TRADE AND FDI FLOWS IN THE INTERNATIONAL ECONOMY

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Abbreviations

BFTA	Baltic Free Trade Area
BSR	Baltic Sea Region
CEEC	Central and Eastern European Country
CEFTA	Central European Free Trade Area
CES	Constant Elasticity of Substitution
CET	Common External Tariff
CGE	Computable General Equilibrium
CIS	Commonwealth of Independent States
CU	Customs Union
DOLS	Dynamic Ordinary Least Squares
EA	Europe Agreement
EC	European Community
ECB	European Central Bank
ECSC	European Coal and Steel Community
EEC	European Economic Community
EMU	Economic and Monetary Union
EU	European Union
FDI	Foreign Direct Investment
FE	Fixed Effects
FEVD	Fixed Effects Vector Decomposition
FTA	Free Trade Agreement
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GMM	General Methods of Moments
H-O	Heckscher-Ohlin
HT	Hausman-Taylor
IA	Interim Agreement
IIA	Independence of Irrelevant Alternatives
IV	Inclusive Value
LR	Likelihood Ratio
MFN	Most Favoured Nation

MiDi	Micro database Direct Investment
MNE	Multinational Enterprise
NEG	New Economic Geography
NUTS	Nomenclature des Unités Territoriales Statistiques (Nomenclature of Territorial Units for Statistics)
OCA	Optimum Currency Area
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PISA	Programme for International Student Assessment
POLS	Pooled Ordinary Least Squares
R&D	Research and Development
RE	Random Effects
RHS	Right Hand Side
ROW	Rest Of the World
RTA	Regional Trade Agreement
UK	United Kingdom
US	United States
USA	United States of America

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CHAPTER 1 PREFACE

1.1 Introduction

During the past decades, globalisation in all of its facets dominated many controversial debates of political leaders and common citizens and called the predominant attention of the international press and the scientific community. A major phenomenon in this context is the ongoing internationalisation of the economic activities of firms. The simultaneous interest in Foreign Direct Investment (FDI) and trade can be attributed to the fact that the two modes at times complement each other or conduce to alternatives in serving a foreign market. The crucial questions that arise in this context are diverse.

Trade activities around the world have since the 1950s largely been backed by Regional Trade Agreements (RTAs) with 214 of them being actively in force (Fiorentino, Verdeja and Toquebeouf 2007). The number of RTAs particularly surged during the past 15 years, coming along with stagnating multilateral negotiations. In Europe, the transition of centrally planned economies to market economies rearranged trade relations between the East and the West profoundly. As an important starting point, the Central and Eastern European Countries (CEECs)[1] signed the so-called Europe Agreements (EAs) with the European Union (EU) in the 1990s. The agreements recognised the CEECs' aspiration to EU membership and allowed for the establishment of Interim Agreements (IAs), which gradually liberalised bilateral trade between the two regions. The eventual EU accession of the CEECs in 2004 and 2007 represented a peak in the process of European integration, but it was not the end of it. From the very beginning, the longsome procedure of negotiations and ratifications has been accompanied by major uncertainties related to the preferential nature of the trade concessions. Whole countries, separate industries or single economic actors outside as well as inside the

[1] Unless otherwise stated the CEECs comprise in this study Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

EU raised concerns about possible adverse effects for themselves (see e.g. Neven 1994). Against this background, a thorough analysis of the trade effects of the agreements on member states and on the Rest Of the World (ROW) can provide important insights about whether and to which extent the Free Trade Agreements (FTAs) have actually caused a geographical restructuring of trade flows.

Almost simultaneously with the signature of the first IAs, the treaty of the EU, widely known as the Maastricht treaty, introduced the Economic and Monetary Union (EMU) as a long term strategy towards the move to a common currency. Although all 27 EU member states participate also in the EMU, only a subset of 15 countries has introduced the Euro yet. In 2007, Slovenia officially adopted as the first of the new EU member states the single currency. Malta and Cyprus followed in 2008 and Slovakia has been approved by the EU commission, the European Central Bank (ECB) and the council of the EU to introduce the Euro by 1 January 2009. Other EU member states will follow in due course although exact dates of entry have not been fixed yet. While the events of real and monetary integration in Europe bear analogies, the underlying questions are distinct. Mundell's (1961) statement that only highly integrated countries can successfully form a currency union has been challenged since Rose's (2000) finding of large ex-post trade gains. In the eve of the CEECs' accession to the Euro Area, it is therefore crucial to obtain information about its potential impact from a trade perspective.

While the enlargement of the EU and the EMU to the East keeps raising fears in the public, the strong increase of FDI flows[2] over the past decades has redirected a great part of scientific interest towards a better understanding of its causes and consequences. In Germany, media and academic research have been heavily concerned with firms shifting their production facilities to low cost countries while staying comparably silent about the determinants and effects of inward FDI. Although recent studies find significant positive effects of inward FDI on the local economy (see e.g. Bitzer and Görg 2008), there exists – to the best of my knowledge – no study investigating the regional determinants of location choices of foreign multinationals in Germany. The analysis is, however, of substantial interest to both, the scientific community and policy makers. Heterogeneities across the German federal states may drive or hamper the competitiveness of regions in the attraction of FDI.

[2] FDI outflows rose by 45.2% and FDI inflows by 38.1% in 2006 amounting to FDI stocks of 12474 and 11999 billions of US$, respectively (UNCTAD 2007: 9).

Accordingly, investigating the determinants of inward FDI endows policy makers with new tools to enhance the relative competitiveness at the regional level.

