.[14]

3.2.2 Four Cases

The model consists of four cases, which are presented in Figure 3.1. In the first step we consider the autarky, with two completely separated markets and no FDI (case 1). This is a benchmark for the further analysis to show

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[12]It is possible to nest the model with a growth model, where the incoming FDI contribute to the country growth by importing capital and technology. See discussion in the "Results" section.

[13]This is a simplifying but realistic assumption, since it is very difficult for the firms from developing countries to enter the markets of final goods in industrialised countries.

[14]The firm has such incentive in order to minimize the input price. Then we get a competition between input good suppliers in both countries.

in a simple way the interaction of the final good producer with the supplier. Then the markets open, giving an opportunity for FDI. Here we will observe vertical and no horizontal FDI (case 2), as long as the foreign market is very small. If the size of the foreign market increases, both types of FDI take place (case 3). Finally, if the foreign market becomes very large, only horizontal FDI will exist (case 4). Given a growing economy in the foreign country, each stage sequentially arises from the previous as the size of the foreign market increases. Thus, one can interpret them as a time pattern. In each stage we look at the profits of the final good producer and of the supplier for a given market size. Then we derive price and quantity of the input good and thus the incentives for vertical and horizontal FDI.

Case 1: Autarky

The situation in autarky is presented in Figure 3.1 (case 1): In each country producer of intermediate goods supplies only the local upstream firm. The final good producer on his part serves only the local markets and has no access to the foreign market. Thus, the upstream firm and the supplier are both monopolists in their markets. The profit function of the upstream firm in autarky is:

$$\Pi^A = \left(p_i - w_i^A\right) q_i^A \tag{3.2}$$

where p is the price of the final good, q is quantity of final good and w the price of the input good. Remember that the upstream firm needs one unit of input good in order to produce one unit of the final good. Then, inserting the demand for the final good in the profit function yields the demand function for the intermediate good:

$$q_i^A = \frac{A_i - w_i^A}{2} \tag{3.3}$$

The profit function of the input good supplier depends on price and quantity of the input good in the country i, as well as on variable costs c_i:

$$\Pi^{S,A} = \left(w_i^A - c_i\right) q_i^A \tag{3.4}$$

As a monopolist, the supplier sets the price for the intermediate good to maximize his profit. Inserting the quantity of the input good into equation (3.4) we get the price for the intermediate good in autarky:

$$w_i^A = \frac{A_i + c_i}{2} \qquad (3.5)$$

As equation (3.5) shows, the price for the intermediate good depends on the size of the market and the production costs of the input good. Given the smaller size of the foreign market $(A_f < A_h)$ and the lower production costs of the input good, the price for the intermediate good in the foreign country is lower than in the home country. Thus, there will be an incentive for the final good producer from h to source the input good from the cheaper country f. This situation is plausible for most transition countries in Central and Eastern Europe after the opening of their markets.

Case 2: Vertical FDI only

Now we consider a market opening, when firms gain access to the foreign market through FDI. As derived in the previous section, the price for the input good in the foreign country f is lower than in the home country h $(w_f < w_h)$, which creates an incentive for vertical FDI. At the same time we start with a small foreign market to illustrate the catching-up process as discussed in the introduction. In this situation there is only vertical and no horizontal FDI as presented in Figure 3.1 (case 2): The upstream firm from the home country serves the local market h, drawing the input good from the foreign country f. Thus, there is by definition vertical FDI in country f, since the production for the home market is geographically separated. The necessary condition for this case can be derived from the inequality $w_f + t < w_h$ by inserting the prices in each country:[15]

$$A_f < A_h - 3t + 2\left(c_h - c_f\right)$$

On the other side, there is no horizontal FDI given fixed costs F for the market entry and small market size A_f. The small market size does not allow

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[15]See section 1 in Appendix 3.6 for derivation.

for the investor to cover the fixed costs for the market entry, even if the final good producer in the foreign country is a monopolist. The threshold level for the market size can be derived from the profit function of investor:[16]

$$A_f \leq 4.2\sqrt{F} + 0.3A_h - 0.3t + 0.7c_f$$

Besides fixed costs and the size of the foreign market this condition also includes the size of the home market A_h, transportation costs t and variable costs for the intermediate good c_f. All these terms influence the price for the input good in the foreign country and thus the profit of the horizontal final good producer in case of market entry. If this condition does not hold, both types of FDI take place as described in the next case 3.

The final good producer in the foreign country f is a monopolist on his own market, since the firm from the home country serves only the local market in h. The monopolistic profit function of the local firm in the foreign country is still similar to the one in autarky:

$$\Pi_h^n = (p_f - w_f)\, q_f^n \tag{3.6}$$

Local firm´s demand for intermediate good is also the same as in autarky:

$$q_f^n = \frac{A_f - w_f}{2} \tag{3.7}$$

Since the price for the input good is lower in country f, the final good producer from country h separates the production geographically and sources the input good in country f as illustrated in Figure 3.1. The profit function of the upstream firm from h equals to

$$\Pi_h^v = (p_h - w_f - t)\, q_h \tag{3.8}$$

and depends positively on prices and quantities of the final good in h, but negatively on prices of the intermediate good in f and transportation costs. The firm does not face the fixed costs since it serves the final good market

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[16]See section 2 in Appendix 3.6 for derivation.

in the own country. From the profit function in (3.8) we obtain the demand of vertical firm for intermediate good required in country h:

$$q_h^v = \frac{A_h - w_f - t}{2} \qquad (3.9)$$

Thus, the supplier in country f produces intermediate goods for the local firm and for the vertical firm as well. His profit function is determined by both quantities q_f and q_h from equations (3.7) and (3.9) respectively, and equals to

$$\Pi_f^S = (w_f - c_f) \left(\frac{A_f + A_h - 2w_f - t}{2} \right) \qquad (3.10)$$

Solving the profit maximisation problem of the monopolist gives the price for the intermediate good in case 2:

$$w_f = \frac{A_f + A_h - t + 2c_f}{4} \qquad (3.11)$$

In contrast to the case of autarky it depends also on the size of the home market and transportation costs. Price comparison for autarky and open markets from equations (3.5) and (3.11) illustrates, that given a larger home market ($A_h > A_f$), the price of the input good in the open host economy is higher than in autarky: $w_f > w_f^A$. Thus, market openness and appearance of vertical FDI lead to a price increase in the host country, which is an important result for the further analysis.

Case 3: Vertical and Horizontal FDI

In case 3 we consider an exogeneous increase of the size of the foreign market A_f in a way, that market size is large enough for the firm from h to cover fixed costs of market entry:

$$A_f > 4.2\sqrt{F} + 0.3A_h - 0.3t + 0.7c_f$$

It is now profitable for the final good producer from the home country to set up an affiliate in the country f, which produces the final good and serves the

foreign market. Thus, the firm from h duplicates the final good production in both countries and we get a horizontal FDI by definition.

At the same time the foreign market is not very large,

$$A_f < A_h - \frac{11}{4}t + \frac{7}{4}(c_h - c_f)$$

so that the condition from case 2 holds for the vertical FDI and guarantees, that the input good is cheaper in the foreign country and vertical separation as in case 2 exists.[17] Therefore, in case 3 we observe vertical and horizontal FDI simultaneously.[18]

Thus, in case 3 the local upstream firm in country f faces a new competitor, the horizontal market entrant. Given Cournot-competition, profits of both firms in final good sector depend on the quantity sold by the competitor. The profit function of the local final good producer is therefore:

$$\Pi_f^n = \left(A_f - q_f^n - q_f^h - w_f\right)q_f \tag{3.12}$$

The profit function of the new horizontal firm looks similar to the local competitor. However, in addition the new firm has to bear fixed costs for market entry:

$$\Pi_f^h = (p_f - w_f)\,q_f - F_h^f = \left(A_f - q_f^n - q_f^h - w_f\right)q_f - F \tag{3.13}$$

Using a standard profit maximisation approach under Cournot-competition we get the demand for input good from the local supplier. Since both firms have the same variable costs, the demand of the local and horizontal firm for intermediate good in country f is the same:

$$q_f^n = q_f^h = \frac{A_f - w_f}{3} \tag{3.14}$$

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[17]See section 3 in Appendix 3.6 for derivation. It can be easily shown, that both condition hold simultaneously.

[18]In the model the same firm undertakes vertical and horizontal FDI since we have only one final good producer in each country.

The geographically separated part of the upstream firm from country h is still buying the input good in f and serving the home market in h. It faces the same profit optimisation problem as in the case 2, shown in equation (3.8). The demand of the upstream firm from country h for intermediate good in country f is the same as before:

$$q_f^v = \frac{A_h - w_f - t}{2} \tag{3.15}$$

The supplier of intermediate goods in the country f now faces the demand from three sources: from the local firm in f and from the h-firm, which now serves the foreign and the home market. Inserting quantities from the equations (3.14) and (3.15) yields the profit function of the supplier:

$$\Pi_f^S = (w_f - c_f) \left(\frac{2(A_f - w_f)}{3} + \frac{A_h - w_f - t}{2} \right) \tag{3.16}$$

Derivation with respect to w_f gives the optimal price for the input good in case 3:

$$w_f = \frac{4A_f + 3A_h - 3t + 7c_f}{14} \tag{3.17}$$

Again, the price for the input good depends on the size of the home and the foreign market. Furthermore, the price for the intermediate good is higher in the presence of vertical and horizontal FDI than in both previous cases. Thus, additional FDI leads to a further increase of the price for input good in the host country and makes the geographical separation (i.e. vertical FDI) less attractive.[19]

Case 4: Only Horizontal FDI

As we have seen from the previous two cases, a larger market and incoming FDI has led to a higher price for the input good in the host country. Thus, in the last step we look at the case when the foreign market is large enough, for prices for intermediate goods in both countries to become similar:

$$w_f + t < w_h, \quad w_h + t < w_f$$

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[19] This can be shown by inserting the new wage from equation (3.17) in the profit function of the vertical firm in equation (3.8).

Now it is more favorable for the final good producers to buy the input good from the local supplier in each country separately.

Inserting the prices for the intermediate goods for both countries in these conditions gives the size of foreign country, when the price for the input good in f is the same as in the home country h in consideration of transportation costs:[20]

$$\bar{A}_f \geq A_h - \frac{11}{4}t + \frac{7}{4}(c_h - c_f)$$

If the demand for the final good in the foreign country f increases to $\bar{A}$, higher production of the final good by horizontal FDI and local firm pushes the price for the intermediate good in f at the same level as in h. So there are no more incentives for vertical separation of production. The firm from country h serves both markets, conducting both stages in each country as shown in Figure 3.1 (case 4) and sources input goods in each country. As a result, there is only horizontal and no vertical FDI in a large and expensive foreign country.

For the sake of completeness we look at profits and prices in this stage. In country f the profit and the demand for the input good of the local firm and of the horizontal MNE are the same as in the case 3, equations (3.13) and (3.14). The price for the input good is derived in the same way as in previous stages and equals to $w_f = (A_f + c_f)/2$.[21] In the home country the producer of final goods buys input goods from the local supplier and gets monopolistic profits, so this case is identical to the case (1) of autarky. Remember that due to the assumption of high fixed costs in h, the foreign firm can not serve the home market with final goods.

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[20]The exit of the vertical FDI from the foreign market will lead to a short fall of w_f. However, vertical FDI will not enter the foreign market again, since this will increase the price over the old level.

[21]See Table 3.6 in Appendix 3.6 for an overview.

3.2.3 Results and Discussion

The results of the model are summarised in Figure 3.2, which shows the incentives for both types of FDI depending on the size of the host country A_f. For vertical FDI the incentive for entering the foreign market is the difference between the profit with local sourcing of input good in h and the profit in case of geographical separation of production stages.[22] For horizontal FDI it is the profit in case of market entry from equation (3.13).[23] The main result presented in Figure 3.2 is that larger foreign market means falling incentives for vertical FDI but growing incentives for horizontal FDI. Thus, during the catching-up process in transition countries vertical FDI are expected to be replaced by horizontal FDI.

Figure 3.2 illustrates that in a small foreign market only vertical FDI exists due to cheaper input goods in the foreign country. There is no horizontal FDI in this situation because the small market size and fixed costs for market entry lead to negative profits for this type of FDI. For very small values of the market size there is a special case with a horizontal incentive line for vertical FDI. This is because the foreign market is very small, so the size of the market has no impact on the profitability of vertical FDI, since there is no production of the final good in the foreign country at all.[24] Larger size of the foreign market A_f allows the potential market entrant to cover fixed costs due to higher operational revenue and to enter the market for final goods. Thus, growing country size leads to more horizontal FDI but as a consequence also to higher demand and price for the input good in country f. An increasing input price has a negative impact on vertical FDI, which

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[22]See section 4 in Appendix 3.6 for mathematical derivation.

[23]The curves are not continuous because in each stage there is a different amount of final good producers and therefore a different price function for the input good. For calculations of incentive functions see section 4 in Appendix 3.6.

[24]The small market size and high price for the intermediate good due to the demand from the foreign country lead to negative profits of the local producer of final good in f.
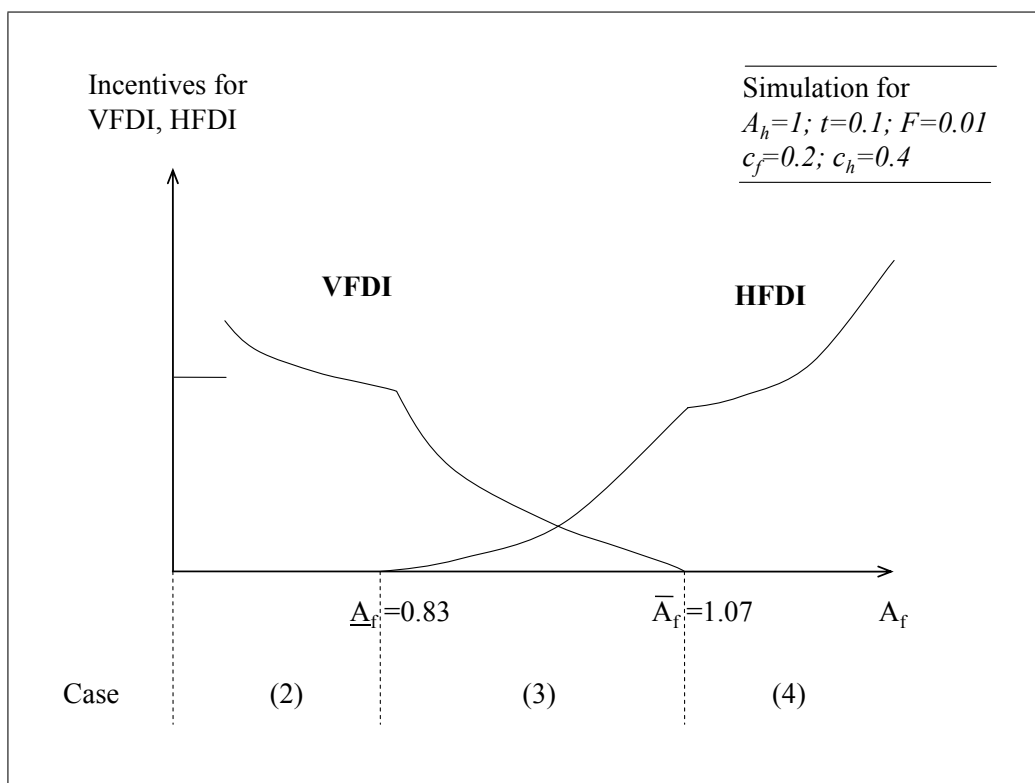
Figure 3.2: FDI Incentives and the Size of the Foreign Market

is therefore falling with respect to market size. Finally, if the market size reaches the level of $\bar{A}_f$, there will be only horizontal FDI and no vertical FDI. Thus, the price for the input good is the main driving force for the vertical FDI, while for the horizontal FDI it is the market size.

Besides the main result of FDI Life Cycle, there are some further outcomes from the model. The first is that incoming vertical and horizontal FDI increase the price of the input good. In particular, vertical FDI can be seen as a negative externality for the host country, since the demand for input goods from abroad increases the local prices. In the extreme case of a very small foreign market it can even lead to a full crowding out of the local production of final good in the foreign country, as illustrated by the horizontal

line on the left side of Figure 3.2. The second result is that horizontal FDI crowds out vertical FDI, since larger market attracts more horizontal FDI which increases the price for input good. Furthermore, this crowding-out effect can lead to even higher input good prices, since we know, that horizontal FDI is dominating over vertical FDI in the world economy.

Some additional remarks can be made about the theoretical model. First, the model is set up in a way, that increasing country size leads to a higher price for the input good. It is also possible to set up the model in the other direction, when increasing input prices lead to a larger market for final goods, since the input prices can be interpreted as local wages. Then, higher wages lead to higher consumption of the final good. However, this line of reasoning requires the modelling of personal utilities, consumption and a relationship between wages and consumption. As a result, one will get the same FDI pattern of vertical and horizontal FDI, as long as there are increasing wages and growing market size.

Secondly, one should examine the two extreme cases with only vertical FDI (case 2) and only horizontal FDI (case 4). They are included in the analysis in order to illustrate the idea of FDI Life Cycle. These cases are possible for several industries, but in an economy as a whole, they are rather unlikely, since the foreign market is big enough for at least some small amount of horizontal FDI. In addition, if wages in the home country of the MNE are also growing, it can be profitable for vertical FDI to separate the production chain even if the foreign market becomes more expensive. In such cases, the cross in Figure 3.2 becomes smoother and curves VFDI and HFDI do not cross the horizontal axis. The main idea however holds: if summing up both types of FDI flows, the share of the vertical FDI will decrease and of the horizontal will increase over time.

3.3 Descriptive Analysis

As the theoretical model has shown, the changing structure of FDI inflows is based on two factors: changes of country characteristics on the one side and different motives for going abroad on the other. Starting from this observation, the section presents empirical evidence for the model. The first section illustrates the changes in country characteristics and the dominant role of FDI in transition economies. Then the firm level data will be introduced in order to analyse vertical and horizontal FDI. Finally, the last section describes the composition of FDI inflows in CEE countries.

3.3.1 Changes in Country characteristics

After the collapse of planned economies the Central and Eastern European countries are undergoing substantial changes of their economies. We describe these changes using two country characteristics related to the theoretical model: market size measured by GDP, and production costs measured by unit labour costs.

Table 3.1 presents the changes of GDP for selected CEE countries as measurement for the purchasing power and the size of the market in the host transition country. The table illustrates two main results: The countries are undergoing substantial changes in market size and costs of production on the one side, and on the other side, the amount of changes varies significantly among the countries. Almost all countries experienced an increase in GDP per Capita. However, this positive effect is much stronger in the accession countries. Thus, one can clearly separate the CEE countries in two groups: the accession countries featuring an overall strong recovery from initial decline and the rest of the region featuring a rather slow recovery. As a result, the countries in the first group becomes more attractive for market seeking FDI, while the second group was characterised by rather shrinking market size, making them less attractive for this type of investment.

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Table 3.1: Changes of Market Size and Production Costs in Selected CEE Countries, *in Percent, 1990-2000, at Constant Prices*

	GDP per Capita	Unit Labour Costs
Accession Countries		
Czech Republic	25	116
Hungary	56	28
Poland	92	242
Slovakia	39	46
Slovenia	68	28
Other countries		
Bulgaria	14	-50
Romania	7	26
Russia	-8	-47
Ukraine	-25	129

Source: WIIW Handbook of Statistics, different years.

Similar difference between country groups appears in case of unit labour costs (ULC). The Central European countries have experienced strong increase of unit labour costs whereas the CIS and the South Eastern countries had a constant or even falling costs of labour. As Table 3.1 illustrates, unit labour costs went up by more then 100 percent in the Czech Republic and 240 percent in Poland. The second country group has rather negative or steady development. Thus, measured by production costs, the accession countries became less attractive for cost seeking vertical FDI than the south Eastern or CIS countries.

One of the key arguments of the model was that FDI inflows affect factor prices in the host country. But an impact on prices is only possible, if foreign firms have enough market power. Therefore, in the next step we explore whether foreign owned enterprises have a significant share in the demand for input goods and in particular labour in the host country.

Table 3.2: Share of Foreign Owned Enterprises in Selected CEE Countries, *in Percent*

| | Employment | | Investment | | Sales | |
	1996	1999	1996	1999	1996	1999
Czech Republic	13.1	26.9	33.5	52.7	22.6	42.4
Hungary	36.1	46.5	82.5	82.2	61.4	73.0
Poland	12.0	29.4	30.6	63.1	17.4	49.0

Source: Hunya (2002).