The preface chapter continues with providing the theoretical (Chapter 1.2) and empirical background (Chapter 1.3) for the topics that have briefly been touched. Based on the state of the existing research, Chapter 1.4 formulates the main research questions and outlines where these will be picked up within this thesis.

1.2 Theoretical Background

This chapter aims at sorting the topics highlighted in the present thesis into the existing theoretical literature. The brief overview does not claim to be exhaustive; rather, the focus of the main chapters determines a selection of theoretical aspects that crucially redound to the understanding of the aspects discussed later on. To start with, I lay out the Vinerian concepts of trade creation and trade diversion (Chapter 1.2.1) and the new trade theory predictions (Chapter 1.2.2) that arise in the context of preferential trade liberalisation. The trade effects of regional integration in Europe will be studied with the help of gravity equations. Chapter 1.2.3 continues therefore with providing some theoretical underpinnings of gravity models. Finally, Chapter 1.2.4 discusses the basic concepts behind the location choice theory.

1.2.1 Trade Creation and Trade Diversion

Theoretical insights into the allocation effects of RTAs were first given by Viner and Byé; their contributions in the 1950s laid the analytical foundation for the Customs Union (CU) theory (Viner 1950; Byé 1950). Before that, economists mostly regarded regionalism as a step towards free trade.[3] The idea behind this perception is that global free trade allows consumers to purchase from the cheapest source of supply, so that production can be located according to comparative advantages. Trade barriers, in contrast, discriminate against foreign supply and divert consumption to the output of domestic industries, even though produced at

[3] There were few exceptions to this view, however. Robbins states in 1937: "…From the international point of view, the tariff union is not an advantage itself. It is an advantage only in so far as, on balance, it conduces to more extensive division of labour." (Robbins 1937: 122). In 1944, Hawtrey even went further than theoretically justified, writing: "In fact the wider the extent of economic activity encircled by a tariff barrier of given height, the greater is its effect in excluding the goods of foreign producers." (Hawtrey 1944: 135).

higher costs. As a consequence, a partial liberalisation through RTAs, reducing at least some tariffs, was widely assumed to generate gains from trade.

Viner questioned the free-trade perception of regional integration arguing that a fractional reduction of trade barriers leads only to a shift, but not to an elimination of the discrimination of different sources of supply. The change in the location of production following the establishment of a CU is accompanied by two opposing effects, the net economic effect of which depends on whether the diversion of purchases is in favour of lower or higher money-cost sources of supply (Viner 1950: 42). In his famous contribution “The Customs Union Issue”, Viner clearly distinguished between trade-creating and trade-diverting effects of CUs.

Trade creation is associated with the portion of the new trade between member countries that is wholly new resulting from an improvement in the international resource allocation. It occurs when subsequent to the formation of a CU, domestic production at high costs is replaced by lower-cost sources from the new partner country. This shift has two aspects: first, it leads to a reduction or elimination of higher-cost domestic production of goods which can now be imported from the more efficiently producing partner country. This saving in real costs is called the production effect. Second, the shift induces a rise in consumption of those goods now being imported at lower costs from the partner country that had to be consumed at higher costs prior to the trade deal. The resulting gain in consumer surplus is called the consumption effect.

Trade diversion refers to the part of the new trade between member countries that is only a substitute for trade with third countries. It describes a situation in which the preferential trade liberalisation causes higher-cost production from the new partner country to replace imports from low-cost sources in the ROW. In this case, the resource allocation is worsened. Here again, two effects can be distinguished: first, the production effect consists this time of a cost increase for those goods initially imported from an efficient producer in a non-member country and now taken from the new trading partner. Second, the consumption effect comprises a loss in consumer surplus due to the substitution of lower-cost goods from outside the CU for higher-cost goods from the partner country (Lipsey 1957: 40).

According to the above portrayal of orthodox theory of CUs, trade diversion is associated with a loss of exports for the ROW and thus, its reduced ability to purchase

imports.[4] Trade creation, in contrast, is associated with an increase in exports for the RTA member states. Since every CU will be trade-creating in some and trade-diverting in other sectors, Viner suggested that the net impact of the tariff reduction depends on the relative magnitude of the two opposing effects. He recognised, however, that even if trade-creating forces are predominant, the outside world loses in the short run due to the reduction in trade, while, in the long run, it may benefit from the worldwide diffusion of the increased propensity (Viner 1950: 44). This aspect was formally assessed only in the context of the new trade theory.

1.2.2 The New Trade Theory and Regional Integration[5]

The original framework for studying allocative effects of CUs is based on the assumptions of perfect competition and homogenous products; the only sources of trade creation and trade diversion are differences in factor endowment and productivity. In the Vinerian CU theory, the issue of economies of scale was partly taken into account. From three possible pre-union situations, production in both, production in neither and production in one of the two member states, Viner analysed only the latter case: in the presence of economies of scale, imports from the ROW will necessarily be replaced by dearer domestic production, because the established Common External Tariff (CET) allows either the initial producer or a new producer (who will drive out the established producer) to capture the whole union market. Viner termed this effect – which occurs equally when there is no initial production – trade suppression. Contrary to the case of trade diversion, the dearer source is a newly established domestic producer. Finally, if both contracting countries were producing the good before the implementation of the CU, the more efficient producer will now serve the whole market at lower costs. Again, the effect differs from trade creation in the sense that instead of moving to a cheaper source of supply a cheapening of an existing source of supply takes place.