Large inflows of FDI accompanied by an extensive privatisation of national enterprises resulted in a substantial role of foreign owned enterprises (FOE) in CEE. Table 3.2 reports the share of FOE´s on employment, investment and total sales in the three largest host countries for the FDI in CEE.[25] In all three countries the share of FOE is very high and has dramatically increased from 1996 to 1999. In Hungary foreign firms employ almost half of the whole labour force and conduct more than 70 percent of all sales by private firms. Similar high levels can be also observed in the Czech Republic and Poland. In all countries the share of FOE on total investment exceeds 50 percent. In some industries it is even higher, for example peaking the 90 percent in the banking sector in several accession countries.[26] In addition, several empirical studies found evidence for the positive effect of FDI on the wages in the host countries.[27] Thus, there is a strong empirical evidence that FDI can increase wages in the host country and that in Central and Eastern Europe the FOE have significant market power to influence the prices for the input goods.

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[25]For the role of MNE in other regions of the world see Lipsey et al. (1998).

[26]The Economist (2002).

[27]See Fenstra and Hanson (1997) for Mexico, Lipsey and Sjöholm (2002) for Indonesia and Bedi and Cielsik (2002) for Poland.

3.3.2 Changing Structure of FDI Inflows

From the theoretical model we would expect, that the amount of vertical FDI will decrease over time, while the number of horizontal FDI will grow. In order to differentiate between vertical and horizontal FDI flows we employ the data from a firm survey conducted by the Chair for International Economics at the University of Munich.[28]

Using the information about the time of investment and the intra-firm trade we compute the amount of vertical and horizontal FDI in CEE over time. From the information on intra-firm trade between parent company and its foreign affiliate in CEE each FDI project can be assigned to vertical or horizontal type according to the following rule: An investment project is defined to be of vertical type if the affiliate receives more than 50 percent of inputs from the parent company or, if more than 50 percent of the affiliate production is exported to the German parent company. Thus, the "or" condition includes both type of FDI, forward and backward integrated vertical FDI respectively.[29] The high share guarantees that only firms with predominantly vertical production strategy are defined as vertical.

To generate the share of each FDI type in total FDI inflows to a particular country we proceed in three steps: In the first step we derive from the information on the intra-firm trade, whether a particular investment project is of vertical or of horizontal type. For this purpose we use the criteria presented above. Then, we aggregate the number of projects of each type for each country and year.[30] Finally we calculate the share of these projects on the total number of FDI projects for each country and year. The chapter employs the number of projects, even though the data contains the information

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[28]See Chapter 1.3 for the description of the data set.

[29]See Chapter 1 for definitions of forward and backward vertical FDI. Other possible approaches are presented in Chapter 4.

[30]Although it is a cross section data, the firms were asked about the year in which the affiliate has been set up. The year of foundation varies between 1989 and 2001.
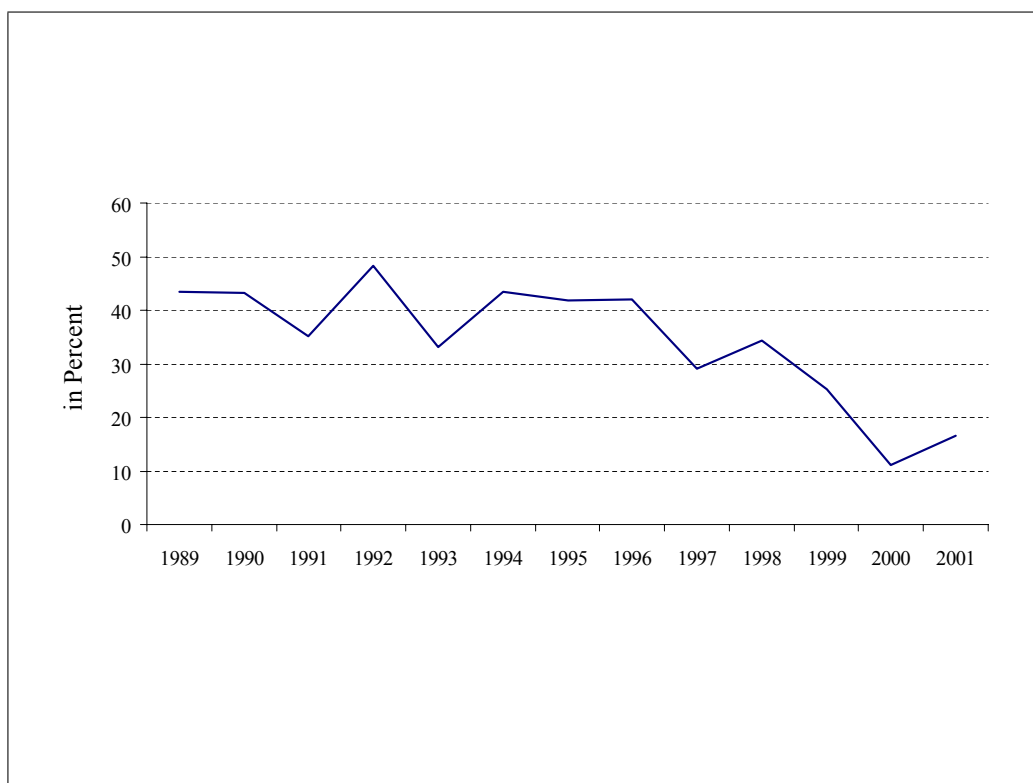
Figure 3.3: Share of Vertical FDI in CEE over Time, *in Percent of Total German Projects*

on volume of FDI and on local sales of the affiliate.[31]

The results are presented in Figure 3.3 which displays the share of vertical FDI projects on the total number of conducted German FDI´s in CEE from 1989 to 2001. As the curve illustrates, the share of vertical FDI was relatively constant at the level of about 40 percent in the first half of the 1990s and is falling in the second part of the 1990s. Thus, we can observe a decreasing share of vertical FDI as predicted by the theoretical model. The situation is even clearer when looking at single countries. While in the Czech Republic

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[31]The volume of FDI from the data set can not be used for this purpose, since the questionnaire only asks for cumulated FDI volume since the first year of investment. Thus, it was not possible to separate the volume for each year. Neither the sales of foreign affiliate can be used, as the cross section data is available only for the last year.
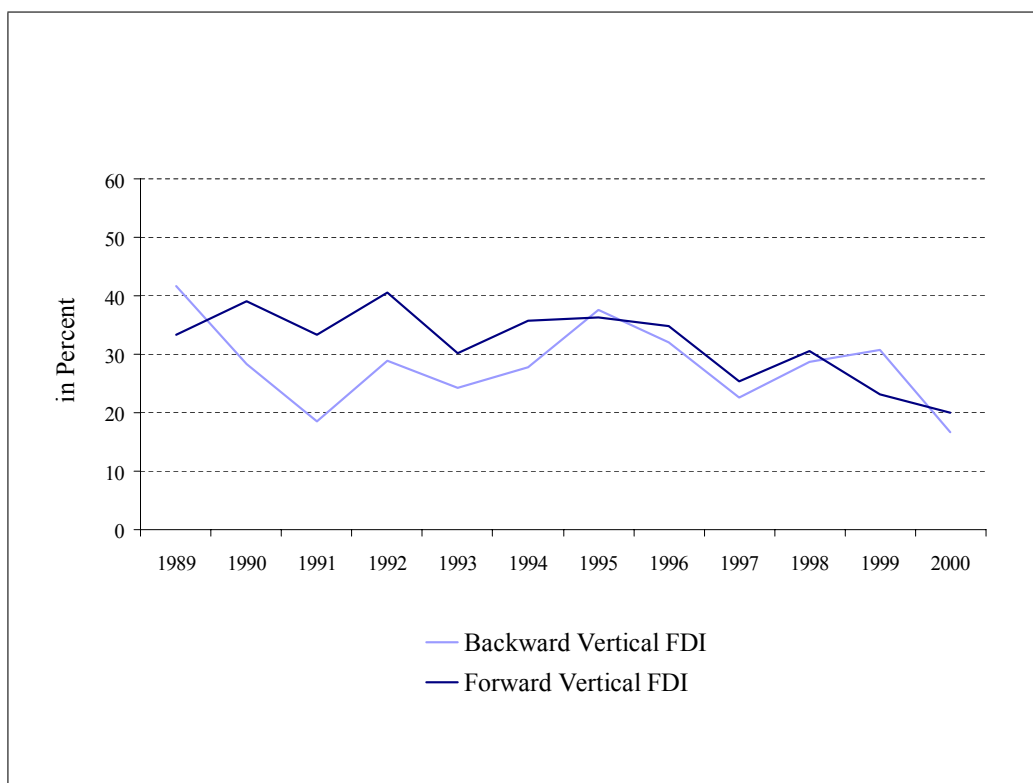
Figure 3.4: Share of Backward and Forward Vertical FDI in CEE, *in Percent of Total German Projects*

and in Hungary the share is also constantly falling, it remains constant or even grows over time in South Eastern countries like Romania and Bulgaria.[32]

There could be several reasons for the constant share in the beginning of the transformation process. The explanation most compatible to the model is that the wage increase in the early 1990s was compensated by falling transaction costs. Another reason could be an early market entry by large MNE with "deep pockets". Even making losses in small markets they use the first mover advantage in order to secure market share.

Finally, in order to give a deeper insight into the time pattern of vertical

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[32]See Chapter 5 for the Czech Republic.

FDI, Figure 3.4 presents both components of this FDI type, backward export oriented and forward host market oriented vertical FDI. As described in the data section, these two types form the vertical FDI by definition. Since the beginning of the 1990s, forward vertical FDI has been constantly falling, because more input goods and services became available locally. The pattern of export oriented vertical FDI is more sophisticated. In the first half of 1990's the share had been increasing, since a growing number of investors used the opportunity of cheap production for the export markets. Appearance of new markets and improving infrastructure contributed to this increase. However, after 1995 the share of new export oriented projects has been constantly falling. Rapidly increasing production costs made the CEE region less attractive for pure cost seeking investments.[33] Thus, both components of vertical FDI have been falling in the second half of the 1990s, contributing to the decline of vertical FDI as a whole.

An even stronger evidence should come from a larger data set. First, the employed data set does not contain the information on disinvestments. So we can only observe the incoming FDI flows, but not the withdrawals.[34] Looking at the disinvestment statistics should give an even more clear-cut picture of possible production relocations. Second, FDI is a long term investment, so it will take a longer period of time for clear observation of possible removals of vertical FDI from the market.

Additional empirical support for the substitution of vertical by horizontal FDI comes from the composition of trade flows between CEE and EU. An empirical study conducted by UNECE (2002) shows that horizontal trade in manufacturing goods has gained a larger share since 1996 in the Czech

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[33]See Table 3.1 for illustration of this effect.

[34]Some cases of disinvestment conducted by large MNE from former "cheap" markets were mentioned in the daily financial news. For example Microsoft, the world biggest software developer, has relocated his software development activities from Hungary to Russia. In another case, Nokia, a Finnish mobile phone producer, closed its production in Estonia to the benefit of cheaper production in China.

Republic, Hungary, Poland and Slovenia. At the same time vertical trade has increased in a low cost location such as Romania. Since in several CEE countries FOE have a majority share on the country exports, it leads to the conclusion, that the horizontal affiliates of MNE are dominating in advanced CEE countries in the last years.

In sum, the data for Central and Eastern Europe support the FDI Life Cycle model: The share of vertical FDI is falling over time while the amount of horizontal FDI is increasing.

3.4 Empirical Evidence

In order to explore the empirical evidence for the idea of FDI Life Cycle this section derives hypotheses from the theoretical model presented in this chapter and confronts them with empirical estimations.

3.4.1 Hypotheses

The results from the theoretical model can be summarised in four hypotheses. Each of them deals with a factor that has an impact on one or both types of FDI and thus on the composition of FDI flows as a whole. The results derived from he model will be also extended by the findings from the previous literature on vertical and horizontal FDI.

Hypothesis 1: Country size has a positive effect on horizontal FDI.
The size of the host market is the main driving force in the theoretical model: Larger markets lead to higher profits for the market seeking horizontal FDI and therefore, attract more horizontal investments. This result is supported by Zhang and Markusen (2001) and Carr et al. (2001) predicts that horizontal FDI dominates between countries with similar size. In case of transition countries, similarity in size means faster convergence to Germany, which will lead to a higher share of German horizontal FDI in Central and Eastern Europe.

Hypothesis 2: Low labour costs attract more vertical FDI.

Low-cost production opportunity is the key driving force behind vertical FDI. From the theoretical literature on vertical FDI we know that factor costs differences are the main criteria for vertical FDI.[35] Theoretical literature uses the factor endowment differences to explain the appearance of vertical FDI.[36] Braconier et al. (2002) argue that factor prices (i.e. wages) explain the existence of vertical FDI better than a comparison of factor endowments. Thus, increasing factor prices make the host country less attractive for the vertical FDI. The labour force is the main input factor driving cost seeking FDI in Central and Eastern Europe. Therefore we will expect labour costs to have a negative impact on the vertical FDI.

Hypothesis 3: Falling transportation costs have a positive effect on vertical but a negative effect on horizontal FDI.

Falling transportation costs decrease the total marginal costs for the vertical separation of production, thus making vertical FDI more attractive. On the other side, horizontal FDI becomes more attractive in comparison to exports in case of increasing transportation costs.

Hypothesis 4: Large investment flows induce more horizontal and less vertical FDI.

Following the argumentation of the model, large FDI inflows increase the local factor prices and make the host country less attractive for vertical FDI. On the other side, as the literature on FDI and growth argue, FDI inflows contribute to growth of the host country, making it more attractive for market seeking horizontal FDI.[37]

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[35] See Helpman (1984).

[36] See Markusen et al. (1996), Markusen and Maskus (2001) and Carr et al. (2001).

[37] See Borensztein et. al (1998). We do not consider agglomeration effects, since it is not clear, what type of FDI would benefit more from the agglomeration.

3.4.2 Estimation

The estimation equations for the proof of the hypotheses is partially based on the literature but also contains some improvements in order to catch the special features of the model. In particular, the contribution is the incorporation of the share of vertical and horizontal FDI as a dependent variable. We estimate the following specification using data over time (t) and country (i) for German investments in CEE:

$$
\begin{aligned}
VFDI_{it}/HFDI_{it} \;=\;\; & \alpha + \beta_1 * GDP_{it} + \beta_2 * GDPCAP_{it} + \\
& + \beta_3 * ULCDIFF_{it} + \beta_4 * INFRA_{it} + \\
& + \beta_5 * FDITOGDP_{it} + \beta_i + \mu_{it} \qquad (3.18)
\end{aligned}
$$

In equation (3.18) the dependent variable is derived from the firm survey data, while the explanatory variables describe the country characteristics and come from different official sources.[38] On the right hand side, the variable $VFDI_{it}$ is the number of vertical and $HFDI_{it}$ the number of horizontal FDI projects for each country and year. We use a ratio as the dependent variable, since the absolute number of projects will indicate the attractiveness of a particular country for both types of FDI.[39] Testing the share of vertical projects on the total number of projects would put additional restrictions on the estimation technique, since the dependent variable would range between zero and one. Furthermore, using this ratio allows to test the time pattern of FDI as shown by the cross in Figure (3.2) on page 50. As discussed above, we use the number of projects and not the sales of affiliates because the information on sales is only available for the last year due to cross section design of the data set. The volume of FDI can not be used since the firms reported the cumulated investment volume since the establishment of the affiliate.

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[38]See Table 3.3 for description of variables and data sources.

[39]An additional reason is property of the cross section data, because the absolute number of projects depends on the time, when firm survey was conducted.

On the right hand side of the equation (3.18) the first two regressors GDP and $GDPCAP$ are measuring the market size of the host country. The first variable is the country nominal GDP in USD terms, the second is per capita GDP, in USD at PPP. While the first coefficient describes the total size of the host market, the second is measuring the purchasing power. This is a similar approach to Hanson et al. (2002), who do not include the size of the US market but only the size of the host market measured by nominal GDP and GDP per capita. The variable $ULCDIFF$ captures production costs in the foreign country. It is a difference between unit labour costs in the host country and in Germany, where unit labour costs data is an index, beginning with 100 points. Thus, the difference is positive, if the ULC in the host country grow faster than in Germany. The variable $FDITOGDP$ is the ratio of cumulated FDI inflows from the previous year to GDP. It captures the effect of FDI inflows on the input prices and local wages, and therefore on vertical and horizontal FDI. The next variable, $INFRA$ is a number of telephone lines per thousand inhabitants in the host country. This is a measurement of the infrastructure quality and thus a proxy for the transportation costs.[40] $TIME$ is a time variable to capture possible time effects.

We do not include the size of the German market in the estimation for two reasons: first, including the total size of the home market would make sense if we consider *all* vertical FDI from Germany. Focusing on particular regions (here CEE) would miss out the possibility for shifting the cost seeking production to other cheaper locations. This could lead to wrong conclusion, when vertical FDI to CEE falls, while the total demand from Germany for vertical disintegration is growing, because it is served by the production from other regions. Thus, the studies by Carr et al. (2001) and Braconier et al.

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[40]Transportation costs is a product of distance and price. Because the first component is constant and is captured by the country dummy, transportation costs are mainly influenced by the quality of the infrastructure. Thus, infrastructure is the best proxy for the transportation costs, since there is no data on transportation costs available for each country and year.

Table 3.3: Variables and Data Sources for Chapter 3

Variable	Definition	Data Source
$VFDI_{it}$	Number of vertical FDI Projects	Firm Survey
$HFDI_{it}$	Number of horizontal FDI Projects	Firm Survey
GDP_{it}	Nominal GDP in USD terms	bfai Country Reports
$GDPCAP_{it}$	GDP per Capita in USD at PPP	WIIW Handbook of statistics
$ULCDIFF_{it}$	$ULC^{it} - ULC^{Germany,t}$, where ULC is an index with 1989=100	WIIW Handbook of statistics
$INFRA_{it}$	Number of telephone lines per Tsd. Inhabitants	EBRD Transition Report
$TIME_i$	time in years, 1989 to 2000	
$FDITOGDP_{it}$	ratio of cumulated FDI inflows to GDP	bfai Country Reports, EBRD Transition Report
Countries Included	Bulgaria, Czech Republic, Croatia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovak Republic and Ukraine	

Note: The subscripts i and t denote the country and the year respectively.

(2002) on US and Swedish FDI respectively, include the size of the home market, but cover all relevant regions for US or Swedish FDI. Second, Germany is the only home country for the FDI in the data set, and, as Braconier et al. (2002) pointed out, including only one home country will bias the results.

In the empirical tests we also do not employ wages as measurement of labour costs for two reasons: it does not explicitly include changes of productivity and is also correlated with the GDP per capita, since wages are a good proxy for the purchasing power. To capture the decline in industry production in the beginning of 1990s we excluded the observations before 1993 from the estimation in the preliminary tests. The coefficients had the same sign, however the explanatory power measured by adjusted R^2 fell. In addition, number of observation felt to only 71.

We estimate equation (3.18) on a panel of cross-country observations over the period from 1989 to 2000. For each of the 13 CEE countries we have at least 7 to 8 observation points. Table 5.6 gives the description of the data and sources. As estimation technique we employ fixed effects regression by introducing country dummies.[41] The estimation method does not employ the log terms, since pretests have shown, that in case of using the log values the most variables becomes less significant while obtaining the same signs. Thus, since there are no explicit reasons to assume a falling relationship we do not use the log terms. Using the ratio of FDI types and the country data from the same year puts an implicit assumption, that FDI decision is taken on the current information basis and was not carried out over a longer period of time. This is not a perfect solution for long term investments like FDI. However, a relatively short observation period does not allow to use large time lags.

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[41]Wooldridge (2001).

3.4.3 Results and Discussion

The equation (3.18) was tested with different numbers of explanatory variables, presented as specifications (1) to (4) in Tables 3.4 and 3.5. In the former table the dependent variable is the major definition of vertical FDI, while the latter employs the export-oriented vertical FDI.[42]

Specification (1) in Table 3.4 includes the first two coefficients from the equation (3.18) and a constant. Thus, the results are showing the role of the market size on the composition of FDI flows, which is the key driving force in the model. As both coefficients have negative signs, the market size has a negative impact on the share of vertical FDI. A larger market leads to less vertical but more horizontal FDI. It has primarily an effect on horizontal FDI, since market size alone is not enough to oust vertical FDI, as for example in China. This result is consistent with the theoretical predictions and with earlier results by Brainard (1997) and Zhang and Markusen (2001): a larger market makes it easier to cover fixed costs of plant for local sales and thus encourages horizontal FDI. Therefore, the first hypothesis is clearly supported, since the market size coefficients are robust and have the same sign in all specifications.