[4] In principle, this loss could be offset by consuming the freed resources domestically. There are, however, situations, in which the reduced exports cannot be perfectly balanced out. First, there may be market distortions, allowing exporters to generate extra profits from selling a good abroad. If the exporter was able to charge monopoly prices selling his goods abroad or if exports (or imports) were taxed, trade diversion may lead to an income loss in the ROW that exceeds the value of the freed resources. Second, the decreased export demand might force down the prices of the ROW's exports and worsen thereby its terms-of-trade. And third, if the reduction of exports is substantial, producers in the ROW may additionally suffer losses of specialisation benefits (Schiff and Winters 2003: 213ff).

[5] Robson (1998) provides an excellent overview on this issue.

Hence, economies of scale can be incorporated into the framework of orthodox CU theory. The traditional concepts of trade creation and trade diversion must simply be supplemented (or extended) by two further effects – trade suppression and cost reduction. Nevertheless, many issues concerning economies of scale were left unresolved by the fact that orthodox analysis can only assess the impact of integration on inter-industry trade but not on intra-industry trade which predominates in Europe since the 1960s (Caves 1981). In this connection, it seems plausible that Viner underestimated the importance of scale economies "[…] there is one qualification in favor of customs union [economies of scale] which needs to be made, on which both free-traders and protectionists can with reason find some common ground, although, in the opinion of the writer, they both tend to exaggerate its importance for the customs union problem." (Viner 1950: 45).

Only the new trade theory evolving in the early 1980s was able to assess the possibly more realistic cases of imperfect competition. While not denying that there are some sectors in the economy in which factor endowments and specialisation according to comparative advantages play an important role, the new approach focuses on the explanation of intra-industry trade in similar products. Even if countries were completely identically endowed and traditional specialisations gains could not be attained, they can still benefit from regional integration by concentrating their production in industries with increasing returns to scale (assuming that there are no excessive transport costs). Potential gains from regional integration arise from

- Increased competition: the reduction of internal trade barriers increases the effective market size, giving rise to more competition and reducing the possibilities for market segmentation;
- Cost reduction: to meet the increased demand of the larger market, firms need to produce a higher output which enables them to reduce their costs;
- Higher product diversity: the increased market size may also allow producing a bigger range of goods profitably, augmenting thereby the consumers' welfare;
- Higher plant specialisation: by reducing production costs integration may lead to producing fewer varieties in one plant, thus, using the production facilities more efficiently and lowering costs in turn again.

With respect to the impact of regional integration for the ROW, the new trade theory makes two statements. First, considering only the relative price changes taking place, the

improved competitiveness of the union may result in a decline of imports from third countries. However, once the income effect is taken into account, the net import demand of the trade bloc may even go up, depending on the relative magnitude of both effects. Second, even if losses from trade diversion occurred, they can be offset by the competitive gains through lower prices (Robson 1998).

Despite of these achievements, analytical elaboration has shown that most of the mentioned arguments depend on the particular circumstances of RTAs and CUs in practice. Viner was well aware of this and stated: "confident judgement as to what the over-all balance between these conflicting considerations [trade creation and trade diversion] would be, it should be obvious, cannot be made for customs unions in general and in the abstract, but must be confined to particular projects and be based on economic surveys thorough enough to justify reasonably reliable estimates as to the weights to be given in the particular circumstances to the respective elements in the problem." (Viner 1950: 52).

1.2.3 The Gravity Equation to International Trade

Two methods have in the past been used to quantify the effects of regional integration on international trade patterns – Computable General Equilibrium (CGE) and gravity models. CGE models are typically used in ex-ante simulations to forecast the effect of trade policy. Their general equilibrium character reflects the manifold interdependencies between sectors, policy fields and market actors well. On the one hand, the CGE models' rigorous and complex theoretic underpinnings help reproducing the various relationships and interlinkages within an economy; on the other hand this intricacy makes the model hard to tackle for researchers and policy makers. Since CGE models are very sensitive to the parameters included, the data used and the assumptions made about the model structure, they have to be interpreted accordingly (Piermartini and Teh 2005).[6]

An alternative to CGE models are empirical gravity models, mostly employed in ex-post analyses of trade policies. This thesis uses and develops gravity equations to capture the effects of trade creation and diversion throughout the process of European integration of the CEECs. Whilst gravity models can appraise with traditional econometric criteria, they do not aim to capture the various interactive effects associated with the formation of an RTA. Their

[6] Panagariya and Duttagupta (2001) underline the sensitivity of results by showing that beneficial trade liberalisation predicted by CGE models is in many cases due to a wrong model structure and wrong parameter values.

static nature makes them subject to the Lucas critique.[7] Other more specific points of critique that apply to this method will be discussed in the respective sections.

Tinbergen (1962), Pöyhönen (1963) and Linnemann (1966) were among the first authors to apply the physics' gravity equation to international trade. Despite the lacking theoretical support at the beginning, the model's high explanatory power turned it quickly into a popular instrument for the empirical analysis of trade flows. The basic idea is that the intensity with which a pair of countries trades is subject to pull factors like their respective Gross Domestic Products (GDPs) and push factors like trade impediments in the form of customs duties or the geographic distance between them. In its simplest form, the equation takes the form

$$M_{ij} = k\frac{Y_i Y_j}{D_{ij}} \tag{1.1}$$

where M_{ij} denotes the imports of country *i* from country *j*, Y_i and Y_j are measures for their economic sizes and D_{ij} stands for the distance between the two countries (k is a parameter constant). Although intuitively plausible, equation (1.1) is not model-based. Especially striking is the missing connection to classical trade theory. Neither technological differences nor relative factor endowments play a role. On the contrary, since the import value is related to the product of the countries' GDPs, the similarity with respect to their relative sizes also matters.