However, the negative sign of GDP coefficients contradicts the empirical results of Braconier et al. (2002), who show that export share on total sales increases with the size of the host market. Although, the authors do not give any explanation why the size of the host country have a positive impact on the export share. The effect in Braconier et al. (2002) is very small, not significant and has a negative sign if the fixed effect estimation technique is used. The negative impact of the market size on vertical FDI is however in line with the empirical study by Hanson et al. (2002), who estimates the share of exports on total sales of the foreign affiliate to be negative correlated with the market size of the host market.

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[42]Country dummies are included in both estimations but not reported.

Table 3.4: Regression Results: Vertical vs. Horizontal FDI

Dependent variable is $VFDI/HFDI$	(1)	(2)	(3)	(4)
GDP	-2.35E-12*	-2.58E-12**	-2.15E-12	-1.67E-12
	(-1.563)	(-1.623)	(-1.371)	(-1.033)
$GDPCAP$	-8.61E-05**	-1.33E-04		
	(-1.336)	(-1.060)		
$ULCDIFF$		-0.014**	-0.014**	-0.014*
		(-1.778)	(-1.687)	(-1.685)
$INFRA$		0.017	0.076	0.140
		(0.782)	(0.333)	(0.579)
$FDITOGDP$			-1.033	
			(-0.537)	
$TIME$				-0.043
				(-0.788)
$Constant$	3.082***	0.631*	0.256	86.630
	(2.096)	(1.456)	(0.413)	(0.792)
R^2	0.331	0.336	0.331	0.332
Adjusted R^2	0.209	0.215	0.203	0.211
No. of observations	104	104	100	104

Note: Cell entries are OLS-fixed effects parameter estimates and t-statistics in parentheses. Country dummies are included in the estimation but not reported in the table. Significance: *** significant at 5% level, ** significant at 10% level, * significant at 15% level.

Specification (2) includes all coefficients from the estimation equation. The most important result here is the negative and significant coefficient $ULCDIFF$: if the labour force in the host country becomes more expensive relative to Germany, the share of cost seeking vertical FDI decreases, as predicted by the theoretical model. Using unit labour costs we compare total costs of labour, thus controlling not only for the labour costs but also for the productivity. The ULC difference to Germany shows to what extent cost advantage of the particular country influences the share of cost seeking vertical FDI.

The coefficient for infrastructure $INFRA$, which is a proxy for the transportation costs has the expected sign but is not significant. The positive sign is consistent with theoretical predictions on transportation costs: better infrastructure means lower transportation costs, thus attracting vertical and discouraging horizontal FDI. Investigating this variable, we found that it is correlated with the market size variable (correlation coefficient is 0.75), which lead to a problem of multicollinearity and thus to insignificant infrastructure coefficient. The reason is that this coefficient could be also related to the purchasing power in each market, since number of telephone lines is also an indication for life quality. Braconier et al. (2002) face the same multicollinearity problem.

In the next step we control for the accumulation of FDI and for the time pattern. Our model predicts, that larger FDI inflows increase the local factor prices and thus lead to less vertical FDI. The results for the coefficient $FDITOGDP$ support this, as the ratio of FDI to the GDP of the host country has a negative sign as expected. The same situation occurs with the $TIME$ coefficient, which has the expected negative sign but is not significant. A possible explanation for the low significance could be the short period of time, since both coefficients are measuring an indirect effect on vertical FDI while FDI is a long term decision.

Since the theoretical model focused on the export-oriented vertical FDI, Table 3.5 presents estimation results with export oriented (backward) vertical FDI as the dependent variable. Additionally we control for the time effect by including year dummies. Using this type of vertical FDI gives very similar results to the general definition of vertical FDI, presented in Table 3.4. The coefficients for the market size and relative labour costs maintain the negative signs. They confirm the results discussed above, that a larger market and higher production costs will reduce the share of vertical FDI. Surprisingly, the coefficient for the infrastructure has a negative sign, however it is not significant.

The goodness of fit measured by adjusted R^2 is not very high for all specifications. It makes clear again, that the observation of the FDI Life Cycle can be difficult empirically for several reasons. In the following we discuss two of them, the rapid opening and the short observation period. First, a rapid opening of CEE markets complicates the observation of change in composition of FDI inflows. As explained above, one would expect vertical FDI to dominate at the beginning and then horizontal FDI to gain an increasing share afterwords. But the new possibility to access already existing markets even if they are relatively small will attract the market seeking horizontal FDI to enter just after the opening. This will not change the basic idea of consequent market entry for different FDI types, but make the estimation procedure more difficult. This effect should be relevant especially for large multinationals with "deep pockets", that do not look at the present situation but at the future potential of the market. The more risk averse middle size firms will only invest if the market size is enough to cover high fixed costs for the market entry.

A further difficulty analysing this question with the current data set is the very short time horizon. Foreign investors can officially invest in the former socialistic countries only since 1989. The available data covers the period from 1989 to 2001. So there are only 13 years, which is a short period given that FDI is characterized by a long term strategy.

Table 3.5: Regression Results: Backward Vertical vs. Horizontal FDI

Dependent variable is (backward VFDI)/HFDI	(1)	(2)	(3)
GDP	-1.86E-12**	-1.86E-12**	-1.46E-12
	(-1.673)	(-1.653)	(-1.268)
$GDPCAP$	-1.57E-04*	-1.52E-04**	
	(-2.519)	(-1.793)	
$ULCDIFF$		-8.40E-05**	-5.34E-05
		(-0.143)	(-0.086)
$INFRA$		-0.015	-0.194
		(-0.073)	(-1.056)
$FDITOGDP$			-1.498
			(-1.056)
$Constant$	2.713***	2.110***	1.613***
	(3.449)	(4.720)	(2.962)
R^2	0.372	0.336	0.351
Adjusted R^2	0.183	0.215	0.123
No. of observations	104	104	100

Note: Cell entries are OLS-fixed effects parameter estimates and t-statistics in parentheses. Country dummies and year dummies are included in the estimation but not reported in the table. Significance: *** significant at 5% level, ** significant at 10% level, * significant at 15% level.

Finally, the falling share of vertical FDI could be also induced by increased local sourcing of the foreign affiliates, since foreign affiliates become more independent from their parent company and more input goods and services become available in the foreign market.

Overall, the estimation results provide a strong empirical support for the "FDI Life Cycle" model. The composition of FDI inflows depends on country size, but also on production and transportation costs. The hypotheses are supported by empirical findings and the results are in line with comparable empirical studies on vertical FDI.

3.5 Conclusion

The amount of FDI inflows into transition countries of Central and Eastern Europe has been growing from year to year. At the same time, the characteristics of the host countries have changed rapidly: markets for final goods have become larger and prices for the intermediate goods and in particular labour costs have increased. The composition of the FDI inflows has reacted to such changes: while the cost seeking vertical FDI dominated in the beginning, the share of horizontal FDI has been increasing over time. This chapter investigated these changes in structure of FDI flows over time from theoretical and empirical perspectives.

The theoretical model describes the dynamic interaction between vertical and horizontal FDI in a tractable framework, thus explaining the composition of FDI flows over time. The model incorporates both types of FDI and shows that FDI inflows increase the price of the input good in the host country. The growing price for the input good makes the country less attractive for cost seeking vertical FDI, while at the same time the growing market attracts more market seeking horizontal FDI. Thus, one should observe a high but falling share of vertical FDI and an increasing share of horizontal FDI in transition counties during the catching-up process.

The idea of "FDI Life Cycle" is supported by empirical evidence for German FDI in Central and Eastern Europe. While the share of vertical FDI on total German FDI projects was constant in the beginning of the 1990s, it has been continuously falling after 1996. Empirical tests for 13 transition countries also indicate the changing structure of FDI inflows: the market size of the host country and the unit labour costs have a negative impact on the share of vertical FDI inflows.

Further analysis is necessary to evaluate the results after a longer period of time, since FDI is a long term decision and can not respond very quickly to rapid changes in country characteristics.

3.6 Appendix: Mathematical Derivations

1. Condition for vertical FDI in case 2

For the geographical separation of production it must be cheaper to source the input good from the foreign country, so the condition $w_f + t < w_h$ must hold. In order to get the size A_f which fulfills this condition we insert the prices for the intermediate goods in case 2 in the host country from equation (3.5) and the price in the home country from equation (3.11). Solving the inequality with respect to A_h gives the country size, under which it is cheaper to source the input good production in the foreign country:

$$\frac{A_f + A_h - t + 2c_f}{4} + t < \frac{A_h + c_h}{2} \tag{3.19}$$

$$A_h > A_f + 3t + 2\left(c_h - c_f\right) \tag{3.20}$$

Q.E.D.

2. Condition for horizontal FDI

Horizontal FDI will only enter the market if its profits can cover the fixed costs. Thus, the profit function in equation (3.13) must be positive. By entering the quantities sold by the incumbent and by the new affiliate of MNE from h we get:

$$\Pi^h = \left(A_f - 2\frac{A_f - w_f}{3} - w_f\right)\frac{A_f - w_f}{3} - F_h^f \geq 0 \tag{3.21}$$

solving the inequality yields

$$\frac{(A_f - w_f)^2}{9} - F_h^f \geq 0 \tag{3.22}$$

and taking only positive values into account gives:

$$A_f \geq 3\sqrt{F} + w_f \tag{3.23}$$

Inserting the price for the intermediate good in case of market entry from the equation (3.17) gives:

$$A_f \geq 3\sqrt{F} + \frac{4A_f + 3A_h - 3t + 7c_f}{14} \tag{3.24}$$

$$10A_f \geq 42\sqrt{F} + 3A_h - 3t + 7c_f \tag{3.25}$$

$$A_f \geq 4.2\sqrt{F} + 0.3A_h - 0.3t + 0.7c_f \tag{3.26}$$

Q.E.D.

3. Condition for vertical FDI in case 3

The derivation is the same as for the case 2 and starts from the condition $w_f + t < w_h$. The difference to case 2 is the new price for the input good in foreign country f, which is taken from the equation (3.17):

$$\frac{4A_f + 3A_h - 3t + 7c_f}{14} + t \geq \frac{A_h + c_h}{2} \tag{3.27}$$

$$A_f \geq A_h - \frac{11}{4}t + \frac{7}{4}(c_h - c_f) \tag{3.28}$$

Q.E.D.

4. Derivation of VFDI-curve in Figure 3.2

The VFDI curve in Figure 3.2 is an incentive for vertical FDI to enter the foreign market. It is calculated as the difference between profits with sourcing of input good abroad (vertical FDI) and in home country (local production):

$$\Pi^v - \Pi^A = (A_h - q_h^v - w_f - t) - (A_h - q^A - w_h) \tag{3.29}$$

By inserting the quantities for autarky from equation (3.3) and for vertical separation from equation(3.9) we obtain

$$\Pi^v - \Pi^A = \left(\frac{A_h - w_f - t}{2}\right)^2 - \left(\frac{A_h - w_h}{2}\right)^2 \tag{3.30}$$

Now inserting the price function w_f for each case gives the VFDI-curve with respect to the size of the foreign market A_f, as shown in Figure 3.2. However, as the summary in Table 3.6 illustrates, the price function differs for each case, since we have a different number of final good producers. Thus, the incentive function must be derived for each case separately.

Table 3.6: Price Function for the Input Good: Summary

cases	(2a)	(2b)	(3)	(4)
w_f	$\dfrac{A_h - t + c_f}{2}$	$\dfrac{A_f + A_h - t + 2c_f}{4}$	$\dfrac{4A_f + 3A_h - 3t + 7c_f}{14}$	$\dfrac{A_f + c_f}{2}$

For the case 2 one has to differentiate between two stages. In a very small foreign market there is no local producer of the final good because of low demand in combination with high production costs due to high demand for the input good from country h. So the price for the input good is only determined by the demand from the country h. It is identical to the price in autarky. As presented in column (2a) of Table 3.6, this price does not depend on the size of the foreign market, so the incentive curve is horizontal. The threshold level of the market size with no local producer of final good in the foreign country can be derived from the profit function of the final good producer in the foreign country:

$$\Pi_f^n = \left(A_f - q_f^n - w_f\right) q_f \geq 0 \tag{3.31}$$

$$\left(A_f - \frac{A_f - w_f}{2} - w_f\right)\left(\frac{A_f - w_f}{2}\right) \geq 0 \tag{3.32}$$

$$\left(\frac{A_f - w_f}{2}\right)^2 \geq 0 \tag{3.33}$$

Now we insert the price for the input good from the column (2a). It is derived as in the case of autarky and equals to $\frac{A_h - w_f - t}{2}$. Then solving the equation

for positive values gives

$$\frac{1}{4}\left(3A_f - A_h + t - 2c_f\right)^2 \geq 0 \tag{3.34}$$

$$\hat{A}_f \geq \frac{A_h - t + 2c_f}{3} \tag{3.35}$$

If the foreign market is smaller than $\hat{A}_f$, there is no final good production in the foreign country (column 2a).

i.) Incentive function for the case 2a:

Inserting w_f from the column (2a) and w_h from (3.5) in (3.29) gives:

$$\begin{aligned}
\Pi^v - \Pi^A &= \frac{1}{4}\left(A_h - \frac{A_h - t + c_f}{2} - t\right)^2 - \frac{1}{4}\left(A_h - \frac{A_h + c_h}{2} - t\right)^2 = \\
&= \frac{1}{4}\left(\frac{A_h - t - c_f}{2}\right)^2 - \frac{1}{4}\left(\frac{A_h - c_h}{2}\right)^2 = \\
&= \frac{1}{16}\left[(t + c_f)^2 - 2A_h(t + c_f) + 2A_h c_h - c_h^2\right]
\end{aligned} \tag{3.36}$$

The final form of equation (3.36) does not contain the size of the foreign market A_f, so the incentive line VFDI in Figure 3.2 is horizontal for small market size $(A_f < \hat{A}_f)$.

ii.) Incentive function for the case (2b):

For a larger market size in case 2 $(A_f > \hat{A}_f)$ there is a local producer of final goods in the foreign country. Therefore, we insert the new price for the input good from equation (3.11) into the incentive for vertical FDI inequation (3.30).

$$\begin{aligned}
\Pi^v - \Pi^A &= \frac{1}{4}\left(A_h - \frac{A_f + A_h - t + 2c_f}{4} - t\right)^2 - \\
&\quad - \frac{1}{4}\left(A_h - \frac{A_h + c_h}{2} - t\right)^2 = \\
&= \frac{1}{16}\left[\left(\frac{3A_h - A_f - 3t - 2c_f}{2}\right)^2 - (A_h - c_h)^2\right]
\end{aligned} \tag{3.37}$$

The first derivation of equation (3.37) with respect to market size A_f gives

$$\frac{\partial \left(\Pi^v - \Pi^A\right)}{\partial A_f} = \frac{1}{32}\left(A_f - 3A_h + 3t + 2c_f\right) < 0 \qquad (3.38)$$

is negative for the sufficiently small size of the foreign market ($A_f < 3A_h - 3t - 2c_f$). Thus, the incentive function for vertical FDI is falling with respect to market size.

iii.) Incentive function for the case 3:

The same procedure for the new price function w_f gives:

$$
\begin{aligned}
\Pi^v - \Pi^A &= \frac{1}{4}\left(A_h - \frac{4A_f + 3A_h - 3t + 7c_f}{14} - t\right)^2 - \\
&\quad - \frac{1}{4}\left(A_h - \frac{A_h + c_h}{2} - t\right)^2 = \\
&= \frac{1}{16}\left[\left(\frac{11A_h - 4A_f - 11t - 7c_f}{49}\right)^2 - (A_h - c_h)^2\right]
\end{aligned}
\qquad (3.39)
$$

Again, the derivation is negative

$$\frac{\partial \left(\Pi^v - \Pi^A\right)}{\partial A_f} = \frac{1}{98}\left(4A_f - 11A_h + 11t + 7c_f\right) < 0 \qquad (3.40)$$

for sufficiently small size of the foreign market.

Chapter 4

Employment Effects of Vertical and Horizontal FDI

4.1 Introduction

The large increase of foreign direct investment (FDI) flows during the last decade was accompanied by growing unemployment in the home countries of multinational enterprises (MNE). This has led to a broad discussion about the employment effects of FDI. With the liberalisation of the Central and Eastern European (CEE) countries MNE's got access to a cheap labour force and new sales markets. In Germany, as a neighbour to this region, both developments created the fear, German multinational firms would use cheap labour in CEE countries and reallocate labour intensive production to this region.[1] However, the impact of FDI on employment depends substantially on the type and motivation of foreign activity. It is well discussed in the literature that, for example, cost seeking investments lead to reallocation and therefore have a much bigger impact on home employment than market seeking FDI. Thus, in order to analyse the employment effects of foreign investments this chapter differentiates between two main types of foreign direct

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[1]In a similar context the trade literature also deals with job losses through imports, see for example Kletzer (2002) and Kucera and Milberg (2002).

investments: horizontal and vertical FDI.[2]

Conducting horizontal investments abroad, MNE duplicates the same production activity in the other country. The models of horizontal MNE include Markusen (1984), Horstmann and Markusen (1987) and Markusen (1995). Horizontal MNE's dominate when countries are similar in size and in relative factor endowments, while trade costs are moderately high (Markusen et al., 1996). Here the MNE expand the production capacity abroad instead of building up the capacity at home and exporting the goods. Therefore with horizontal FDI one would expect a substitution effect of foreign investment on the labour demand in the home country. However, this substitutional relationship exists only in case of tradable goods and low transportation costs, since in case of non-tradable goods the MNE could not serve the new market by exports. In such a case, establishing a new affiliate in the other country would have no negative or even positive effects on the employment in the home country.

In case of vertical FDI multinationals separate the activities geographically by stages of production. Theoretical models of vertical separation were introduced by Helpman (1984) and Helpman and Krugman (1985). The theory predicts a dominant role of vertical multinationals in countries with different relative factor endowments, which is the case in most CEE countries compared to Western Europe. The separation typically occurs on the basis of factor intensities. The MNE locates, for example, skilled labour intensive activities in countries with large endowment of skilled labour. In case of vertical multinationals, foreign production is complementary to the production at home. Higher production in the foreign affiliate means higher labour demand in the home country. Substitution of employment occurs here in the initial stage, when the multinational reallocate existing production stages abroad.

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[2]The third alternative is the "Knowledge Capital Model" proposed by Markusen and Maskus (2002), which incorporates the first two. See Chapter 2 for detailed discussion.

For the analysis of employment effect it is necessary to differentiate between marginal and absolute effects. Marginal effects are based on the assumption of existing plants at home and abroad and describe changes in employment in the home country, when there is a change in wages in the foreign affiliate. In contrast, absolute effects measure the total number of reallocated jobs from the home country, including plant shut downs and reallocation of production stages from the home to the foreign country. The main focus of this chapter is on marginal effects of German FDI in Central and Eastern Europe.

Previous empirical studies on employment effects of FDI can be grouped following this differentiation. The first group calculates absolute effects of foreign investments on labour demand in the home country of investing firms. Knödler (1999) surveys this literature and undertakes descriptive calculations of absolute job losses for the German labour market.[3] The second group of studies explores marginal effects of wage changes in one location of MNE on labour demand in other locations. Here Brainard and Riker (1997a, 1997b) investigate whether US multinationals reduce labour demand at home when they expand production abroad. Using firm-level data authors estimate labour demand equations within the firm and show that affiliate activities in developing countries are complements rather than substitutes for labour demand in the US.

While Brainard and Riker (1997b) employ educational levels in order to distinguish between different types of host countries, Braconier and Ekholm (2000) use differences in wage levels for the same purpose. They estimate cross-elasticities of labour demand within the Swedish multinational firms and show, that wage changes in one location affect labour demand in another location of multinational enterprises. In particular, Braconier and Ekholm (2000) find a substitutional relationship between employment in Sweden and

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[3]See section 4.6 for detailed survey of this literature.

other high-wage countries. On the other hand, the labour demand in affiliates with low wage-levels is complementary. Both results support the idea of this chapter, since horizontal FDI dominates in industrialised countries and the share of vertical FDI is higher in low wage countries.[4] In the second paper, Braconier and Ekholm (2001) investigate the employment effects of Swedish FDI with regard to the opening of Eastern European markets. They found a small positive employment effect on Swedish labour market, while there is a negative substitution effect for the Southern European countries like Spain and Portugal. Finally, these results were supported by Konings and Murphy (2001), who studied similar question using a large data set of European multinationals and they foreign affiliates. The empirical results show that the job reallocation takes place mainly between parents and affiliates in other EU based affiliates and not between parents and their low cost Eastern European based subsidiaries. Furthermore, as one would expect the reallocation was observed in the manufacturing sector but not in the service sector. Konings and Murphy (2001) also pointed to a dominant role of horizontal FDI in Central Eastern Europe.