Against this background it is not astonishing that first attempts to endorse the model with a sound theoretical foundation emerged mainly in the context of the new trade theory and were based on a set-up of increasing returns to scale, imperfectly competitive markets and firm-level product differentiation (Helpman and Krugman 1985; Bergstrand 1989, 1990).[8] Helpman (1987) went on to demonstrate that the trade volume in the Heckscher-Ohlin (H-O) model under factor price equalisation is independent of the country sizes, concluding, thus,

[7] In a macroeconometric framework, Lucas stated that a policy change alters the parameters of the model, so that inferences based on a structural model become invalid (Lucas 1976).

[8] In an early attempt to endorse the gravity equation with a theoretical framework, Anderson (1979) models goods to be differentiated by country of origin. This so-called Armington assumption was overcome with the concept of monopolistic competition.

that the gravity equation cannot arise from any market structure but monopolistic competition. Deardorff (1998), however, showed that the standard H-O model, based on comparative advantages and perfect competition, permits interpretations that correspond to the gravity model as well as the new theories of international trade.[9]

With respect to the theoretical underpinnings of the gravity equation, this thesis is methodologically closely related to the discussion of multilateral trade resistances. In a gravity study on trade flows between Canadian and United States (US) provinces, McCallum (1995) came to the remarkable conclusion that cross-provincial trade is up to 22 times larger than cross-border trade. These extraordinarily high numbers gained some fame under the title "McCallum border puzzle". Probably even better known has in the meantime become the solution to the puzzle, as developed by Anderson and van Wincoop (2003). The authors build upon Anderson's (1979) Constant Elasticity of Substitution (CES) expenditure system with monopolistic competition in differentiated products. Unlike the early work in gravity theory, in which prices were assumed to be identical across countries, Anderson (1979) accounted for "price effects" related to transportation costs and other border barriers that cause prices to differ internationally. By using an implicit solution of the price terms (compare equation (1.12) in Box 1.1), Anderson and van Wincoop (2003) demonstrate that each country's price index depends on these border barriers and on its trading partners' price indices which again depend on their respective border barriers and their trading partners' price indices. For this reason, the eventually derived gravity equation defines trade not as a function of the bilateral trade resistance of two countries in a trading pair but as a function of the bilateral trade resistance relative to the multilateral trade resistance of these two countries to trade with the ROW (see Box 1.1 for a formal derivation of Anderson and van Wincoop's (2003) gravity equation).[10] As earlier studies (including McCallum) did not properly take this fact into

[9] In light of the theoretical advances, authors have begun to assess the portion of the competing theories in the success of the gravity equation. Evenett and Keller (2002) use several trade models to see whether the gravity model shows a better performance in sub-samples of country pairs that better fit the presumptions of the different models. They find that trade between an industrialised and a developing country can be well explained by an imperfect specialisation H-O model of trade in homogenous goods (Evenett and Keller 2002: 283). Focusing on transition countries, Kandogan (2003) examines the role of the competing trade theories in the different components of trade. His main finding is that the H-O theory explains the inter-industry component of trade while intra-industry trade components are elucidated by the new trade theory. However, since "[…] the gravity equation appears to characterize a large class of models", Deardorff warned that "its use for empirical tests of any of them is suspect." (Deardorff 1998: 21).

[10] Different approaches on how to include the multilateral trade resistances correctly in empirical gravity applications are discussed in Chapter 2.4.1.

account, they could not explain why a country (or a province) is pushed towards trading with a given partner.

Box 1.1: The Gravity Equation by Anderson and van Wincoop (2003)

Since the gravity estimations in Chapters 2 and 3 of this thesis will be built upon an Anderson and van Wincoop-like specification, I briefly lay out its foundation. Anderson and van Wincoop's (2003) homothetic, identical CES preferences take the functional form of

$$U_i = \left(\sum_{j=1}^{J} \beta_j^{(1-\sigma)/\sigma} c_{ij}^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)} \quad \text{with} \quad \sigma \in (1, \infty) \tag{1.2}$$

where c_{ij} is country *i*'s consumption of goods from country *j*, β_j is a positive distribution parameter and $\sigma \in (1, \infty)$ is the above-unity elasticity of substitution between goods originating from country *i* and country *j*. Assuming CES preferences might not be realistic for every product pair, but secures that consumers always prefer the same product originating from the geographically closest country and allows thereby incorporating a key feature of the gravity equation – the negative relation between distance and trade – into the model. Transport costs t_{ij} are assumed to be of the "iceberg" type, where a fraction $(t_{ij} - 1)$ of the total imports of a certain good "melts" away in transit. Since transport costs are shifted to the importer, the 'landed' c.i.f. (cost, insurance, freight) price is in most studies defined as

$$p_{ij} = t_{ij} p_j \tag{1.3}$$

as a function of bilateral trade costs t_{ij} and the f.o.b. (free on board) price p_j. The representative consumer in country *i* maximises its utility subject to the budget constraint

$$Y_i = \sum_{j=1}^{J} p_{ij} c_{ij} \tag{1.4}$$

with Y_i being country *i*'s aggregate nominal expenditure, which yields the demand

$$c_{ij} = (\beta_j p_{ij} / P_i)^{-\sigma} (Y_i / P_i) \tag{1.5}$$

where P_i refers to country *i*'s price index for all import-competing goods, defined as

$$P_i = \left(\sum_{j=1}^{J} (\beta_j p_{ij})^{(1-\sigma)} \right)^{1/(1-\sigma)}. \tag{1.6}$$