Thus, previous literature does not discriminate between different types of foreign investments while investigating the employment effects. Although, some studies make indirect interpretations, assuming for example, that countries with low wages or education attract only vertical FDI. Other studies come to the conclusion, that complementarity of employment points to vertical type of FDI. But overall, lack of data did not allow to distinguish between vertical and horizontal FDI among investment flows to one region. On the other hand, as argued before, different types of investment have different motivations and different impacts on employment. From this perspective, the main objective of this chapter is to explore these differences in impact of vertical and horizontal FDI on employment in the home country of the multinational firm.

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[4]See Markusen (1995) and Markusen and Maskus (2001).

In the next section a theoretical model explores the relationship between labour demand in different locations of the MNE depending on the type of investment. Then, in sections 3 and 4 the results from the theoretical model will be empirically estimated for each type of FDI separately. In order to conduct separate estimations for vertical and horizontal FDI, the empirical part also develops three ways to distinguish between these types of FDI and gives the main characteristics of each investment type.

4.2   Model of Cross Border Employment Effects

The model is based on the theoretical framework developed by Brainard and Riker (1997) and by Braconier and Ekholm (2000). In comparison to the former, our model differentiates between vertical and horizontal FDI. The advancement to the latter is the use of cost minimisation approach, which allows exploring labour demand given the output of MNE. The primary objective of the model is to illustrate the differences in cross border employment effects of vertical and horizontal FDI.

Consider a multinational enterprise with affiliates in two countries h and f. The firm faces the following demand function for the final product Q_i in country i:

$$Q_i = Y_i - P_i, \quad i \in h, f \qquad (4.1)$$

where Y_i is aggregate demand and P_i is price in country i. For simplicity we exclude exports of final goods from the model, so that the market i can not be served through foreign production. The production of the final good requires two intermediate goods A and B, that are produced with input factors labour L and capital K. The firm employs a two-stage production

technology, with a Cobb-Douglas production function in the first stage[5]

$$A_i = L_{i,A}^{\alpha} K_{i,A}^{\beta}, \quad B_i = L_{i,B}^{\alpha} K_{i,B}^{\beta}, \quad 0 < \alpha < 1, 0 < \beta < 1 \qquad (4.2)$$

and a fixed-proportions production function of Leontief type in the second stage:

$$Q_i = min\left[A_i, B_i\right] \qquad (4.3)$$

The Cobb-Douglas-Production function has, by assumption, constant returns to scale, $\alpha + \beta = 1$. In contrast to previous studies, this model differentiates between two sectors in one country for better illustration of local effects in case of vertical FDI.

The production of intermediate goods requires different types of labour, L_A and L_B, thus excluding the substitution between labour producing different intermediate goods. In addition labour is assumed to be immobile across countries, which is a standard assumption in related literature. As a consequence, the firm faces wages w_i^A and w_i^B for production of input goods A and B in country i.[6] In the final goods market the MNE acts under perfect competition in both countries. In case of vertical FDI, there is intra-firm trade in intermediate goods with transportation costs of the "iceberg" type t.[7] The costs of capital r are assumed to be the same for both sectors and countries. This simplifying assumption enables us to concentrate on wage effects and is supported by the empirical findings about the form of FDI financing in CEE.[8] Considering different wages and transportation costs between coun-

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[5]Previous studies used Leontieff-Production-Function in both stages. The advantage of Cobb-Douglas is the exact calculation of the interaction between wages and labour demand.

[6]For simplicity we assume, that wages are exogenous and are not affected by the labour demand of the firm.

[7]If tG was shipped from one country only G arrives the other country, where $t > 1$.

[8]Marin et al. (2002) show that German investors relocate internal financial resources or take credits in Germany to finance the investments in CEE and therefore faces very similar costs of capital.

tries the MNE decomposes production across borders to minimize the cost function:[9]

$$C = \sum_i \left[r^\beta \gamma \left(A_i \left((1 + t_{i,j}) w_i^A \right)^\alpha + B_i \left((1 + t_{i,j}) w_i^B \right)^\alpha \right) \right] \qquad (4.4)$$

where $\gamma = (\alpha/\beta)^\beta + (\alpha/\beta)^{-\beta}$ and $i \in h, f$. Equation (4.4) is the sum of labour and capital costs in different locations and is computed as lowest cost for given output. The cost function in equation (4.4) illustrates the general case, when affiliates in both countries produce the intermediate goods for the local market and for export. Therefore, transportation costs t for the intermediate goods are also included besides the price for each factor.

The total labour demand of the firm depends on labour costs w_i, costs of capital r_i, the total quantity Q_i and in case of intra-firm trade on transportation costs t_i. The labour demand function has the general form:

$$L_i = f_i \left(w_i, r_i, Q_i, t_i \right) \quad i \in h, f \qquad (4.5)$$

In the next section we will derive the labour demand function for horizontal and vertical division of production separately, in order to show the cross border relationship of labour demand for each type of FDI. Thus, the question is now, what are the marginal effects of increasing wages in one country on the labour demand in the other country?

4.2.1 Horizontal Division of Production

To generate the special case of a horizontal division of production in this model the following restrictions have to be satisfied: high transportation costs for intermediate goods and similar local wages in both countries. Both conditions follow the theoretical literature on horizontal FDI.[10] In this situation the costs of local production of intermediate goods are lower than the costs of foreign production and importing:

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[9]See Section 1 in Appendix 4.7 for derivation. For another approach of cost minimisation for two plants see Gravelle and Rees (1994).

[10]See for example Brainard (1997) and Markusen (1995).

$$t_{hf} w_h^A > w_f^A, \quad t_{hf} w_f^A > w_h^A$$
$$t_{hf} w_h^B > w_f^B, \quad t_{hf} w_f^B > w_h^B$$

If transportation costs are taken into account, it is not profitable to have an intra firm trade in intermediate goods. In order to guarantee the production of the final good in both countries, we assume that for any relevant values of w_i^A, w_i^B there is a sufficient demand for the final good in each country. Consequently, affiliates in both countries serve only their local market and therefore act independently from each other.[11] Then, the total labour demand in country i is a sum of labour demands necessary for production of both intermediate goods A and B in country i and equals to:[12]

$$L_i = \left(\frac{\alpha}{\beta} \right)^{\frac{\beta}{\alpha+\beta}} Q_i^{\frac{1}{\alpha+\beta}} \left(\left(\frac{r}{w_i^A} \right)^{\frac{\beta}{\alpha+\beta}} + \left(\frac{r}{w_i^B} \right)^{\frac{\beta}{\alpha+\beta}} \right) \tag{4.6}$$

Now taking the first derivations with respect to the relevant variables we can show, how labour demand in each location depends on local wages, interest rates and output:

$$\frac{\partial L_i}{\partial w_i^A} < 0, \ \frac{\partial L_i}{\partial w_i^B} < 0, \ \frac{\partial L_i}{\partial Q_i} > 0, \quad i,j \in h,f; \ i \neq j$$

As expected, higher output of final goods or lower wages lead to higher employment. On the other hand, wage changes in one country do not influence employment in the other country, since their are not contained in the labour demand function (4.6):

$$\frac{\partial L_i}{\partial w_j^A} = 0, \ \frac{\partial L_i}{\partial w_j^B} = 0, \ \frac{\partial L_i}{\partial Q_j} = 0, \quad i,j \in h,f; \ i \neq j$$

Therefore, the main result for horizontal FDI is the absence of marginal effects of wage changes on employment in the foreign affiliate. Thus, employment abroad is neither substitute nor complement for employment in

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[11]Note, that since there is no trade in final goods firms can not supply the foreign market through exports.

[12]See Section 2 in Appendix 4.7 for derivation.

the home country. This result relies on absence of exports, which is a realistic feature for investments in particular in non-manufacturing sectors.

Following the logic for marginal effects, the absolute effect of wage changes, i.e. the reallocation of jobs to other country, depends on the level of transportation costs for the final good. As discussed in Brainard (1997), for low transportation costs labour demands in both countries are substitutes: final goods can be produced in the home country and exported. In this case the production capacity in the foreign country is either relocated from the home country or is built abroad instead of additional capacity in the home country. In the opposite case with very high transportation costs the absolute effect is rather positive: the firm must produce abroad to be able to serve the foreign market at all. The overall production volume is higher than in the case of exports and reduces the share of overhead costs. This makes the final good cheaper in the home market and leads therefore to higher labour demand in the home country.

4.2.2 Vertical Division of Production

Without loss of generality the following restrictions are necessary to generate the appearance of vertical FDI in this model. Following Markusen and Maskus (2002) it is assumed, that wages differ between countries h and f and transportation costs t_{hf} are low. The wages in country f for the production of intermediate good B are assumed to be lower than in country h:

$$t_{hf}w_f^B < w_h^B$$

Then, even taking transportation costs into account, the MNE finds it more profitable to produce intermediate good B exclusively in country f and to export it to the country h. Thus, the multinational shifts the complete production of input good B to country f. By assumption, wages for the other intermediate good A are still similar in both countries:

$$t_{hf}w_h^A > w_f^A, \quad t_{hf}w_f^A > w_h^A$$

Now the affiliate in the country h produces A for the local demand and imports the input good B, necessary to produce the amount Q_h of the final good. The labour demand of the firm in the country h can be derived in the similar way as the equation (4.6) and equals to

$$L_h = \left(\frac{\alpha}{\beta}\right)^{\frac{\beta}{\alpha+\beta}} Q_h^{\frac{1}{\alpha+\beta}} \left(\frac{r}{w_h^A}\right)^{\frac{\beta}{\alpha+\beta}} \tag{4.7}$$

which is the employment necessary to produce only the intermediate good A in country h. Obviously, differentiation of equation (4.7) with respect to wages and output shows that labour demand in country h depends negatively on local wages and positively on output of the final good in h:

$$\frac{\partial L_h}{\partial w_h^A} < 0, \quad \frac{\partial L_h}{\partial Q_h} > 0,$$

However, in contrast to the horizontal case, the MNE imports the intermediate good B produced in country f in order to produce the output Q_h. Therefore, labour demand L_h in the home country h depends also directly on wages w_f and transportation costs t_{fh}. Differentiating the labor demand function illustrates, that higher wages abroad and higher transportation costs lead to less employment at home in case of vertical specialisation:[13]

$$\frac{\partial L_h}{\partial w_f^B} < 0, \quad \frac{\partial L_h}{\partial t_{fh}} < 0$$

The intuition behind this result is following: If wages in country f or the transportation costs t_{fh} increase, the final good in country h becomes more expensive. From the demand function (4.1) we see that sales of final good falls. Thus, the demand for intermediate good A produced in h also goes down and thus the demand for local labour in h decreases.

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[13]See Section 3 in Appendix 4.7 for mathematical proof.

Now we turn to the other affiliate in country f. It produces both intermediate goods A and B for the local demand and the input good B for the country h[14]. Therefore, the labour demand in country f is the sum of labour needed for the local production of both intermediate goods A, B and for export of the intermediate good B.

$$L_f = \left(\frac{\alpha}{\beta}\right)^{\frac{\beta}{\alpha+\beta}} \left(\left(\frac{r}{w_f^A}\right)^{\frac{\beta}{\alpha+\beta}} + \left(\frac{r}{w_f^B}\right)^{\frac{\beta}{\alpha+\beta}}\right) Q_f^{\frac{1}{\alpha+\beta}}$$

$$+ \left(\frac{\alpha}{\beta}\right)^{\frac{\beta}{\alpha+\beta}} \left(\frac{r}{t_{fh}w_f^B}\right)^{\frac{\beta}{\alpha+\beta}} Q_h^{\frac{1}{\alpha+\beta}} \tag{4.8}$$

Differentiating the labour demand function with respect to output, wages and transportation costs gives:

$$\frac{\partial L_f}{\partial Q_f} > 0, \ \frac{\partial L_f}{\partial Q_h} > 0, \ \frac{\partial L_f}{\partial w_f^A} < 0, \ \frac{\partial L_f}{\partial w_f^B} < 0, \ \frac{\partial L_f}{\partial t_{fh}} < 0$$

As expected, labour demand in country f depends positively on local demand for the final good and on demand for the final good in country h, but negatively on local wages. Furthermore, labour demand in country f depends on wages in the home country h. The motivation and the proof are the same as for the affiliate in country h. A wage increase in h leads to higher costs and lower sales of the final goods Q_h in the home country of MNE. Consequently, the demand for the intermediate good B and imports from f decrease and the employment in f falls. Therefore wage changes in h lead to changes in labour demand in f:[15]

$$\frac{\partial L_f}{\partial w_h^A} < 0$$

As the differentiation results from the equations (4.7) and (4.8) illustrate, in case of vertical FDI labour demand in one country depends on wages in

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[14]It is possible to model an extreme case with no local demand for the final good in f. Then, the affiliate in f produces only the one input factor for the market in h.

[15]Mathematical proof is identical to the previous case of country f, which is presented in Section 3, Appendix 4.7.

the other country. Higher wages in the foreign country mean lower labour demand in foreign *and* in the home country. The same relationship holds in other direction too. Therefore, the main result is that the vertical diversification of production implements a complementarity of labour demand within the MNE. This complementarity effect can be observed as a marginal effect between parent companies and existing foreign affiliates in case of relatively small wage changes. The absolute effect can nevertheless be negative. In case of large differences in wage levels between countries, MNE has an incentive to reallocate complete production stages to the cheapest location. In our model, the complete production of the intermediate good B was located in the country f. Such reallocation should be observed after the opening of the new markets with strong differences in factor endowments, as it was the case in Central and Eastern Europe.

To summarize the results from the theoretical model, the type of foreign investment makes a significant difference on the cross border employment effects. Horizontal FDI creates completely independent labour demand in both countries. In contrast, vertical FDI leads to a direct relationship between wages and output in one country and the labour demand in another. However, this marginal effects of foreign activity on the home employment can differ from the absolute effects.

4.3 Empirical Evidence

The empirical part of this chapter is based on the data set of 400 German multinational enterprises with investment projects in Central and Eastern Europe (CEE).[16] The data set includes main characteristics about the German parent firm and its CEE affiliates like sales, employment and wages. It also contains the information about intra-firm trade with final and inter-

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[16]For description of the data set see Chapter 1.3.

mediate goods between parent company and its CEE affiliates. Using this information it is possible for the first time to differentiate between vertical and horizontal investments at the firm level and conduct the analysis separately for both types of FDI.

4.3.1 Empirical Definitions of Vertical and Horizontal FDI

As mentioned in the introduction, previous empirical studies on labour effects of FDI did not differentiate between vertical and horizontal FDI in their estimations. However, this differentiation was conducted in the theoretical literature on multinational enterprises. This literature employed macro criteria like trade costs, differences in relative or absolute factor endowments and investment barriers to distinguish between different types of FDI.[17] These criteria were employed in empirical analysis of FDI on the macro level. Several empirical studies at the firm level also used these criteria in order to explain whether vertical or horizontal FDI dominates among investment flows to a particular region, however, without looking at each investment project.[18] Finally, some empirical studies differentiate between the two types of FDI by making very general assumptions.[19]

Therefore, in order to estimate labour demand for the two types of FDI we will first derive the criteria for the separation between vertical and horizontal investments on the firm level. To identify each type of investment we use the definitions of vertical and horizontal multinational enterprise and indicators proposed in recent empirical studies. Since there are many possibilities

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[17]Helpman and Krugman (1985), Markusen et al. (1996), Markusen and Maskus (2001). Brainard and Riker (1997) used differences in education level to differentiate between countries.

[18]See for example Markusen and Maskus (2002).

[19]For example Hansson (2001) uses a rough classification of FDI by assuming, that Swedish FDI in non-OECD countries are vertical.

to do so, this section develops three possible separation methods.[20] Using all three definitions for the further empirical analysis enables us to build on results from different strands of previous literature, shed more light on the differences between vertical and horizontal FDI and test the robustness of empirical estimations.

The three methods are shown in Table 4.1, which contains criteria for each method and the share of vertical and horizontal FDI in the sample according to each method. The first approach to differentiate between vertical and horizontal FDI ($typeI$) is based on the theoretical definition of vertical FDI presented in the introduction and relies on the input-output relationship between parent company and its foreign affiliate, as initially proposed by Helpman (1984) and Helpman and Krugman (1985). The firm is defined to be vertically integrated, if the foreign affiliate receives a substantial share of input goods from the parent company *or* sends its output to German parent, otherwise it is a horizontal FDI.

A similar method was proposed by Braconier and Ekholm (2001) as they employed the information about goods, that foreign affiliates of Swedish firms send to Sweden. However, they do not distinguish whether these goods were sent to the parent company for further production or sold at the Swedish market. In a related paper Braconier et al. (2002) refer to an investment of vertical type, if the foreign affiliate exports to the parent´s home country or to a third country. The $typeI$-definition incorporates these two sources. In addition, the intra-firm trade in both directions is relevant, since it can be a forward or backward integration of production[21]. The threshold level for the share of intermediate goods received from or sent back to the parent company is 50 percent. Such a high share ensures, that substantial part of the affil-

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[20]See Braconier et al. (2002) for different types of vertical and Markusen (1995) for horizontal FDI.

[21]See Head (2002) and the Introduction of the thesis for detailed discussion.

iate works in a vertically fragmented production chain.[22] Preliminary tests have shown a low sensitivity of the 50 percent level, which guarantees stable empirical results, since moving the threshold to other levels like 30 or 70 percent does not lead to significant changes (under 5 percent) in distribution of investments among the two types.

Table 4.1: Empirical Definitions and Shares of Vertical and Horizontal FDI, *in Percent*

Definition	Criteria	Share* horizontal	Share* vertical
type I	FDI is of vertical type if: $> 50\%$ of input come from parent *or* $> 50\%$ of output sold to parent	64	36
type II	$< 100\%$ of output sold on the local market	51	41
type III	$> 50\%$ of output exported	71	27

Source: Sample of 1,050 German FDI projects in CEE.
Note: * Share on surveyed German FDI in CEE. Shares do not add to 100 percent due to missing values.

The next method to distinguish between different types of investment ($type II$) is based on the market orientation of the foreign affiliate. It defines horizontal investment if the foreign affiliate is completely market oriented i.e. exclusively serves the local market, otherwise it is a vertical FDI. This definition dates back to an empirical study by Lankes and Venables (1997), who differentiate between the two types of FDI on the basis of investment

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[22]In some cases, after setting up a foreign plant, the parent company supports the new affiliate with management know-how and with input goods. After some time the affiliate becomes more independent and buys the inputs from local suppliers or directly from suppliers of the parent company. High share of input goods from the parent company will exclude this effect from our estimation.

motives. They refer to horizontal FDI if it is market oriented, so the foreign affiliate was set up to serve the local market only. Vertical FDI is cost oriented: The affiliate produces in the foreign country in order to use cheap labour for export or for further production in the parent company, as proposed by Hanson et al. (2001). Therefore, as Table 4.1 shows, definition of $typeII$ identifies a horizontal FDI if the affiliate sells his complete output in the foreign country. In all other cases it is a vertical FDI.

The third definition ($typeIII$) is a mixture of the first two: FDI project is called vertical, if more than 50 percent of output are exported. In all other cases it is a horizontal FDI. This definition includes market orientation on the one hand and exploitation of country specific cost advantages on the other hand.

In order to verify the definitions of horizontal and vertical investment we consider the motivation of both investment types. In the survey German investors were asked for the motivation behind the decision to conduct each investment project. The results are presented in Table 4.2 for all three definition. As we would expect from the theoretical literature, both types of FDI are driven by strongly different motivations. While for horizontal FDI market entry and market proximity are most important, vertical FDI is characterised by interest in low production costs and qualified labour force. The differences in motivation for vertical and horizontal FDI remain strong for all three types of definition, even when the size of the difference varies slightly. Overall, the differences between the two types of FDI with respect to motivation of investment confirms the introduced definitions of vertical and horizontal FDI. The motivation results are even clearer than the findings of Lankes and Venables (1997).

A further difference to previous studies on vertical and horizontal FDI is the inclusion of service providers in the analysis of vertical and horizontal FDI. The reason is that even among investors from the non-manufacturing

Table 4.2: Motivation for Vertical and Horizontal FDI

Definitions:	type I		type II		type III	
	horiz.	vert.	horiz.	vert.	horiz.	vert.
Low production costs	3.2	3.2	4.1	1.8	3.8	1.9
Qualified labour force	3.6	3.4	4.0	2.4	3.8	3.1
Access to market	1.7	2.2	1.5	1.9	1.5	2.9
Market size	2.2	2.7	2.0	2.3	2.1	3.5

Source: Sample of 1,050 German FDI projects in CEE.
Note: The valuation ranges from 1 for "very important" to 5 for "absolutely not important".

sector, the share of vertical FDI varies between 19 and 30 percent depending on definition. It is not surprising, that the share of vertical FDI is significantly higher in manufacturing industries. But given a high share of vertical FDI among service providers, the non-manufacturing sector should not be excluded from the estimation.

4.3.2 Vertical and Horizontal FDI in CEE

Using the three definitions developed in the previous section, the surveyed investments in Central and Eastern Europe can be separated into vertical and horizontal type. Table 4.1 on page 91 reports the share of both FDI types for each definition.[23] Depending on the definition type, the share of vertical FDI in CEE ranges between 27 and 41 percent. The first definition based on the intra-firm trade gives 36 percent, while the market oriented definition of *typeII* reaches 41 percent. The latter should overestimate the real number, since some market oriented horizontal affiliates also serve the markets in the neighbour countries.

All three numbers are relatively high in comparison to previous studies.

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[23]For other measurement of vertical integration in CEE see Marin et al. (2002).

For example Markusen and Maskus (2002) predict an overwhelming role for horizontal FDI for industrialised countries. Konings and Murphy (2001) see horizontal FDI dominating in the CEE countries too. However, a high share of vertical FDI in this region is not surprising when compared to the predictions from the theoretical literature.[24] There is a large wage gap between Germany and CEE countries, while the distances and transportation costs are relatively small compared to other low cost regions of the world.[25] These characteristics make CEE very attractive to place the labour intensive production of German firms and thus explain a high share of vertical FDI.

Now we turn to the composition of investment flows to each country. Table 4.3 presents the share of horizontal and vertical investments on total FDI inflows for major FDI recipients countries in CEE. The share of vertical FDI in Central European accession countries ranges between 30 percent in Hungary and 45 percent in Slovenia ($typeI$). Thus, about one third of all investments in the main host countries for German FDI in CEE are vertical.[26]

In the most South European countries the share of vertical investments is even higher. In accordance with the theoretical models a high share in this region can be explained by low wages and short distances to Germany. Thus, these countries are more likely to be used for labour intensive production of German multinationals. Other outlying regions like the CIS countries have also a relatively high share of vertically integrated firms. However, the major reason for high share of vertical FDI here is the large amount of input goods, that local affiliates draw from the German parent companies. This can be clearly seen from definition of $typeIII$: share of vertical FDI in CIS countries is in particular low if one uses the market oriented definition of FDI.

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[24]See Markusen et al. (1996) and Chapter 2 for a detailed discussion of conditions for each type of FDI.

[25]See Chapter 3.3 for empirical evidence.

[26]This group of countries received almost 70 percent of German FDI in CEE, see Deutsche Bundesbank (2001).

Table 4.3: Shares of Vertical and Horizontal on Total FDI in CEE, *in Percent*

Definitions:	*type I*		*type II*		*type III*	
	horiz.	vert.	horiz.	vert.	horiz.	vert.
Central Europe						
Czech Rep.	64	36	44	45	64	35
Hungary	70	30	53	39	70	28
Poland	73	27	52	43	76	23
Slovakia	68	32	52	35	65	34
Slovenia	55	45	50	50	65	35
South Eastern Europe						
Bulgaria	46	54	58	33	71	29
Croatia	63	37	75	21	83	17
Romania	48	52	50	46	58	42
Other*	0	100	56	44	78	22
Baltic states						
Estonia	55	45	64	36	82	18
Latvia	65	35	71	29	76	24
Lithuania	54	46	63	33	83	17
CIS						
Russia	47	53	53	43	82	18
Ukraine	58	42	63	38	83	17
Other**	46	54	54	46	74	26
Total	**63**	**37**	**51**	**41**	**71**	**27**

Source: Sample of 1,050 German FDI projects in CEE.
Note: Shares do not add to 100 percent due to missing values. "Other" includes weighted average of countries of the relevant region with low number of observations. * Albania, Bosnia and Herzegovina, Macedonia, Yugoslavia, ** Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Uzbekistan.

In sum, the results on geographical distribution widely confirm the predictions from the theoretical literature: Vertical FDI can be observed in countries with cheap labour force and low transportation costs to Germany.

4.3.3 Estimation

The empirical estimation follows the method proposed by Brainard and Riker (1997b). The estimation equation is based on the equation (4.5) and uses variables from the model in log-linear form.[27] Following previous literature on FDI employment effects we employ ordinary least squares (OLS) to estimate the labour demand function:

$$\ln L_i = \alpha + \beta_1 \ln w_i + \beta_2 \ln Q_i + \beta_3 \ln w_j + \beta_4 \ln Q_j + \mu + \delta_k + \epsilon_i \qquad (4.9)$$

Labour demand L_i in country i depends on local wages w_i and local output Q_i but also on wages w_j and output Q_j in the other country j, with $i \neq j$, and $i, j \in h, f$. This way we capture simultaneously the direct effect of local production on employment and the interaction with foreign affiliate. The latter is our main focus and is a two-directional relationship between parent and affiliate. The labour demand of the parent firm and of the affiliate company are estimated separately, which gives a better insight into the relationship of wages and labour demand between both companies and is an improvement compared to the prior studies. Thus, we estimate the equation (4.9) four times: labour demand for parent and affiliate, and for vertical and horizontal FDI separately.

The dependent variable L_i is measured by the number of employees in each affiliate, while for the parent firm it is the number of employees in Germany. Since the firms reported the total wage bill in each location, wages are calculated as total expenditures on labour per capita, which includes gross

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[27]This is a simplifying assumption since not all of the labour demand equation are log-linear in explanatory variables. However, it is a standard approach in the empirical literature on marginal wage effects.

salary and all additional expenses. Output Q_i is measured as sales of the affiliate or the parent firm in Germany. Sales are used as an approximation for the output of the firms, since it includes sales of final goods to external customers, exports and sales of intermediate goods to parent or foreign affiliate. In a similar way Blomström et al. (1997) used parent and affiliate net sales as a proxy for output in order to estimate the effects of FDI on labour demand in US and Sweden. Carr et al. (2001) also take sales volume to indicate the production activity while estimating the knowledge capital model. In contrast, Brainard and Riker (1997b) and Braconier and Ekholm (2000) conduct the estimation of labour effects using the demand for the final good, which is proxied by aggregated demand in this sector or GDP per capita. However, this indirect method leads to a lower explanatory power of estimation results.

In addition to output and wages, which are derived directly from the model, the estimation equation includes some further explanatory variables. The fixed effects are captured by country group coefficient δ_k with $k \in [1; 3]$. The countries with affiliates of German firms are grouped in four geographical regions: Central European accession countries, Baltic states, Southern European countries and CIS, in accordance to the Table 4.3. The first and largest country group is not included in δ_k coefficient but is captured by the constant α, thus showing the difference between the left three regions and the main recipient region.

Previous studies predict different employment effects for manufacturing and service providers, since service activities are more difficult to relocate than the industrial manufacturing. We control for this effect using a dummy variable μ for industry of the parent firm.[28] A company is defined as manufacturer ($\mu = 1$), if it fits the SITC classification registry, and is service provider else ($\mu = 0$).

In contrast to Konnings and Murphy (2001) estimation equation (4.9)

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[28]In the most cases parent and affiliate have the same type, since it was one of the criteria for the firm selection. See introduction for more details.

does not contain interest rates. The data set on German FDI shows, that in most cases the financing of FDI comes mostly from the reallocation of financial resources within the firm.[29] External financing was observed only in few cases, and most of them were conducted through German banks. Since most surveyed firms are big investors they also face similar interest rates. Therefore all investors have similar costs of financing, which can not explain differences in labour demand.

Table 4.4: Expected Signs of the Labour Demand Function

Dependent Variable:	Affiliate employment		Parent employment	
	horizontal	vertical	horizontal	vertical
Affiliate sales	+	+	**0**	+
Affiliate wages	-	-	**0**	-
Parent sales	**0**	+	+	+
Parent wages	**0**	-	-	-

Based on the results from the theoretical model Table 4.4 reports the expected signs for the coefficients in equation (4.9). Coefficients showing complementarity or substitutional relationship between parent and affiliate employment are set in bold face. The first obvious prediction is that higher local output has always positive and higher local wages always negative impact on labour demand. On the other side, the cross border effect of output and wages on labour demand in the foreign affiliate depends on the type of investment. In case of horizontal FDI variation of sales or wages in one country has no marginal effects on employment in other country. Nevertheless, for low transportation costs the final good can be shifted back due to some substitution effects. In such case the sign would turn negative if the absolute effect dominates. In case of vertical FDI labour demand is complementary

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[29]See Marin et al. (2002).

in both locations: higher output in one country means higher demand for input goods from the other country and therefore a higher labour demand abroad. Similarly, higher wages make the product more expensive, sales go down and labour demand decreases.

4.4 Results

4.4.1 Estimation Results

The estimation results are reported separately for the three definitions of horizontal and vertical FDI in Tables 4.5, 4.6 and 4.7. Each table includes estimations of the equation (4.9) with employment in foreign affiliate and in parent company as depending variable. In addition, the estimations are conducted with separate subsamples of horizontal and vertical FDI. Coefficients showing complementarity or substitution effects of labour demand are highlighted in bold face.

The main finding on marginal employment effect is that the complementarity characteristic of vertical FDI can be supported by empirical data for the first time. On the other hand, the horizontal FDI has, as predicted, no effect or only small substitutional effect on employment in other country.

Table 4.5 presents estimation results for vertical and horizontal FDI according to the definition of *type I*. In the first two columns the dependent variable is labour demand of the foreign affiliate. In the case of horizontal FDI there is no significant relationship between parent sales or parent wages and the affiliate employment, thus fully supporting the prediction from the theoretical model. Both coefficients are small and not significant. In the case of vertical FDI parent sales have a positive impact on employment in the foreign affiliate. This is again a clear confirmation of the theoretical model. Higher sales by the parent company lead to stronger demand for intermediate goods from the affiliate in CEE and thus to higher labour de-

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mand abroad. If parent sales increase by 10 percent labour demand in CEE increases by 0,85 percent. On the other hand, the cross border wage elasticity is negative as predicted, but not significant. The negative sign attests the complementarity character of vertical FDI. Generally it can be observed, that labour demand in case of vertical FDI is more sensitive to wage changes than with horizontal investments.

The manufacturing-dummy is in all cases positive and significant. This points to larger affiliates of manufacturing companies in CEE and therefore to a higher labour demand compared to service providers. The industry dummy for vertical FDI is always larger, which also can be interpreted as larger foreign affiliates of vertical multinationals. This is a plausible result, since export oriented outsourcing FDI serves a larger foreign market.[30] The dummies for country groups have a negative sign for horizontal and a positive sign for vertical FDI and are not significant.

The last two columns of Table 4.5 display the estimation results with parent employment as dependent variable. Parent sales and parent wages have the expected sign and are strongly significant. The coefficient "affiliate sales" is negative and significant, so horizontally segmented firms are characterised by a negative relationship between sales abroad and employment in the home country. This contradicts the theoretical model of marginal effects and points to a substitutional relationship: higher sales abroad lead to increasing employment in the affiliate and falling labour demand in the home country. This points to a reallocation from parent to affiliate if the foreign market becomes larger. At the same time affiliate wages have no significant impact on the parent employment as predicted by the model. For vertical FDI the results are not as clear as for the estimation with affiliate employment as dependent variable. As predicted, higher wages abroad lead to lower employment at home, so the cross wage elasticity is negative.

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[30]Chapter 5.2 will present empirical evidence for this argument.

Table 4.5: Estimation of Labour Demand: Type I

Dependent Variable:	Affiliate employment		Parent employment	
	horizontal	vertical	horizontal	vertical
Affiliate sales	0.694***	0.596***	**-0.127*****	**-0.098****
	(0.039)	(0.059)	**(0.031)**	**(0.044)**
Affiliate wages	-0.677***	-0.867*	**0.037**	**-0.219***
	(0.068)	(0.083)	**(0.053)**	**(0.063)**
Parent sales	**0.017**	**0.085****	1.028***	1.067***
	(0.031)	**(0.047)**	(0.024)	(0.036)
Parent wages	**0.079**	**-0.204**	-0.639***	-1.683*
	(0.123)	**(0.263)**	(0.096)	(0.198)
Manufacturing	0.408***	0.739***	0.401***	0.593***
	(0.131)	(0.195)	(0.102)	(0.146)
Baltic States	-0.104	-0.269	0.181	-0.200
	(0.339)	(0.339)	(0.265)	(0.255)
Southern E. Europe	-0.206	-0.098	-0.257	-0.228
	(0.260)	(0.223)	(0.202)	(0.168)
Former SU	0.241	-0.997***	0.164	0.014
	(0.180)	(0.211)	(0.140)	(0.159)
Constant	-1.638	3.257	-4.663***	8.214***
	(1.303)	(2.639)	(1.017)	(1.987)
R^2	0.751	0.691	0.915	0.905
Adjusted R^2	0.742	0.673	0.912	0.899
Number of observations	225	147	225	147

Source: Sample of 1,050 German FDI projects in CEE.
Note: *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level, standard errors in parentheses. Coefficients showing the cross border employment effects are set in bold face.

On the other hand, higher sales in the foreign affiliate have a negative impact on employment in Germany. From the theoretical model one would expect the positive sign for this coefficient. One possible explanation is that, again, absolute effects of reallocation dominate over the marginal effects: If the foreign affiliate produces more, this occurs through reallocation of additional production from the parent company. Thus, the negative impact of increasing affiliate sales on parent employment for both, horizontal *and* vertical FDI are signs for the relocation trend to CEE. Interestingly, the negative effect cannot be observed from the other direction: The comparable coefficients in the first two columns ("Parent sales") are positive. So the negative effect can be observed only in one direction. Such asymmetry for sales variable could be a result of large differences in size between the parent MNE and a much smaller foreign affiliate. In contrast, the coefficients of cross border wage elasticity are similar for both direction but are not significant for the foreign affiliate employment.

Table 4.6 presents the results of the same estimation equation, but for the different definition of horizontal and vertical FDI (*typeII*). For the relevant coefficients of cross border labour demand the results are similar to the previously described definition of *typeI*. For the affiliate employment they fully support the theoretical predictions. Within the same country own sales have positive and own wages a negative impact on labour demand. The cross country effects have all the right sign and are significant except for parent wages. In case of parent employment the affiliate wages have a negative sign but are not significant, which is good for the horizontal model and bad for the vertical. Again, the affiliate sales have a negative sign and are strongly significant. This reinforces the arguments used to explain the results for the definition of *typeI*. The coefficient for manufacturing stays positive and significant. The country groups coefficients in the second column turn positive, even though not significant.

Table 4.6: Estimation of Labour Demand: Type II

Dependent Variable:	Affiliate employment		Parent employment	
	horizontal	vertical	horizontal	vertical
Affiliate sales	0.729***	0.651***	**-0.088****	**-0.098****
	(0.043)	(0.047)	**(0.038)**	**(0.035)**
Affiliate wages	-0.667***	-0.746***	**-0.072**	**-0.024**
	(0.084)	(0.071)	**(0.074)**	**(0.053)**
Parent sales	**-0.016**	**0.130****	0.987***	1.056***
	(0.035)	**(0.035)**	(0.031)	(0.026)
Parent wages	**0.189**	**-0.122**	-0.801***	-0.818***
	(0.163)	**(0.166)**	(0.142)	(0.125)
Manufacturing	0.285**	0.368**	0.346**	0.404***
	(0.152)	(0.144)	(0.132)	(0.109)
Baltic States	-0.268	0.281	0.160	-0.066
	(0.152)	(0.311)	(0.327)	(0.234)
Southern E. Europe	-0.082	0.091	-0.096	-0.107
	(0.241)	(0.235)	(0.210)	(-0.177)
Former SU	-0.449**	0.163	0.190	0.116
	(0.202)	(0.194)	(0.176)	(0.146)
Constant	-3.071**	-0.031	-1.699	-2.966
	(1.716)	(1.667)	(1.498)	(1.255)
R^2	0.757	0.721	0.886	0.919
Adjusted R^2	0.745	0.709	0.880	0.916
Number of observations	174	184	174	184

Source: Sample of 1,050 German FDI projects in CEE.
Note: *** significant at 1 percent level, ** significant at 5 percent level, * significant at
10 percent level, standard errors in parentheses. Coefficients showing the cross border
employment effects are set in bold face.

The results are also similar for the last definition ($typeIII$), as shown in Table 4.7. For affiliate employment there are no deviation in signs from the previous definitions presented in Tables 4.5 and 4.6. In case of parent employment the coefficient for the cross wage elasticity has a positive sign but stays not significant. Thus, the predictions from the model about marginal cross border effects are empirically supported even using different separation techniques between vertical and horizontal FDI.

Finally we turn to some robustness checks. The general fit of the estimation equation measured by adjusted R^2 is high for all estimations. To prove the stability of results the estimations have been run only with variables from the theoretical model shown in Table 4.4. In this specification the size of the coefficients deviated slightly, while the signs for all relevant variables remain the same. In the second step the estimations have been conducted without the coefficient for parent employment in order to see, whether other effects are also dominated by this coefficient (heterogeneity). Even then, relevant coefficients from the model still keep the same sign. The single change appeared for the coefficient of affiliate employment. However, this is what one would expect, since sales of parent and affiliate are correlated. If parent sales are excluded, affiliate sales provide the best proxy for parent sales. In the last step, firms have been ranked by total sales of parent company in Germany in order to control for the firm size. Then all estimations were extended by the coefficient "ranking". However, incorporation of the size effect did not have any significant effect. Thus, firm size effects were caught by the constant and the sales coefficient.

Overall, the complementarity result for vertical FDI is empirically supported. Horizontal FDI is shown to have no or at least an one-directional substitution effect on labour demand in Germany. The negative impact of affiliate sales on parent employment points to reallocation effects toward CEE and holds for all three definitions and for both types of FDI.

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Table 4.7: Estimation of Labour Demand: Type III

Dependent Variable:	Affiliate employment		Parent employment	
	horizontal	vertical	horizontal	vertical
Affiliate sales	0.693***	0.733***	**-0.100*****	**-0.009**
	(0.038)	(0.058)	**(0.030)**	**(0.045)**
Affiliate wages	-0.753***	-0.678***	**-0.087**	**0.004**
	(0.068)	(0.089)	**(0.055)**	**(0.070)**
Parent sales	**0.033**	**0.093***	0.997***	1.022***
	(0.030)	**(0.052)**	(0.024)	(0.041)
Parent wages	**0.156**	**-0.133**	-0.796***	-0.757***
	(0.137)	**(0.198)**	(0.110)	(0.155)
Manufacturing	0.283**	0.219	0.341***	0.604***
	(0.124)	(0.215)	(0.100)	(0.169)
Baltic States	-0.372	0.546	0.071	-0.034
	(0.329)	(0.340)	(0.265)	(0.267)
Southern E. Europe	-0.155	0.161	-0.155	0.043
	(-0.221)	(0.240)	(0.178)	(0.188)
Former SU	-0.168	-0.232	0.188	0.055
	(0.166)	(-0.300)	(0.134)	(0.235)
Constant	-2.171	-0.929	-1.566	-4.938***
	(1.435)	(1.946)	(1.158)	(1.527)
R^2	0.725	0.777	0.891	0.925
Adjusted R^2	0.716	0.758	0.888	0.919
Number of observations	262	103	262	103

Source: Sample of 1,050 German FDI projects in CEE.
Note: *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level, standard errors in parentheses. Coefficients showing the cross border employment effects are set in bold face.

4.4.2 Comparison with Previous Empirical Studies

Table 4.8 compares the estimation results with previous studies on labour effects of FDI. The direct comparison is possible because this chapter, like most studies in this field, employs the estimation procedure introduced by Brainard and Riker (1997a). On the other side, the differences to previous studies are the distinguishing between vertical and horizotal FDI and the employment of the cross section data set, while all other use panel data. We compare our results on German FDI in CEE with estimations for high-wage home country (US or Sweden) and different low-wage host countries. The comparison will be carried out for vertical FDI of the *typeI* definition.

As expected, in our study local wages have always negative and local output always positive impact on employment in the same location. This result is fully supported by previous studies: The effects of local sales and wages on labour demand in the same location are similar to Brainard and Riker (1997b) and Koning and Murphy (2001), while the coefficients in Braconier and Ekholm (2000) are smaller. Therefore in the following we focus on the cross border effects that are presented in the Table 4.8.