From the definitions and derivations outlined, it follows that the total value of country *i*'s imports from country *j* can be expressed as

$$M_{ij} = p_{ij} c_{ij} \tag{1.7}$$

whereby substituting from equation (1.5) gives

$$M_{ij} = Y_i \left(\frac{\beta_j p_{ij}}{P_i} \right)^{1-\sigma} . \tag{1.8}$$

Employing general equilibrium conditions has the convenient side effect of eliminating the distribution parameter β_j, for which data is not on-hand. Producer prices in country *j* must then adjust, such that

$$Y_j = (\beta_j p_j)^{1-\sigma} \sum_{i=1}^{I} \left(\frac{t_{ij}}{P_i} \right)^{1-\sigma} Y_i . \tag{1.9}$$

Anderson (1979), Deardorff (1998) and Anderson and van Wincoop (2003) solve now for the scaled prices $p_j \beta_j$ by assuming that all supply prices p_j are equal to one, thus,

$$p_j \beta_j = \left(\frac{Y_j}{\sum_{i=1}^{I} \left(t_{ij} / P_i \right)^{1/1-\sigma} Y_i} \right)^{1-\sigma} . \tag{1.10}$$

Substituting back into equation (1.8) and defining $Y_w = \sum_{i=1}^{I} Y_i$ then gives

$$M_{ij} = \frac{Y_i Y_j}{Y_w} \left(\frac{t_{ij}}{P_i P_j} \right)^{1-\sigma} \tag{1.11}$$

where

$$P_i^{1-\sigma} = \sum_{j=1}^{J} P_j^{\sigma-1} t_{ij}^{\ 1-\sigma} \frac{Y_j}{Y_w} . \tag{1.12}$$

Equation (1.12) reveals that the equilibrium price index depends on the average transport costs of all exporters to importer *i*, weighted by their import shares, as well as on the price levels of the trading partners. Since their price levels are, in turn, influenced by their bilateral trade costs to all importers and their respective price levels, the price level in country *i* eventually depends on all bilateral trade costs, even when they do not directly affect country *i*. These multilateral trade resistances are the central innovation of Anderson and van Wincoop (2003).

The latest evolution of trade models in which productivity differences across firms together with variable and fixed export costs ensure that only the most productive firms serve foreign markets (see Melitz 2003), have proved to be compatible with gravity specifications as well. Helpman, Melitz and Rubinstein (2007), Felbermayr and Kohler (2007) and Chaney (2008) incorporate important features of Melitz' heterogeneous firm model into the gravity framework. Since only those firms that produce with a productivity above a certain threshold find it profitable to export, the authors are able to explain the existence of zeros in the trade

matrix. Helpman, Melitz and Rubinstein (2007) propose a two-stage estimation to control for sample selection and unobserved heterogeneity where the probability with which two countries trade is calculated in the first step (the so-called extensive margin of trade) and their trade volume is calculated in the second step (the so-called intensive margin of trade). Based on a Tobit model, Felbermayr and Kohler (2007) find in this context that a trade policy may exert influence by increasing the number of trading partners, even though it did not significantly boost the volume of non-zero trade.[11]

1.2.4 The Location Choice Theory

Until the 1990s, a great part of the regional economic literature followed Marshall's early propositions from the 1920s that firms would cluster in space first, because concentrated industries entail a specialised pooled labour market, second, because clusters support the production of non-tradable inputs and third, because informational spillovers improve each firm's production function. Marshall was not aware of the distinction of technological externalities, which affect the production function of a firm directly through nonmarket interactions from pecuniary externalities, which are mediated by market prices. In a survey article, Krugman (1996) lists centripetal and centrifugal forces that affect the location of economic activity in various models. The centripetal forces include natural location advantages, market size, external economies related to demand and supply linkages and pure external economies in the sense of knowledge spillovers. The centrifugal forces comprise market (e.g. commuting costs and land rent) and nonmarket forces (e.g. congestion). Contrary to Marshall, Krugman (1996) emphasises the distinction between the two kinds of externalities, which have motivated different strands of research.

Pure or technological externalities are extensively discussed by Fujita and Thisse (1996). The authors describe a simple model that goes back to Fujita, Imai and Ogawa and in which the agglomeration force is the existence of informational spillovers among firms. With r_i and w_i as location i's land and wage rates and S_f and L_f as the amount of land and labour needed by the firm, its profit can be described as

[11] The authors contradict herewith Rose's (2004) notion that "we currently do not have strong empirical evidence that the [General Agreement of Tariffs and Trade (GATT)] GATT/WTO has systematically played a strong role in encouraging trade" (Rose 2004: 98).

$$\pi_i = a_i - r_i S_f - w_i L_f \,. \tag{1.13}$$

a_i represents the aggregate benefit a firm enjoys from information, which is an increasing function of the density of firms at location *i*. Intrinsic to the model are therefore on the one hand a positive effect of agglomeration that rises with the number and the closeness of firms. On the other hand, agglomeration in a single area increases the commuting distance of workers and provokes higher wages and land rents in the surrounding area. The equilibrium distribution of firms is therefore determined as a balance of two forces of agglomeration, the positive network spillovers and the negative competition pressures.