The results in this chapter show the complementarity of labour demand for vertical FDI: Higher wages in one location lead to lower labour demand in other location. Higher output of the parent company has a positive impact on labour demand in the affiliate company. These results are supported by previous studies. For example Brainard and Riker (1997b) find similar cross border wage elasticities for parent and affiliate labour demand in sign and amount. Using the data for US multinationals they show a complementary relationship between wages in low-wage location and the parent employment. The positive effect of parent sales on affiliate employment was also found by Braconier and Ekholm (2000) for Swedish multinationals.

However, one difference occurs with respect to wage effects in comparison to Braconier and Ekholm (2000) and Konnings and Murphy (2001). In both

Table 4.8: Comparison with Previous Studies

Dependent Variable:	Affiliate employment*		Parent employment**	
Explanatory Variables:	parent		affiliate	
	wages	sales	wages	sales
Brainard/Riker (1997a)	-0.225	-	-0.185	-
	(0.080)	-	(0.049)	-
Braconier/Ekholm (2000)	-0.64	0.28	0.06	0.35
	(0.85)	(0.23)	(0.11)	(0.09)
Konings/Murphy (2001)	-	-	0.015	-
	-	-	(0.022)	-
This Study***	-0.204	0.085	-0.219	-0.098
	(0.263)	(0.047)	(0.063)	(0.044)

Note: * Foreign affiliate in CEE or in low-wage countries, ** parent company or affiliate in high-wage countries, *** vertical FDI, definition *typeI*, standard errors in the parentheses.

studies affiliate wages have a positive effect on parent employment, however, it is small and not significant. In Konnings and Murphy (2001) the wage elasticity coefficient turns negative for manufacturing sector, but it is again small and not significant. The main difference to Braconier and Ekholm (2000) is that affiliate sales have a negative impact on parent employment. This result can be an indication for some reallocation effects and is not supported by positive marginal effects. Finally, the reason for different size of wage effects, and in some cases different signs of the sales effect could be explained by different composition of FDI flows used for the estimation. While previous studies conduct the estimation for FDI as a whole, i.e. vertical and horizontal together, this study estimates each of them separately.

4.5 Conclusions and Implications

The impact of foreign direct investments on employment in the home and host countries of multinationals is one of the major questions for empirical research on multinational enterprise. However, previous studies on this topic do not distinguish between different types of investment. As this chapter has shown, vertical and horizontal FDI have different motivations and thus, different impacts on employment. To demonstrate this, the chapter developed a theoretical model of cross border employment effects for each type of FDI and tested the predictions with the empirical data. Overall, the differentiation between vertical and horizontal FDI gives a better understanding of employment effects of FDI.

In the first part, a theoretical model presents the theoretical basis for the analysis of cross border employment effects. Following previous literature, it focuses on marginal effects of existing affiliates and differentiates between vertical and horizontal FDI. The model predicts, that in case of horizontal FDI there are no marginal effects between different locations of MNE. Thus, changes in wages or output in one location have no impact on the labour demand in foreign affiliate. At the same time, vertical separation of production leads to complementarity of labour demand in different locations.

The empirical part is based on the data set of German FDI in Central and Eastern Europe and consists of two stages. Firstly, based on intra-firm trade and geography of sales we create three measurements for distinguishing between vertical and horizontal FDI. For the first time the chapter describes empirically the differences between both types of FDI like motivation and the composition of FDI flows to a single country in CEE. As predicted, both types of FDI have clearly different motivations: Vertical FDI is more cost oriented, while horizontal FDI more host market oriented. Overall, empirical data points to a high share of vertical FDI in CEE, which ranges between 27 and 41 percent depending on definition.

Secondly, theoretical predictions have been widely supported by empirical estimation of labour demand function of multinational enterprise. The estimated coefficients indicate a significant complementarity of labour demand between affiliates in case of vertical division of production. In the case of horizontal FDI the cross border labour effects are much smaller and not significant in most cases. Nevertheless, some reallocation effects from German labour market can be observed for both, horizontal and vertical investments.

The results of this chapter have also political implications, as they give a sense for transmission effects of shocks from CEE to Germany. Earlier studies argue, that higher wages in CEE mean lower competition for the German labour market, which is truth for the initial reallocation decision. But growing wages in CEE do not only mean the smaller danger of reallocation. As the chapter shows for already existing affiliates, a wage increase in CEE makes inputs for German firms more expensive and brings additional pressure on the German labour market, since the share of vertical FDI among German investments to CEE is very high. Thus, high share of vertical FDI means close relationship between production volume and labour demand in both regions. For example, growing wages in CEE due to EU accession or due to the growing bargaining power of trade unions can lead to job losses in Germany.

4.6 Appendix

1. Cost Function

The cost function of the multinational enterprise is derived in two steps. In the first stage, the cost functions for the intermediate goods A and B are calculated. In the second stage they are added due to the fixed proportion feature of the Leontieff production function and summed up for all locations.

i.) Cost Function for Intermediate Good

Due to the same production function for both intermediate goods the cost function is symmetric for both input goods. Here we derive it for the intermediate good A in country i, while the function for the input good B is identical. We minimise the cost function for the input good A

$$c_i = (1 + t_{ij})w_i L_i + rK_i \quad \rightarrow \quad min! \tag{4.10}$$

under the constraint of the Cobb-Douglas production function

$$A_i = L_{A,i}^{\alpha} K_{A,i}^{\beta} \tag{4.11}$$

with constant returns to scale $\alpha + \beta = 1$. The Lagrangean for the problem is

$$L = (1 + t_{ij})w_i L_i + rK_i + \lambda \left[A - L_{A,i}^{\alpha} K_i^{\beta} \right] \tag{4.12}$$

The first order conditions for the minimum of L are

$$\frac{\partial L}{\partial L_{A,i}} = (1 + t_{ij})w_i - \lambda \alpha L_{A,i}^{\alpha-1} K_i^{\beta} = 0 \tag{4.13}$$

$$\frac{\partial L}{\partial K_i} = r - \lambda \beta L_{A,i}^{\alpha} K_i^{\beta-1} = 0 \tag{4.14}$$

$$\frac{\partial L}{\partial \lambda} = A - L_{A,i}^{\alpha} K_i^{\beta} = 0 \tag{4.15}$$

Division of (4.13) by (4.14) gives

$$K_i = \frac{\beta}{\alpha} \frac{(1 + t)w_{A,i}}{r} L_{A,i} \tag{4.16}$$

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Inserting the equation (4.16) in (4.15) and using the property of constant returns to scale gives the factor consumption functions for labour $L_{A,i}$ and capital K_i:

$$L_{A,i} = \left(\frac{\alpha}{\beta} \frac{r}{(1+t)w_{A,i}} \right)^{\beta} A_i \qquad (4.17)$$

$$K_i = \left(\frac{\alpha}{\beta} \frac{r}{(1+t)w_{A,i}} \right)^{\beta-1} A_i \qquad (4.18)$$

Inserting the factor consumption equations into the cost function from the equation (4.10) produces the cost function for the intermediate good A in the country i

$$C(A_i) = A_i \left((1+t_{ij}) \, w_{A,i} \right)^{\alpha} \left(\left(\frac{\alpha}{\beta} \right)^{\beta} + \left(\frac{\alpha}{\beta} \right)^{-\alpha} \right) \qquad (4.19)$$

Since the intermediate good B is produced with the same production function as A it has the same cost function:

$$C(B_i) = B_i \left((1+t_{ij}) \, w_{B,i} \right)^{\alpha} \left(\left(\frac{\alpha}{\beta} \right)^{\beta} + \left(\frac{\alpha}{\beta} \right)^{-\alpha} \right) \qquad (4.20)$$

ii.) Cost Function for final goods in two countries

Adding up the cost functions for intermediate goods A and B in both countries h and f gives the cost function of the MNE:

$$
\begin{aligned}
C \;\; &= \;\; \sum_i \left[C_i(A_i) + C_i(B_i) \right] = \\[2mm]
&= \;\; \sum_i \left[r^{\beta} \gamma \left(A_i \left((1+t_{ij}) \, w_{A,i} \right)^{\alpha} + B_i \left((1+t_{ij}) \, w_{B,i} \right)^{\alpha} \right) \right]
\end{aligned}
\qquad (4.21)
$$

where $\gamma = \left(\frac{\alpha}{\beta} \right)^{\beta} + \left(\frac{\alpha}{\beta} \right)^{-\beta}$ and $i \in h, f$

Q.E.D.

2. Labour Demand Function

The total labour demand of an affiliate is the sum of labour needed to produce input goods A and B. The labour demand for the intermediate good is the same for both goods A and B and is derived from the production function using a standard Lagrange optimisation approach:

$$L = wL_{A,i} + rK_A + \lambda \left[A_i - L_{A,i}^\alpha K_A^\beta \right] \tag{4.22}$$

The procedure is the same as for the equation (4.17), however without transportation costs, since the input goods are used in the same country. So the labour demand function equals to

$$L_{A,i} = \left(\frac{\alpha}{\beta} \frac{r}{w} \right)^{\frac{\beta}{\alpha+\beta}} A_i^{\frac{1}{\alpha+\beta}} \tag{4.23}$$

The labour demand function for the input good B is derived in the same way. Finally, adding the labour demands required for the production of each input good and substituting Q for A (since one unit of input good is required to produce one unit of final good) gives the total labour demand function:

$$L_i = \left(\frac{\alpha}{\beta} \right)^{\frac{\beta}{\alpha+\beta}} Q_i^{\frac{1}{\alpha+\beta}} \left(\left(\frac{r}{w_i^A} \right)^{\frac{\beta}{\alpha+\beta}} + \left(\frac{r}{w_i^B} \right)^{\frac{\beta}{\alpha+\beta}} \right) \tag{4.24}$$

Q.E.D.

3. Relationship Between Labour Demand in country h and Wages in country f

From the fixed proportion property of the Leontief production function we know that for the production of one unit of final good Q_h the MNE needs one unit of intermediate good B. In case of vertical division of production the intermediate good B is imported from country f. Substituting B_f for Q_h in equation (4.7) we get

$$L_h = \left(\frac{\alpha}{\beta} \right)^{\frac{\beta}{\alpha+\beta}} B_f^{\frac{1}{\alpha+\beta}} \left(\frac{r}{w_h^A} \right)^{\frac{\beta}{\alpha+\beta}} \tag{4.25}$$

Now we can show that B_f depends on local wages w_f by rewriting the equation 4.17 for intermediate good B:

$$B_f = \left(\frac{\beta}{\alpha} \frac{t_{f,h} w_f^B}{r} \right)^{-\beta} L_f \qquad (4.26)$$

Inserting B_f from (4.26) into (4.25) gives the labour demand function depending on foreign wages:

$$
\begin{aligned}
L_h &= \left(\frac{\alpha}{\beta} \right)^{\frac{\beta}{\alpha+\beta}} \left(\left(\frac{\beta}{\alpha} \frac{t_{f,h} w_f^B}{r} \right)^{-\beta} L_f \right)^{\frac{1}{\alpha+\beta}} \left(\frac{r}{w_h^A} \right)^{\frac{\beta}{\alpha+\beta}} = \\
&= \left(\frac{\alpha}{\beta} \right)^{\frac{2\beta}{\alpha+\beta}} \left(\frac{r^2}{t_{f,h} w_f^B w_h^A} \right)^{\frac{\beta}{\alpha+\beta}} L_f^{\frac{1}{\alpha+\beta}}
\end{aligned}
\qquad (4.27)
$$

Differentiation with respect to wages w_f and transportation costs t_{fh} gives

$$\frac{\partial L_h}{\partial w_f^B} = -\frac{\beta}{\alpha+\beta} \left(\frac{\alpha}{\beta} \right)^{\frac{2\beta}{\alpha+\beta}} \left(\frac{1}{w_f^B} \right)^{\frac{\beta-1}{\alpha+\beta}} \left(\frac{r^2}{t_{f,h} w_h^A} \right)^{\frac{\beta}{\alpha+\beta}} L_f^{\frac{1}{\alpha+\beta}} < 0 \qquad (4.28)$$

$$\frac{\partial L_h}{\partial t_{fh}} = -\frac{\beta}{\alpha+\beta} \left(\frac{\alpha}{\beta} \right)^{\frac{2\beta}{\alpha+\beta}} \left(\frac{1}{t_{fh}} \right)^{\frac{\beta-1}{\alpha+\beta}} \left(\frac{r^2}{w_f^B w_h^A} \right)^{\frac{\beta}{\alpha+\beta}} L_f^{\frac{1}{\alpha+\beta}} < 0 \qquad (4.29)$$

Q.E.D.

Thus, in case of vertical division of production labour demand in country h depends negatively on wages in country f and on transportation costs between these two countries.

Chapter 5

The Good, the Bad or the Irrelevant: Vertical and Horizontal FDI in the Czech Republic

5.1 Introduction

Governments of many countries try to attract foreign direct investments through regulatory and tax incentives. In particular in Eastern European transition countries foreign direct investment play a crucial role in the catching-up process, since they bring capital, technology and managerial know-how. However, when promoting foreign investments governments often favour those investments which are oriented towards the local market and locate the complete production chain in the host country. An example is the assembly plant for car engines of Audi AG in Hungary, which attracted many complaints from local politicians, because most intermediate goods were imported, only the labour intensive assembly took place in Hungary and final products were exported to foreign markets. So the question is, whether such discrimination between different types of investments is legitimate. Is market seeking FDI

good and cost seeking FDI bad for the host economy? This chapter will try to answer this question, focusing on different types of German direct investments in the Czech Republic.

The Czech Republic is one of the largest recipients of Foreign Direct Investment (FDI) in Central and Eastern Europe. Measured by amount of foreign investments per capita it is the leader since 1998.[1] Foreign owned enterprises play a significant role in the Czech economy as a large employer and capital stock builder (Zemplinerova and Rajdoval, 2002). Since the beginning of the transition process, Foreign Direct Investments contributed substantially to the strong economic recovery in the Czech Republic, bringing capital, up-to-date technology and management skills. The largest part of the contribution are the transfers of capital and technology to the own affiliates of multinational enterprises.[2] But besides these direct transfers to foreign owned affiliates the host country benefits from FDI inflows in many other ways. Technology dispersion to the local firms has been seen as one of the most important ways. In addition, foreign investments contribute to the employment in the host country, its integration in the global production network and the amount of local R&D activities. Finally, they also affect the local competition and tax income.

The theoretical literature on multinational enterprises distinguishes between two types of investments: vertical FDI, when the multinational separates the production process between countries (Helpman and Krugman, 1985), and horizontal FDI, when the multinational duplicates the same production in different locations (Markusen, 1995). However, this differentiation was not used in the literature on host country effects of FDI. One reason was the absolute dominance of horizontal FDI in the world investment flows. In addition, the theoretical and empirical basis for vertical FDI was created

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[1]See Table 1.2 in the Chapter 1.

[2]See Marin et. al. (2002), Djankov and Hoeckman (2000).

only recently. However, recent empirical studies show the increasing importance of vertical FDI (Blomström et al., 2001) and even introduce other new types of FDI like export platform or distribution FDI (Hanson et al., 2001). In Central and Eastern Europe (CEE), vertical FDI seems to play a larger role than in industrialised countries.[3] Thus, the next step is to distinguish between these types of investment in order to analyse the effects of FDI on the host economy. Furthermore, the previous literature on spillover effects of FDI delivered very controversial results. This chapter argues, that different types of investment have a different impact on the host economy and therefore the distinction between vertical and horizontal FDI can explain the contradictory findings of previous literature.

There is an extensive literature on the host and home country effects of FDI, with most empirical studies focusing on technology spillover effects as the major contribution to the host economy.[4] However, the results of this literature are rather mixed. On the one hand, a number of case studies as well as some empirical studies point to significant positive spillovers.[5] On the other hand, several empirical studies found negative spillover effects on domestic firms without foreign participation (Djankov and Hoeckman, 2000, Aitken et al., 1997, and Harrison 1996). Most studies for transition countries show negative effects, while they are positive for developed and developing countries, even if the total effect of FDI on the host economy is overwhelmingly described to be positive.[6]

Several recent studies explore the spillover effects in transition countries. The first group employs firm level data to investigate the intra-industry spillovers when technology is transferred within the same industry. Here,

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[3]See Marin et al. (2002) and Chapter 4 of the thesis for the share of vertical FDI in CEE.

[4]See Lipsey (2002) and Blomström and Kokko (2003) for an overview.

[5]See Görg and Greenway (2001)for an overview.

[6]For an overview see Görg and Greenway (2001). Moran (1998) and UNCTAD (1999) discuss the positive effects of FDI in general on the host country.

Djankov and Hoeckman (2000) reported negative and Kinoshita (2001) not significant spillover effects on the productivity of domestic firms in the Czech republic. Konings (2001) and Damijan et al. (2001) confirmed this negative effect for the most CEE countries. The second group focuses on the inter-industry spillovers, occurring from foreign affiliates to local suppliers in other industries. Using firm level data for Lithuania, Smarzynska (2002) found positive inter-industry (vertical) spillover effects but no significance for intra-industry (horizontal) spillovers. The negative results could reflect the fact that in transition economies local firms takes more time to adapt and learn to apply a new technology, since the most mentioned studies cover periods of up to 4 years.

As mentioned above, the literature on technology spillovers distinguishes between two types of spillover channels. Horizontal spillovers take place in the same industry. Vertical spillovers occurs from the foreign affiliate to the local input goods supplier. The scale of the vertical channel depends therefore on the question, how much input goods foreign affiliate obtains from domestic firms and how much from the parent company. At the same time the definition of vertical FDI is based on the criterion, whether the input good comes from the parent company. Thus, it is necessary to differentiate between two types of vertical FDI: forward and backward vertical FDI. Forward vertical FDI takes place if the foreign affiliate receives input goods from the parent for further production. Backward vertical FDI describes the investment, when the affiliate sends its final goods back to the parent for the further production or sales. The differentiation between forward and backward FDI is empirically not always clear cut, since some investments belong to both categories simultaneously, if the affiliate receives input goods from the parent company and sends its production back. This is the so called "outsourcing FDI". Even if its share is not very large and consists of the described two types of vertical FDI, a part of the analysis will be dedicated to this type, since this type of FDI feeds the fears of local governments in host countries about encapsulated plants without linkages to the local economy.

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Besides the spillover effects, other studies of the impact of FDI on the host country concern financial and export performance, integration into global markets and industrial restructuring.[7] But again, they do not distinguish between different types of FDI. Therefore, the contribution of this chapter consists of three points: First, the next section delivers empirical evidence for different types of FDI in the Czech Republic. Second, section 3 estimates spillover effects of vertical and horizontal FDI on domestic firms. Finally section 4 compares other impacts and characteristics of different FDI types on the host country like employment and technology.

5.2 Vertical and Horizontal FDI in the Czech Republic

5.2.1 Data

The chapter employs two data sources: data on German FDI from a firm survey to identify different investment types and data on foreign and domestic enterprises from the Czech Statistical Office to analyze host country effects. The data set of German FDI in the Czech Republic is a part of the firm survey conducted by the Chair for International Economics at the University of Munich.[8] The total number of surveyed investment projects in the Czech Republic is 265 and the total investment volume is 12.5 billion DEM. Thus, the empirical basis for the further analysis is equivalent to 51.1 percent of all German FDI measured by number of affiliates and 24.8 percent measured by number of employees on all German FDI in the Czech Republic in 1999.[9]

We distinguish between vertical and horizontal FDI using two types of

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[7]Kaminsky and Riboud (2000), and Hunya (1998).

[8]A detailed description of the data set is given in the introduction of the thesis.

[9]Bundesbank (2003). The collected investment volume is with 128,5 percent even larger than the sum of FDI inflows, since the survey employs a slightly wider definition of FDI.

information: the intra-firm trade with input goods between German parent and Czech affiliates and the geography of sales of affiliates. An investment project is defined as vertical, if the Czech affiliate receives more than 50 percent of its inputs from the German parent company (forward vertical FDI) or if it sends more than 50 percent of production to Germany for further refinement or sales (backward vertical FDI). All other cases are of the horizontal type.[10]

The data set on domestic firms in manufacturing sector comes from the Czech statistical office.[11] It contains the information on sales, assets and employment for the period from 1993 to 1999. The data set distinguishes between firms with foreign participation (fully owned by foreign firms or joint ventures) and domestic firms without foreign participation.

5.2.2   Composition of German FDI

The Czech Republic is one of the largest FDI recipients in Central Eastern Europe. Gross FDI inflows into the Czech Republic reached 4.9 billion USD in 2001 or 8.9 percent of GDP, the highest in the region, bringing the stock to over USD 20 Bill., or 40 percent of GDP.[12] Measured by investment per capita, the Czech Republic achieved inflows of 477 USD in 1999 and has been the largest recipient of FDI in Central and Eastern Europe since 1998 as shown in Table 1.2 in the Introduction. Foreign owned enterprises employs 89.3 thousand people in the Czech Republic and are responsible for 24.8 percent of exports. So they play a very important role in the Czech economy.

German FDI accounted for 26 percent of FDI stocks in the Czech Republic in the 1999 (UNCTAD, 2002). Table 5.1 describes the composition of German FDI using the data from the representative firm survey. Horizontal FDI accounts for 39.7 percent and vertical for 60.3 percent of all investment

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[10]See Chapter 4 for detailed discussion and further possible definitions .

[11]Czech Statistical Office (2001). I am grateful to Dr. Gabor Hunya for providing the data in electronic form.

[12]IMF (2002).

Table 5.1: Vertical and Horizontal FDI in the Czech Republic

	VFDI		HFDI
	Backward	Forward	
Share on total FDI			
by number projects, *in percent*	38.4	35.9	39.7
Average size			
FDI Sum, *mill. DEM*	19.3	11.3	93.6 (17.7)
Number of employees	253	136	516 (202)
Other characteristics			
Greenfield Investments, *in percent*	68.1	77.2	50.6
productivity*, *in thousand DEM*	118.4	236.4	145.9

Source: Survey of 265 German investment projects in the Czech Republic.
Note: numbers for the manufacturing sector only. * Measured as sales per employee.

projects.[13] The last number consists of forward and backward FDI, however it is lower than the sum of both numbers in the first and second column, because 14 percent of investments were simultaneously classified as forward and backward vertical FDI or so called "outsourcing" FDI. Measured by FDI volume, the share of horizontal FDI is with 76.7 percent much larger, which is a consequence of several very large investments in financial and automotive sectors. Two important conclusions arise from these results: First, the share of vertical FDI in the Czech Republic is relatively high by international comparison. Second, outsourcing FDI represents only a small share of German FDI in the Czech Republic.

Finally, Figure 5.1 shows the development of the different FDI types over time. The share of vertical FDI among new projects has been continuously falling since 1989, which is clear support of the Idea of the "FDI Life Cycle" in transition countries presented in Chapter 3. An evolving trend is the

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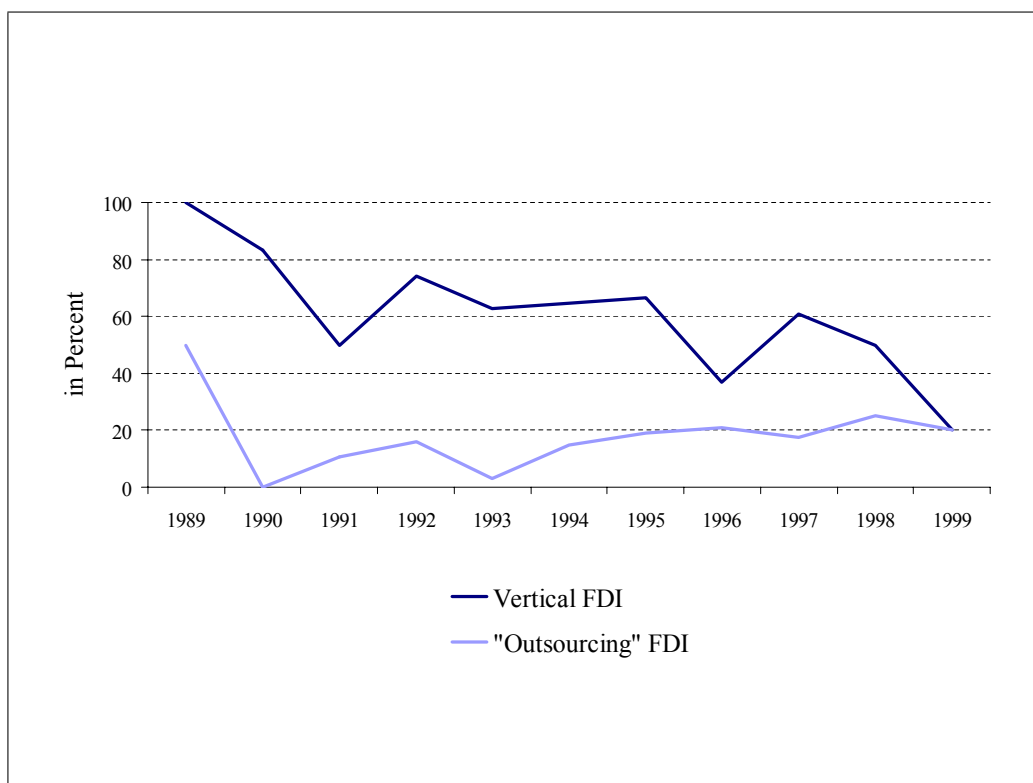[13]Here and in all following computations shares are valid values.

Figure 5.1: Time Pattern of Different FDI Types in the Czech Republic, *in Percent of New Investment Projects*

slightly growing share of outsourcing FDI, which are investments in production with the Czech affiliate receiving input goods from the parent company and sending final goods back for further production. This positive trend is an indication for a growing specialization (since not the full production chain is conducted locally) and an increasing integration of the Czech economy in the global production network.

5.2.3 Differences between Vertical and Horizontal FDI

In order to analyse the impacts of vertical and horizontal FDI on the Czech economy it is necessary to explore the main differences between between them that can influence the technology spillover. In this section we focus on

the main characteristics like size, productivity and employed technology. As Table 5.1 illustrates, horizontal FDI´s are on average larger size than vertical FDI measured by investment and employment. However, this result is driven by one very large investment, which distorts the average size of firms in this group. Excluding this observation we get 17.6 million DEM average FDI volume and 202 employees for horizontal FDI. In this case, backward vertical investment projects are on average larger than forward vertical and horizontal FDI in matter of investment, sales and employment. This result supports the "export platform" theory, because backward vertical affiliates serve a larger foreign market.[14]

Further differences between vertical and horizontal FDI exists with respect to the mode of market entry. So, horizontal FDI takes place in almost 50 percent of all cases by acquiring local firms as shown in Table 5.1. One possible explanation is that buying an existing firm gives the investor a quick access to a large market share. In addition, a well established local brand makes it easier to serve the new market. In contrast, 68.1 percent of export oriented backward vertical FDI choose greenfield investment as the form of market entry. These multinationals seem less interested in local brands, and a modernisation of existing old production lines could be more expensive than a completely new production site.[15]

In order to analyse spillover effects of different FDI types it is essential to explore the differences between them with respect to productivity and technology. So the last line in the Table 5.1 reports the labour productivity for all three types of FDI. The productivity is measured as sales per employee in thousands DEM for the investment projects in manufacturing industries. It varies from 118.4 thousand for export oriented vertical, over 145.9 thousand

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[14]See Hanson et al. (2001) and Ekholm et al. (2003).

[15]For technology, competition and other reasons which motivate the entry modes see Mueller (2002)

for horizontal to 236.4 thousand for market oriented forward vertical FDI. The low productivity of backward vertical FDI could mean that the country is specialised on labour intensive goods for exports. Or in other words that export oriented MNEs are investing in labour intensive production, exploiting comparative advantage of the host country in cheap labour force. This result supports the theories of vertical separation of production, with German firms shifting labour intensive stages in the Czech Republic, which has a much lower unit labour costs. The highest productivity is achieved by forward vertical FDI, since this type of affiliates receives know-how through input goods and have a stronger distributional character. On average, domestic firms without foreign participation have a productivity of 51.1 thousand DEM per worker. Thus, German affiliates are two (backward vertical) to four times (forward vertical) more productive than the local firms in manufacturing sector. German affiliates are even more productive than other Foreign Owned Enterprises (FOE) in the Czech Republic, that achieve 102.6 thousand DEM per employee.[16] In sum, productivity differences between FDI and local firms should represent a large potential for technology spillovers.

Next, we focus on technology used by different types of FDI. The question here is whether export oriented investment only exploit the cheap labor costs and do not conduct local R&D. The differences between vertical and horizontal FDI with respect to technology employed and local expenditures for R&D are displayed in Table 5.2. Measured by the stage of innovation, vertical FDI transfers a higher technology than horizontal. Technological advantage compared to local competitors is larger for the backward vertical FDI, but is equal for both FDI forms oriented toward the Czech market. The striking similarity between forward vertical and horizontal FDI could have several reasons. During the interviews the investors claimed, that the strongest competition occurs from the same international competitors as in the home or in other foreign markets. Combined with the high share of FOE

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[16]Czech Statistical Office (2001).

Table 5.2: Technology Used by Vertical and Horizontal FDI, *in Percent*

	VFDI		HFDI
	Backward	Forward	
Technology			
Stage of Innovation, *index**	2.26	2.22	2.45
Advantage to competitors	57.0	43.1	43.0
Local R & D			
R&D expenditure to sales	1.3	0.7	0.8
R&D personal to total employment	11.5	9.4	9.6

Source: Survey of 265 German firms in Czech Republic.
Note: * The valuation for innovation is an index from 1 for "new, not yet established technology" to 4 for "old technology".

in the Czech Republic, this can explain the similarity between forward vertical and horizontal FDI. In addition, vertical FDI employs a technology, which it perceives to be more difficult to duplicate than in case of horizontal FDI. The technological advantage of vertical FDI is backed by the extend of local R&D efforts. Export oriented vertical FDI spends more on R&D activity, measured by the share of R&D expenditures on sales and by the number of scientific employees than investments oriented toward the local market.

Finally, firms were asked, whether their products are easy to duplicate, since duplication is one of the major channels for technology spillovers. Forward vertical FDI, which receives more inputs from the parent firm than other two types, claims to be the most difficult to duplicate. On the other side, horizontal FDI produces products that are easiest to duplicate. These results support again the idea of know-how transfer via trade in input goods, proposed by Markusen et al. (1996).

In sum, the export oriented vertical FDI applies a better technology than foreign investments oriented toward the Czech market.

5.2.4 Industry Distribution

Now we turn to the distribution of different FDI types among sectors and industries of the Czech economy in order to answer the question, whether vertical and horizontal FDI follow different specialisation patterns. The theoretical literature predicts vertical FDI in more labour intensive sectors, while horizontal FDI should occur in industries with high transportation costs.[17] Thus, in a first step we investigate how different FDI types are distributed among all sectors of the Czech economy. In a second step, we concentrate on the manufacturing sector in order to get a more in depth comparison of German FDI with local enterprises and with other foreign affiliates.

Table 5.3 shows clear patterns of specialisation for different FDI types among sectors of the Czech economy, measured by volume of investment and number of investment projects.[18] More than 50 percent of all investments went to the manufacturing sector. The financial sector attracts also a substantial part of foreign investment, while other sectors are rather weakly represented. Measured by volume of investment, the manufacturing of mechanical products is even more important, attracting some very large investment projects, while the distribution pattern is still very similar. The overwhelming part of horizontal FDI is going to the manufacturing sector because of the outlier mentioned above. As expected, vertical FDI is also strongly concentrated on manufacturing. However, there are some clear differences between forward and backward vertical FDI. The former is strongly represented in the trade and financial sector, while the latter is concentrated in the metal manufacturing sector.

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[17]Helpman and Krugman (1985), Brainard (1993b), Markusen (1995).

[18]Measurement by sales or by number of employees gives a similar distribution.

Table 5.3: German FDI in the Czech Republic: Sector Distribution, *in Percent*

ISIC - Category	All German FDI		VFDI*		HFDI*
	No. of firms	FDI Sum	Forward	Backward	
1 - Mining, manufacture of food and textiles	6.8	3.0	2.3	8.7	2.9
2 - Manufacture of metal and other basic products	35.5	16.0	29.0	63.2	7.2
3 - Manufacture of mechanical and electrical products	17.7	56.5	23.0	19.1	85.6
4 - Electricity and construction	9.4	3.2	0.7	0.0	1.8
5 - Wholesales and Retail trade	7.9	5.0	26.5	0.1	0.9
6 - Transportation and financial services	12.8	14.5	15.5	6.7	1.3
7 - Renting and other business activities	9.8	1.9	3.0	2.2	0.3
Total	100.0	100.0	100.0	100.0	100.0

Source: Survey of 265 German firms in the Czech Republic.
Note: * measured by FDI volume.

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Next, we focus on the distribution within the manufacturing sector, which is the largest recipient of German FDI. The data set for the Czech Republic allows for the comparison with local and other foreign owned enterprises (FOE). Table 5.4 compares the distribution of all firms in manufacturing sector with all FOE's and different types of German affiliates from the survey. Here we employ again the number of firms, since it is the most appropriate way to compare different data sources.[19]

As the first three columns of Table 5.4 make clear, German FDI has a different distribution path across the manufacturing sector than the local firms and even other FOE. German investments are strongly represented in know-how intensive sectors like machinery and equipment industry, motor vehicles and publishing sector. To the contrary, German FDI is only weakly represented in "commodity" industries like food and beverages, textiles and wood. FOE follow a similar distribution path as all Czech firms.

The sectoral distribution of FDI gives a strong empirical support for several theories of vertical and horizontal multinationals. Horizontal FDI is strongly represented in publishing and food manufacturing sector, which are characterised by high transportation costs and customer proximity. This distribution supports the proximity-concentration approach introduced by Brainard (1993b). On the other hand, vertical FDI is concentrated in labour intensive sectors like fabricated metals, machinery, equipment and motor vehicles. Thus, in accordance with Helpman and Krugman (1985) export oriented vertical FDI exploits the comparative advantage of the Czech economy, since labour costs are lower then in the source countries of FDI.

In some industries the differences between vertical and horizontal FDI are even larger, like in food manufacturing and in electrical machinery. At the same time, other industries show similarities between horizontal and mar-

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[19]But even here are some mismatches, like for instance in coke and petroleum industry between German FDI and all other FOE. The reason could be differences in classification of firms to ISIC codes.

Table 5.4: Distribution in Manufacturing Industry, *in Percent*

ISIC - Category	Firms			VFDI		HFDI
	All	FOE	GER	bckw.	fwd.	
15 - Food products, beverages	16.0	7.4	3.8	0.0	0.0	13.0
16 - Tobacco	0.1	0.4	0.6	0.0	0.0	2.2
17 - Textiles	5.6	6.0	3.2	5.6	4.1	2.2
18 - Wearing apparel, dressing	4.5	4.6	1.9	1.4	2.0	0.0
19 - Tanning, dressing of leather	1.8	1.5	0.6	1.4	0.0	0.0
20 - Wood	4.6	4.7	0.6	0.0	0.0	2.2
21 - Paper and paper products	1.5	2.8	0.0	0.0	0.0	0.0
22 - Publishing, printing	2.8	2.4	11.5	1.4	14.3	21.7
23 - Coke and petroleum	0.1	0.0	0.6	0.0	2.0	0.0
24 - Chemicals	2.2	2.8	2.6	2.8	2.0	2.2
25 - Rubber and plastic	3.9	7.0	10.9	12.5	6.1	13.0
26 - Other non-metallic minerals	6.4	8.5	5.8	5.6	0.0	10.9
27 - Basic metals	3.1	2.0	1.9	4.2	2.0	0.0
28 - Fabricated metals	14.5	12.4	9.0	12.5	10.2	4.3
29 - Machinery and equipment	12.7	10.1	17.3	15.3	14.3	13.0
30 - Office machinery	0.1	0.3	0.6	0.0	2.0	0.0
31 - Electrical machinery	5.5	9.1	7.7	5.6	8.2	2.2
32 - Radio, TV sets	1.5	2.6	0.6	1.4	2.0	0.0
33 - Medical, precision instr.	1.8	2.7	2.6	1.4	4.1	4.3
34 - Motor Vehicles, trailers	2.9	6.1	14.1	23.6	24.5	6.5
35 - Other transport equipment	1.5	0.6	0.6	1.4	2.0	2.2
36 - Manufacturing n.e.c.	6.4	5.5	3.2	4.2	0.0	0.0
37 - Recycling	0.4	0.3	0.0	0.0	0.0	0.0
Total Manufacturing	100.0	100.0	100.0	100.0	100.0	100.0

Source: Czech Statistical Office (2001) and Survey of 265 German firms in Czech Republic.

ket oriented forward vertical FDI, for example in publishing or in medical and optical instruments. Here, forward vertical FDI shows similarities with the horizontal FDI, since both serve the local market. The differences occur mainly if the forward VFDI is exporting his production (backward vertical FDI). This type of "outsourcing" FDI takes place mainly in textile, fabricated metals and office machinery industries, where it achieves almost 50 percent of the surveyed investment projects. The total share of this type is 30 percent in the manufacturing industry, but only 14 percent on all German FDI in Czech Republic.

To summarize the result of this section, vertical and horizontal FDI differ significantly in motivation, size, technology and industry distribution. Thus, the results make clear the importance of distinguishing between different types of FDI when analysing host country effects of FDI.

5.3 Spillover Effects

5.3.1 Channels for Spillover Effects

There is an extensive theoretical and empirical literature which identifies spillover effects of FDI as a whole on domestic firms in the host country.[20] This literature suggests that knowledge spillovers can occur through different channels like imitation, competition, labour mobility and export. However, different types of FDI will exploit these channels in different ways. Thus, as a starting point for the empirical analysis we will emphasize different impacts of vertical and horizontal FDI by looking at the channels for technology spillover. Table 5.5 presents the main channels for technology dispersion from the foreign affiliates to the domestic firms: imitation, competition, labour turnover and backward linkages.

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[20]See Görg and Greenway (2001) and Blomström and Kokko (2003) for a survey.

Table 5.5: Impacts of Vertical and Horizontal FDI on Domestic Firms through Different Spillover Channels

| | Vertical FDI | | Horizontal FDI |
	Backward	Forward	
Imitation	+	+/-	+/-
Competition	0	+/-	+/-
Labour Turnover	+	+	+
Export	+	0	0
Local Inputs	+	0	+

Imitation is a classical mechanism to develop new products or to acquire technology from foreign firms.[21] Clearly the scope of the spillover effect depends on the complexity of the product and on how much the competitors can see from the product. Therefore, products manufactured and sold locally as it is the case for horizontal FDI, are supposed to be easier to imitate, because complete production and sales take place in the same country. On the other hand, vertical FDI can be easier imitated, if they conduct labour intensive production with lower technology frontier.[22]

Many studies emphasize the important role of competition between foreign and domestic firms for the technology transfer.[23] Even if the local competitor is not in a position to imitate the technology of the foreign affiliate, it is under pressure to use the existing technology more efficiently, which brings productivity gains. This channel is in particular relevant for host country oriented horizontal but also for forward vertical FDI. However, for several reasons competition can also lead to negative results. First, as Djankov and Hoeckman (2000) argue, multinationals tend to acquire the most productive firms in the host country, decreasing the average productivity level of the

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[21]See Wang and Blomström (1992) and Das (1987).

[22]See Girma et al. (2001) for empirical evidence.

[23]See for example Wang and Blomström (1992) and Glass and Saggi (2002).

remaining firms in the industry. Second, foreign affiliates are expected to guard their knowledge more closely and prevent any leakage to the domestic competitors. Third, as Harrison (1996) pointed out, growing presence of foreign firms has a negative effects on the economies of scale of local firms, since their market share and volume of sales fall. Thus, market oriented FDI can under such circumstances cause a negative effect on the productivity of domestic firms.

Technology transfer can also occur through labour turnover. Workers that move from MNE to local firms or start own firms carry with them knowledge of new technology.[24] This channel is common for all types of FDI and is seen as one of the most important spillover channels.

Export spillovers are the next way for indirect knowledge transfer to local firms. Here, domestic firms learn from multinationals how to export, getting the information about new markets, regulatory arrangements, and consumer preferences.[25] This type of spillovers would occur from export oriented vertical FDI, since multinationals conduct such FDI in order to serve the foreign markets and bring the knowledge about destination markets to the host country.

Finally, technology can be transferred to local firms through backward linkages with local suppliers, as shown by Markusen and Venables (1999). By obtaining input goods from local suppliers MNE transfer their standards and knowledge to the local firms. This type of spillover is characteristic in particular for horizontal FDI, and not for forward vertical FDI, which receives its inputs from the foreign parent company.

Thus, through different spillover channels vertical and horizontal FDI have different impacts on the productivity of local firms. This variety of channels and different effects of vertical and horizontal FDI can be the reason

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[24]See for example Djankov and Hoeckman (2000).

[25]See Aitken et al. (1997).

for mixed empirical results on technology spillovers obtained so far, since the composition of FDI inflows varies between countries and even changes through time as shown in Chapter 3.