Theoretical work grouped under the name New Economic Geography (NEG) and initiated by Krugman (1991) leaves technological externalities aside and emphasises pecuniary externalities instead. Although the strand of literature belongs to regional economics rather than international trade economics, it shares some common analytical elements with the latter. A key element in location choice theory is that in the presence of Samuelsonian iceberg-type transportation costs and a monopolistically competitive environment with scale economies, producers want to concentrate close to their potential customers. Consumers, in turn, also have incentives to co-locate with firms, because the clustering of economic activities bids up factor prices and lowers the overall price index through mill-pricing. Thus, forward linkages (the supply of more varieties of a good increases the workers real income) and backward linkages (a greater number of consumers attracts more firms) trigger a self-reinforcing process of spatial concentration which is the essence of Krugman's model. It explains why two equivalent regions persistently diverge due to small historical accidents. Such a locked-in core-periphery structure is likely to occur under certain circumstances, namely if (i) transportation costs are positive, but low, (ii) goods are sufficiently differentiated and (iii) the share of the manufacturing sector (relative to the homogenous agricultural sector) is large.

Interestingly, the proximity-concentration trade-off that is known from the recent FDI literature (see e.g. Helpman, Melitz and Yeaple 2004) offers very similar predictions as the NEG. While the former is confronted with a firm's location decision between two countries, the latter is concerned with the location of economic activity between two regions within one country. The choice whether to produce at home (and export) or abroad (and set up a foreign affiliate) is in many respects only a special case of the geographical organization of markets:

first, scale economies make it profitable to concentrate production in a relatively small number of plants, so that increasing returns constitute a centripetal force in the NEG and a force towards extending production at home and exporting in the theory of the multinational firm. Second, the geographical extension of markets together with positive transportation costs implies that production is dispersed, which is called a centrifugal force in the NEG and induces the establishment of a production affiliate abroad via FDI in the theory of the multinational firm. Hence, in both fields, one can find a fundamental trade-off between scale economies and transportation costs. Recent research on the multinational firm's location choice rely on integrated FDI and NEG models with the decision to invest at home or abroad and the decision where to invest abroad as two steps of one decision making process (Mayer, Méjean and Nefussi 2007).

1.3 Empirical Overview

After having provided some theoretical background, this chapter gives an overview of the gravity-based empirical literature on the trade effects of the EU integration of the CEECs (1.3.1) and of the adoption of the Euro as the single currency (1.3.2). It continues with discussing the available evidence on the determinants of inward FDI (1.3.3).

1.3.1 Trade Effects of the EU Integration of the CEECs

Not only on a theoretical basis, but also in the numerous empirical applications, have several adjustments been made since the original formulation of the gravity equation. Most studies nowadays include a wide range of dummy variables to capture cultural proximity (such as a dummy for a common language or colonial ties) or to better approximate the geographical distance between trading countries (e.g. through adjacency, island or landlocked dummies). Since Aitken (1973), dummy variables have also regularly been employed to quantify the effects of FTAs on the direction of trade. Over time, intra-bloc dummies have been supplemented by extra-bloc dummies to account for the possibility that the effects of a trade policy occur not only among participating countries but also between participating and non-participating countries, as discussed in Chapter 1.2.1.

The studies that explicitly assess the EU FTAs signed with the CEECs are listed in Table 1.1.[12] Early analyses by Laaser and Schrader (2002) and Paas (2003) use cross-section estimation techniques and put a special focus on the Baltic Sea Region (BSR). The authors explain the strongly significant and positive estimate of the BSR dummy through the Baltic Sea as a means to save transport costs. Against this, Laaser and Schrader (2002) report an insignificant EU dummy in all of their specifications and Paas (2003) even goes further providing results that indicate that East-West trade flows are only 0.7 times as large as other trade flows under ceteris paribus conditions.

The first gravity-like equation estimates of EU-CEEC trade from Martín and Turrión (2001) were based, however, on a panel data set and point into a different direction. The authors assess the share of exports of a country in the imports of the trading partner through a set of control variables, amongst these, a set of regional dummy variables. Their main result suggests that the rise of EU-15 exports in CEECs' imports has been stronger than in other Organisation for Economic Co-operation and Development (OECD) countries' imports. Reversely, the CEECs' exports in EU-15 imports have also increased, but to a much lesser extent.

Adam, Kosma and McHugh (2003) assess the impact of the EU-CEEC FTAs against the intra-CEEC FTAs, like the CEFTA and the BFTA. According to their estimates, the latter agreements performed comparably better and were able to outweigh potential trade-diverting effects due to the hub-and-spoke nature of the EU-CEEC FTAs. This result is confirmed by the study of De Benedicitis, De Santis and Vicarelli (2005) who come to a similar overall conclusion when employing a system GMM estimator.

Using the same estimation technique, but a worldwide country sample Herderschee and Qiao (2007) find substantially higher estimates for the EU-CEEC FTA and the CEFTA dummy. As a robustness check, they additionally differentiate between the impacts of the agreements on individual countries. Among the CEECs-12, Poland benefited most and Slovenia least. The most recent study by Caporale, Rault, Sova and Sova (2008) applies the FEVD estimator[13] to an EU-15 plus four CEECs dataset and reports a trade increase of 23% attributable to the agreements.

[12] For studies assessing the general impact of the EU as a whole, see e.g. Bayoumi and Eichengreen (1995) or for a more recent study, see Carrère (2006).
[13] For details on this estimator, see Appendix A2.4.

Table 1.1: Literature on the Trade Effects of the EU-CEEC FTAs

Study	Innovation	Data	Estimation technique	Results
Martín and Turrión (2001)	First estimates of EU-CEEC FTAs' effect on trade	1988-1998, OECD plus Estonia and Slovenia	Two-step panel Fixed Effects (FE)	Increase of export share of the EU in CEECs' imports is sharper than the other way around (coefficients of 2.38 and 0.83 respectively)
Laaser and Schrader (2002)	Baltic States' trade relations	1995 and 1999, EU-15 and twelve CEECs	Cross-section Ordinary Least Squares (OLS)	BSR dummy exhibits significantly positive influence on Baltic States' ex- and imports, rest-EU dummy insignificant
Adam, Kosma and McHugh (2003)	Assessment of EU-CEEC FTAs against Central European Free Trade Area (CEFTA) and Baltic Free Trade Area (BFTA)	1996-2000, 37 OECD, Eastern European and Commonwealth of Independent States (CIS) countries	Two-step panel FE	EU-CEEC FTAs stimulated trade, but to a lesser extent than CEFTA and BFTA
Paas (2003)	Assessment of EU-CEEC trade against other special trading zones (e.g. the BSR)	2000, EU-15 and twelve CEECs	Cross-section OLS	East-West flows on average 0.7 times as large as other trade flows.
De Benedictis, De Santis and Vicarelli (2005)	Approach allows to distinguish between centre-periphery and intra-periphery trade	1993-2003, EU-15 and eight CEECs	System General Methods of Moments (GMM)	FTAs boosted CEECs' bilateral trade by 11% (14% for intra-periphery agreements)
Herderschee and Qiao (2007)	Impact of various trade agreements (over time)	1990-2005, selection of world wide countries, not further specified.	Panel FE and system GMM	EU imports from the CEECs rise between 35 and 55% depending on the estimation technique, Poland benefited most, Slovenia least
Caporale, Rault, Sova and Sova (2008)	Trade effect of EU-CEEC-4 agreements	1987-2005, EU-15, four CEECs and Belarus, Russian Federation and Ukraine	Panel FE, Random Effects (FE) and Fixed Effects Vector Decomposition (FEVD)	EU trade with CEECs increases by 23%, no evidence for trade diversion

1.3.2 Trade Effects of the Introduction of the Euro

Since Rose's (2000) finding that members of currency unions trade over three times more with each other, a large body of literature emerged mainly preoccupied with reducing the effect through improved specifications. Possibly due to the contemporaneous event of the introduction of the Euro as the single currency of initially eleven EMU member states, much of this research has focused on Europe (see Table 1.2 for an overview).

The first of the numerous EMU-specific estimates can be found in Micco, Stein and Ordoñez (2002) only three years after the official introduction of the common currency. The authors are doing well in reducing what has become known under the name "Rose effect" by providing estimates in the range of 5 to 20%. With the same data set, but a different estimation method, Faruqee (2004) reduces the effect further to 7 to 8%, where 2001 and 2002 are identified as the years with the strongest impact. On an individual country level, Spain and the Netherlands experience the largest trade gain through their Euro adoption, while Portugal, Finland and Ireland underperformed over the time period considered.

The subsequent studies attempted to give more insights either by differentiating across industries or by further improving the empirical specification. In the first class of studies, Baldwin, Skudelny and Taglioni (2005), Flam and Nordstrom (2006a) and De Nardis, De Santis and Vicarelli (2007) agree in attributing a positive, significant Euro effect in particular to sectors characterised by economies of scale and product differentiation. While also presenting sectoral estimates, the study by Baldwin, Skudelny and Taglioni (2005) is primarily interested in providing a rationale for a positive Euro effect even when exchange rate volatility is already brought down to zero. Their model shows that the Euro effect increases disproportionately when exchange rate volatility approaches zero, since more small firms that are especially affected by the uncertainty, enter the export markets. Thus, along with the sales per firm (intensive margin), the number of firms (extensive margin) increases (compare also Chapter 1.2.3).

Table 1.2: Literature on the Trade Effects of EMU Integration

Study	Innovation	Data	Estimation technique	Results
Micco, Stein and Ordoñez (2002)	First estimates of the Euro effect on trade	1992-2002, 22 developed countries	Panel FE	Positive EMU effect on intra-Euro Area trade in the range of 5 to 20%, no evidence for trade diversion
Faruqee (2004)	Trade effects at individual country level, panel cointegration technique	As in Micco, Stein and Ordoñez (2002)	Panel Dynamic Ordinary Least Squares (DOLS)	Rising trade gains unevenly distributed, no trade diversion
Baldwin, Skudelny and Taglioni (2005)	Theoretical framework for Euro effect on trade	1991-2002, EMU-12, three EU countries plus Australia, Norway, Canada, Japan and the United States of America (USA), ISIC 2- and 3-digit manufacturing sectors	Pooled Ordinary Least Squares (POLS) with importer, exporter and industry FE	Convex trade-volatility link, EMU exhibits trade effect on top of the one observed when exchange rate volatility is set to zero.
Berger and Nitsch (2005)	Control for general trend in economic integration	1948-2003, 22 industrialised countries	POLS	No EMU effect in the long-run
Flam and Nordstrom (2006a)	Unilateral exports on sectoral level to account for spillovers	1989-2002, ten Euro and ten industrialised countries, nine 1-digit sectors	POLS	Increasing trend, Euro effect in differentiated products
Flam and Nordstrom (2006b)	Euro effect at the extensive and intensive margin	1995-2005, ten Euro and ten industrialised countries, >5000 HS 6-digit product lines	POLS	Significant effects on the extensive margin, no trade diversion
Baldwin and Di Nino (2006)	Heterogeneous firms model to measure the Euro effect at the extensive and intensive margin	1994-2003, EU-15 plus Switzerland, Norway, Iceland, USA, Canada, Japan, 5000 HS 6-digit product lines	Tobit, Logit and POLS	Support of new-goods hypothesis, pro-trade effect for the Euro Area and the ROW
Bun and Klaassen (2007)	Country-pair-specific time trend	1967-2002, EU-15 plus Switzerland, Norway, Japan, USA, Canada	Panel FE and DOLS	Euro effect drops to 3%
De Nardis, De Santis and Vicarelli (2007)	Sectoral analysis in dynamic setting	1988-2004, 13 EU and ten OECD countries, 25 SITC 2-digit sectors	System GMM	Positive Euro effect in scale-intensive industries