5.3.2 Estimation

To examine the relationship between productivity of domestic firms and foreign presence in the same industry we follow the approach taken by the previous literature and estimate different variations of the following equation:

$$
\begin{aligned}
\Delta ln Y_{it} = {} & \alpha + \beta_1 \Delta ln K_{it} + \beta_2 \Delta ln L_{it} + \beta_3 \Delta ln SFOE_{it} + \\
& + \beta_4 \Delta ln VFDI_{it} + \beta_5 \Delta ln VFDI(F)_{it} + \\
& + \beta_6 \Delta ln VFDI(B)_{it} + \beta_i + \mu_i
\end{aligned} \tag{5.1}
$$

In equation (5.1) Y_{it} denotes the value added in the industry i in year t.[26] In contrast to previous literature we employ value added instead of total output as dependent and inputs as explanatory variable in order to avoid multicollinearity and gain degrees of freedom. On the right hand side, the coefficient K_{it} is the value of total assets as a proxy for the employed capital. Labour as the second input factor is captured by L_{it}, which stands for the average number of employees in each industry and year. $SFOE_{it}$ measures the share of foreign owned enterprises in industry i. It is defined as a share of firms with foreign participation on the total sales in each industry, thus incorporating the size and the role of foreign firms in the industry. Previous studies employed different measurements of the foreign activity like the share of assets or employment. However, here investment volume or employment are not suited to measure the share of each FDI type, because in the employed cross section data set this information is available for the last year only.

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[26]Data sources and variable descriptions are provided in Table 5.6.

$VFDI_{it}$ captures the share of vertical FDI on the total number of FDI projects in industry i in year t.[27] Vertical FDI is calculated as described in the previous section. Additionally vertical FDI is split in two types in order to test the effects of forward and backward vertical FDI, here $VFDI(F)_{it}$ and $VFDI(B)_{it}$ respectively. Separate estimation of spillover effects for different types of investment allows not only to capture the effect of each FDI type, but also different spillover channels, since they have different impacts as shown in Table 5.5

As Djankov and Hoeckman (2000) pointed out, foreign investors tend to acquire the largest and most successful companies in the host countries. We avoid such a bias by estimating the productivity for the local firms only as proposed by Smarzynska (2002).[28] Following previous empirical studies on FDI spillovers we employ OLS fixed effects as the estimation technique.[29] Fixed effects are measured by industry dummies, thus controlling for industry specific effects. We estimate the year to year changes in logarithmic forms for each estimation variable with a panel data set of 23 sectors at ISIC two digits level of the Czech manufacturing industry between 1995 and 1999.

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[27]In contrast to other variables, the share of vertical FDI is computed for industry sectors at the ISIC1 (one digit) level, since the low number of observation does not allow to calculate the share for each year and industry at ISIC2 (two digit) level separately.

[28]Preliminary tests have shown that the share of greenfield FDI has a negative effect on productivity of local firms. This surprisingly result can occur due to negative competition effect, because greenfield investments are 2.5 times more productive than acquisition and rule out local competitors.

[29]Djankov and Hoeckman (2000), Kinoshita (2000), and Smarzynska (2002) and several prior studies employ this technique. Smarzinska (2002) also employs Olley and Pakes-technique, which requires a high number of observations.

5.3.3 Results

The estimation results are presented in Table 5.7, with OLS in the first three and fixed effects estimation in the last three columns.[30]

In columns (1) and (4) we estimate the effects of foreign presence on productivity of domestic firms in the same industry. The $SFOE$ coefficient has a negative sign, however it is not significant in both estimation techniques. Controlling for the type of FDI shows a clearer picture: in all following specifications with different FDI types $SFOE$ is negative and significant. Thus, a stronger presence of FOE in the industry reduces the productivity of domestic firms in this industry (horizontal spillover). This result supports previous findings for the Czech Republic by Djankov and Hoeckman (2000) who used industry level instead of firm level data to estimate the spillover effect. The negative effect of foreign presence occur due to several factors, discussed in the previous section.

Now we turn to the coefficients of different FDI types. Coefficient $VFDI$ in columns (2) and (5) has a positive sign, thus the share of vertical FDI on total foreign investment in the sector has a positive, while horizontal FDI a negative effect on productivity of domestic firms. This result supports the hypotheses from the previous section. Vertical FDI has several positive channels for spillover, while the negative effects dominate in case of horizontal investment, since this type of foreign affiliates compete with local firms and thus reinforce the negative effects described above. Thus, in case of the competition channel, the negative effects as acquiring the most productive firms, crowding out competitiors and guarding own technology seems to overweight the positive effect of efforts toward higher competitiveness.

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[30]Year dummies for each estimation does not change the result significantly and are therefore not reported.

Table 5.6: Variables and Data Sources for Chapter 5

Variable	Definition	Data Source
Y_{it}	value added, domestic firms only, in USD	Czech Statistical Office
K_{it}	total assets, domestic firms only, in USD	ibid
L_{it}	number of employees, domestic firms only	ibid
$SFOE_{it}$	share of FOEs on total sales in industry i	ibid
$VFDI_{it}$	share of vertical investments on total number of investment projects	Firm Survey
$VFDI(F)_{it}$	share of forward vertical investments on total number of investment projects	Firm Survey
$VFDI(B)_{it}$	share of backward vertical investments on total number of investment projects	Firm Survey

Note: The subscripts i and t denote the country and the year respectively.

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As shown in the previous section, vertical FDI consists of two types of investments with export and host market orientation. They differ in particular over the competition with local firms, what seems to play an important role for technology spillover. Therefore, in columns (3) and (6) we control for forward and backward vertical FDI separately. Export oriented backward FDI has a positive and strong significant effect on the productivity of the domestic firms in the same industry. Here, the positive effects of imitation, labour turnover and knowledge of foreign markets seem to prevail. On the other hand, host country oriented forward vertical FDI has a negative sign, similar to the host market oriented horizontal FDI. However, it is not significant.

Different results for backward and forward vertical FDI point to the different spillover channels concerned by each type of vertical investment. Besides the channels that are common for all types of FDI, like imitation and labour turnover, the main difference between backward and forward vertical FDI is that the former involve the local supplier of input goods into the production process to a much larger extent. The positive effect of backward VFDI therefore is likely to be due to the larger share of inputs from local suppliers. This points to the positive intra-industry (vertical) spillover effect, thus confirming the findings of Smarzynska (2001) with the firm level data.

The results also give empirical support to the recently emerged idea, that the ability to absorb the new technology plays an important role for technology transfer.[31] The estimation results show a negative impact of horizontal FDI on spillover. But at the same time this type of investment dominate between developed economies, where the total spillover effects of FDI are significantly positive (Görg and Greenway, 2001). Thus, the negative effect in transition countries can be based on the low absorbing capacity of domestic firms in these countries.

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[31]See Borensztein et al. (1998) and Glass and Saggi (2002).

Table 5.7: Regression Results: Spillover Effects

Dependent Variable is Y_{it}	(1)	(2)	(3)	(4)	(5)	(6)
K_{it}	0.536***	0.327***	-0.085	0.623***	0.381**	-0.016
	(5.219)	(2.749)	(-0.694)	(4.869)	(2.472)	(-0.101)
L_{it}	0.500***	0.624***	0.936***	0.555***	0.637***	0.918***
	(3.440)	(4.332)	(6.559)	(3.119)	(3.684)	(5.575)
$SFOE_{it}$	-0.088	-0.095*	-0.167***	-0.103	-0.107	-0.191***
	(-1.486)	(-1.683)	(-3.658)	(-1.438)	(-1.561)	(-3.439)
$VFDI_{it}$		0.245***			0.240***	
		(3.059)			(2.572)	
$VFDI(F)_{it}$			-0.104			-0.121
			(-1.054)			(-1.106)
$VFDI(B)_{it}$			0.470***			0.454***
			(7.977)			(6.850)
Constant	0.341	-0.368	1.512***	-0.415	-0.794	1.255
	(0.385)	(-0.421)	(2.211)	(-0.361)	(-0.717)	(1.402)
Industry Fixed Effects	No	No	No	Yes	Yes	Yes
R^2	0.450	0.510	0.701	0.518	0.568	0.739
Adjusted R^2	0.429	0.485	0.682	0.327	0.386	0.623
Number of observations	81	81	81	81	81	81

Note: Estimation technique is OLS fixed Effects. Cell entries are OLS parameter estimates and t-statistics in parentheses. Significance: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

In sum, foreign presence has a negative effect on the productivity of domestic firms in the Czech Republic. This is in particular the case for horizontal FDI. Among the vertical investments, backward export oriented FDI has a strong positive, while host country oriented vertical FDI has no significant effect.

5.4 Other Host Country Effects

Besides technology spillovers, the host economy earns benefit in several other ways from foreign direct investments. Main direct effects would also include the creation of employment in the host country, its integration in the world economy through exports, an increase of local capital stock, a boost of local R&D expenditures and finally the contribution to the tax income due to higher profits and wages. The effects of foreign presence as a whole has been empirically investigated and extensively summarised.[32] Here, we distinguish again between vertical and horizontal FDI in order to identify the differences in characteristics between the two types with respect to the mentioned effects.

We start with the direct impact of multinationals on their Czech affiliates. Foreign owned enterprises are a big employer in the Czech Republic, employing 26.9 percent of the labour force in manufacturing alone. Measured by the total amount of employees in the Czech affiliates, backward vertical FDI and horizontal FDI are similar, with 43.4 and 38.9 percent of all employees with German affiliates in the Czech Republic respectively. Forward vertical FDI plays a smaller role with 17.7 percent. As shown in Table 5.1, on the firm level backward vertical affiliates are on average larger employers than affiliates of other types of FDI, because they serve large foreign markets. In addition vertical FDI is more often a pure job creator, since more than 70 percent of vertical FDI projects are greenfield investments. In contrast,

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[32]see Lipsey (2002), UNCTAD (1999) for the overview of empirical evidence and Moran (1998) and Protsenko et al. (2001) for discussion of positive and negative effects.

horizontal investments acquire in every second case an existing enterprise, which often involves lay offs in the starting stage due to optimisation process of former state enterprises. Thus, from the employment perspective, vertical FDI is more attractive for the host economy.

Second, FDI contributes to the host economy by transferring significant amounts of capital to own affiliates in the host country (Marin et al., 2002). As shown in Section 2, horizontal investments are in total much larger than vertical one. However, excluding one large investment project in the automotive sector make export oriented vertical FDI on average larger than the horizontal. Thus, both types contribute significantly to the investment stock in the Czech Republic.

Third, FDI is treated to be boosting export competitiveness and to enhance the economic integration of the host country into world economy. Indeed, FOE contribute 60.5 percent to manufacturing exports from the Czech Republic.[33] Here, the vertical FDI is doubtless the driving force behind foreign trade of the Czech economy.[34] As expected, backward vertical FDI is strongly export oriented, achieving an average export share of 68.3 percent from total sales. At the same time forward vertical FDI imports more than 80 percent of its inputs. Thus, both types of vertical FDI contribute to an increase of foreign trade. On the other side, theoretical literature see horizontal FDI to be trade reducing, since the foreign market is served by local production instead of exports (Brainard, 1993, and Markusen and Venables, 2000). This theoretical result is supported by the data for the Czech Republic, where this type of FDI has an export share of 18.5 percent and obtains more than 70 percent of inputs locally.

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[33]Manufacturing sector in 1999, Czech Statistical Office (2001).

[34]The results however depends essentially on the definition of horizontal FDI. For example Lankes and Venables (1997) calls the FDI horizontal if 100 percent of the output is sold locally. For further discussion see Chapter 4.

Fourth, from the perspective of the host government, foreign investors are an essential source of taxes from profits and wages. Empirical evidence is eminent, that foreign affiliates pay substantially higher wages than local firms in the same industry, increasing the welfare and contributing to higher local consumption and higher tax income (Lipsey and Sjoholm, 2003). Less clear is the situation with the profits. According to the Czech Statistical Office (2001), foreign firms in all manufacturing industries on average have been profitable between 1996 to 1999. In the same period of time, domestic firms in total have been making losses in almost all industries.[35] This result has two implications. First, foreign firms contribute substantially to the tax income from firm profits, even if they have more opportunities for profit shifting then their local counterparts. In particular vertical FDI has a better opportunity for profit shifting through intra-firm trade. Second, one of the reason for losses of domestic firms is fierce competition from the more productive foreign firms. Thus, horizontal firms have less profit shifting possibilities, but they can reduce tax revenues by lowering the profits of domestic firms. Therefore, the difference in tax revenues by vertical and horizontal FDI is less clear.

Finally, there are several indirect effects of foreign direct investments for the local consumers. For example horizontal FDI increases product variety in the host country and intensifies local competition, so local consumers can benefit from better choice opportunity and lower prices. However, as some studies argue, foreign firms can also decrease competition and drive out local competitors.[36]

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[35]It is not clear, whether the losses of domestic firms are the consequence of the competition pressure from FOE or for other reasons, like better knowledge of local tax system.

[36]Harrison (1996).

5.5   Conclusion

The fact that foreign investments bring great benefits to the host country is well established. In this chapter we explored the question, whether the same can be told about different types of FDI, namely for vertical and horizontal FDI. The governments worldwide often tend to be in favour of horizontal, host market oriented investments. The results of this chapter clearly show, that this perception is not reasonable. Vertical investment contribute positively to the local economy at least as well, and in several fields like technology spillovers or export orientation even much stronger than horizontal FDI.

In order to evaluate the different impacts this chapter combines the data on vertical and horizontal FDI from the survey of German Investors and official statistics about the productivity of foreign and domestic firms in the Czech Republic between 1995 and 1999.

For the first time the main characteristics and distribution of vertical and horizontal FDI within a host country have been described empirically. The largest share of German FDI is going into the manufacturing sector, while vertical FDI is concentrated in machinery and metal manufacturing and horizontal one in the food sector and publishing. Within the manufacturing sector, about 30 percent of all FDI are "outsourcing" investments, when the Czech production is an intermediate stage of the production abroad. This type of FDI has only 14 percent of German FDI in the Czech Republic.

The host market benefits in several ways from foreign owned firms. The effects of capital and technology transfer by multinationals to the own affiliates in the host country are beyond doubt positive and contributed to the successful restructuring of the Czech economy, as pointed out by previous research. The effect on domestic firms is less clear. Empirical results of this chapter show that in one of the most important impact channels, the technology spillover, foreign owned enterprises as a whole have a negative effect on the productivity of domestic firms in the same industry. This is in particular true for horizontal host market oriented FDI. The negative result

could be due to fierce competition and privatisation of the most productive domestic firms. To the contrary, vertical export oriented investments have a significant and positive effect on the productivity of domestic firms. They do not compete with domestic firms for local consumers, however remain a source for spillovers through information about foreign markets, imitation and labour turnover. Measured by other effects on the local economy, vertical FDI appears to be at least as attractive as horizontal FDI. Vertical FDI is better for the host economy in fields of technology, R&D expenditures, employment and integration in the world economy.

Thus, the results dispel the concerns, that host market oriented FDI has the best positive impact on the host country. However, further analysis is necessary to look at the firm level evidence of the vertical and horizontal FDI over a longer period of time. Comparisons with other countries will also give additional insights into distributional patterns and impacts of vertical and horizontal FDI.

Chapter 6

Conclusion: Summary of Results and Outlook

The world economy experienced a dramatic increase in foreign direct investment (FDI) and multinational activities over the last decade. Explaining this process, previous literature seemed to have overlook the different types of FDI, in particular when analysing the composition of investment flows and the effects of FDI on host and home countries. Starting from this point, this thesis differentiated between two major groups of foreign direct investment: vertical and horizontal FDI.

Vertical FDI occurs, when a multinational enterprise separates its production chain geographically, while horizontal FDI takes place, when the same production process is duplicated in a foreign country. Based on this differentiation the contribution of the thesis is twofold: it explores the composition of FDI flows in transition countries over time and analyses the impact of vertical and horizontal FDI on home and host countries. In particular, it provides the first empirical evidence for vertical and horizontal FDI in transition countries of Central and Eastern Europe. This chapter summarises the major findings and gives a short outlook for the further research.

Lack of empirical data was one of the major shortcomings for studying vertical and horizontal FDI. Therefore, the empirical part of the thesis is

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based on a unique firm level data set collected by the author and his colleages from the Chair of International Economics, University of Munich. The data set covers up to 80 percent of German investment projects in Central and Eastern Europe. Information on intra-firm trade between parent and affiliate company provides the possibility to differentiate between vertical and horizontal FDI and to conduct the analysis for each type of FDI separately.

In the first step, Chapter 2 gave an overview of the literature on vertical and horizontal FDI. The survey made clear that, so far, related theoretical literature explained only the appearance and determinants of vertical and horizontal FDI. However, the question of impacts for each FDI type remained open. The overview of prior empirical studies illustrated a strong empirical support for models of horizontal FDI and showed that the theories of vertical FDI found empirical support only recently. Recent evidence for vertical FDI is based on three reasons: an increasing role of vertical FDI in the 1990s, improved estimation techniques and new detailed data sets.

Under the term "FDI Life Cycle" Chapter 3 explored how the pattern of FDI inflows into transition countries changed over time. The theoretical model developed in this chapter argued that FDI inflows affect the host country characteristics and, in turn, the changes of host country characteristics influence the composition of FDI flows. Thus, the results explain why we should observe a changing pattern of FDI inflows during the catching-up process in transition countries: Vertical cost seeking FDI dominates in the beginning of the transition process in order to exploit low factor prices, while the share of horizontal FDI increases over time, as the market becomes larger and higher factor prices drive out vertical FDI. In the second step, Chapter 3 provided empirical evidence for the changing composition of FDI inflows to Central and Eastern Europe. The main observation was the falling share of vertical FDI on total German FDI inflows in CEE since middle of the 1990s, while the share of horizontal FDI increased. This is a clear evidence for

the "FDI Life Cycle", since the host countries experienced increasing labour costs and growing market size in this period of time. In particular, estimation results indicated a negative relationship between the share of vertical FDI in total FDI inflows and difference in production costs as well as the size of the foreign market.

Chapters 4 and 5 argued that vertical and horizontal FDI have different impacts on the home and host countries of multinational enterprise. Chapter 4 illustrated theoretically and empirically, that vertical FDI leads to a complementary relationship of labour demand between different affiliates of multinational enterprise. For example, a wage increase in a CEE affiliate leads to lower labour demand in the parent company in Germany. In case of horizontal FDI there is no such marginal relationship between different locations, since affiliates produce the same goods and the production processes are not interconnected. In order to analyse the impacts of vertical and horizontal FDI, Chapter 4 also developed three alternative ways to identify each type of investment from the firm level data. These three approaches were used to estimate the labour demand function of the multinational enterprise. The outcome was a clear evidence for complementarity in labour demand for vertical FDI, while there was no significant relationship for horizontal FDI with respect to wages in other locations. Estimation results also pointed to some substitutional features for both types of FDI, since increasing sales in Central and Eastern Europe lead to lower labour demand in Germany. The findings provide a refinement of previous literature on FDI employment effects, because the total effect between two countries depends significantly on the composition of FDI flows between them.

Chapter 5 explored the impacts of vertical and horizontal FDI on a host transition country. The main focus was on technology spillovers from foreign to local firms, however, other differences between the two types of FDI like technology and employment were also considered. Using data for the Czech

manufacturing sector Chapter 5 showed that vertical and horizontal FDI generate different technology spillover effects from foreign affiliates to domestic firms. Employing spillover channels like knowledge about export markets or labour turnover, vertical export oriented FDI has a positive impact on the productivity of local firms. Horizontal market seeking FDI exploits other spillover channels, like competition or imitation, and exercises a negative effect on domestic firms. Such contradictory result adds a new perspective to the explanation of inconsistent results from the previous literature on FDI spillover effects, since different investment types dominate in FDI flows to different countries. The estimation results also showed that a larger share of foreign firms in an industry has a negative effect on the productivity of local firms in the same industry. Besides the spillover effects, Chapter 5 explored the patterns of vertical and horizontal FDI in a host country, which is the first empirical attempt to analyse the distribution and the time pattern of vertical and horizontal FDI. The empirical findings widely support theoretical predictions that vertical FDI are more labour intensive than horizontal, while horizontal FDI takes place in industries with high transportation costs. In sum, taking different characteristics and effects into account, vertical FDI have a stronger positive effect on the host economy than horizontal FDI.

This thesis is the first step in the empirical analysis of impacts and roles of vertical and horizontal FDI. It emphasizes the necessity to distinguish between different investment types when analysing the effects of FDI. However, further research on vertical and horizontal FDI is necessary in the fields of growth, trade and agglomeration effects. These topics are already well discussed for FDI as a whole but are still widely unexplored for different types of investment flows.

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