Berthou and Fontagné (2008)	Firm-level data	1998-2003, 50 countries, CN 8 product lines are aggregated into 28 ISIC sectors	Panel RE and FE	Positive effect of the Euro at the extensive margin unrelated to reduced exchange rate volatility

The second class of studies (Flam and Nordstrom 2006b, Baldwin and Di Nino 2006 and Berthou and Fontagné 2008) confirms the conjecture by Baldwin, Skudelny and Taglioni (2005) of significant positive Euro effects at the extensive margin.[14] Berthou and Fontagné (2008), however, conclude that for France, the positive Euro effect on the number of exported varieties is independent of reduced nominal exchange rate volatility and rather attributable to lowered trade costs or increased price transparency.

Finally, Berger and Nitsch (2005) and Bun and Klaassen (2007) account for a general trend in greater economic integration, whose omission in Rose's (2000) study might have spurred the size of the estimate. Berger and Nitsch (2005) specify this common trend for the EMU-11, which causes the EMU effect to become insignificantly different from zero. Bun and Klaassen (2007) introduce a country pair-specific trend, which, as a nice side effect, helps to control for Anderson and van Wincoop's price terms. In their preferred specification, the Euro effect drops to 3%.

Common to the cited studies is not only that they succeeded in lowering the common currency effect for the Euro Area drastically to a nowadays widely accepted range of 3 to 15%, but also that the remaining intra-EMU trade increases have not been at the expense of the ROW. This common finding gives rise to a very topical issue. A low Euro effect on intra-EMU trade and at the same time, no evidence of trade diversion raises uncertainty about the right strategy for the CEECs as when to enter the currency union.

The question whether the CEECs will benefit or lose from their adoption of the single currency in terms of trade with the EMU-12 is not widely explored (compare Table 1.3). The first study by Maliszewska (2004) uses the coefficients of a model fitted for the EU-15 countries and plugs in the values of the explanatory variables for the CEECs. She finds that although some of the CEECs, namely the Slovak Republic, Hungary, Estonia and the Czech Republic already trade more with the EU-15 than predicted, the Euro brings additional trade gains to all CEECs in the range of 10.9 percentage points for Hungary and 45.5 percentage

[14] Note, that the extensive margin is defined here according to the new goods hypothesis. In FDI studies, researchers rather refer to the entry of new firms when using the term.

points for Slovenia. By including also exchange rate measures, Brouwer, Paap and Viaene (2008), find generally lower trade gains for the CEECs spanning from 0.83% for Lithuania to 10.72% for Poland.

Table 1.3: Literature on the Trade Effects of EMU Enlargement

Study	Innovation	Data	Model	Results
Maliszewska (2004)	Trade effects of EMU enlargement	As in Micco, Stein and Ordoñez (2002), but limited to EU member states	POLS	Trade expansion for all CEECs, especially high for Slovenia
Brouwer, Paap and Viaene (2008)	Trade and FDI effects of EMU enlargement	1990-2004, 29 countries	POLS, FE and RE	Positive effect of EMU arising through the various channel

1.3.3 The Determinants of Inward FDI

In response to the theoretical advancements through the NEG, a number of empirical studies emerged that investigate the determinants of a firm's location choice, many of which thereby laying a special focus on measuring agglomeration economies. In an influential study, Head, Ries and Swenson (1995) distinguish between domestic and foreign firm industry clusters and find that both substantially increase the probability of a US province being chosen as a plant location. While literature on Germany is scarce, a few studies deal with the location choice of multinational firms within individual European countries. To achieve comparability to the approach followed in Chapter 4, only studies using discrete choice models are discussed and listed in Table 1.4.[15]

Studies that focus on individual Western European economies confirm the theoretically accentuated positive externalities that emerge from industry and knowledge clusters. Guimarães, Figuireido and Woodward (2000) assess various agglomeration variables on their impact on FDI to Portugal and find particularly strong cluster effects within the service sector. Crozet, Mayer and Mucchielli (2004) show for France that domestic as well as foreign competitors increase the probability of a new investment. In addition to analysing the impact of agglomeration, Barrios, Görg and Strobl (2006) focus on the role of regional policy in Ireland. While policy measures mainly attract low-tech firms, specialised labour markets work as a pull factor for companies operating in the high-tech sector.

[15] Cieslik (2005) and Basile (2004) address a similar problem by using count data models.

Table 1.4: Literature on the Determinants of Inward FDI

Study	Innovation	Data	Model	Results
Guimarães, Figuireido and Woodward (2000)	First empirical estimates of agglomeration effects on FDI location	1985-1992, Portugal, concelho level	Conditional logit	Agglomeration variables and distance significant, no influence of local labour costs
Crozet, Mayer and Mucchielli (2004)	Detailed study of agglomeration effects by industry, country of origin and over time	1985-1995, France, Nomenclature des Unités Territoriales Statistiques (NUTS) III	Conditional and nested logit	Impact of agglomeration varies by countries, industries and declines over time, no evidence for regional policies
Barrios, Görg and Strobl (2006)	Differentiation between low- and high-tech-firms	1973-1998, Ireland, county level	Nested logit	Regional policy has an effect on low-tech-firms, urbanization economies attract high-tech-firms
Defever (2006)	Functional fragmentation	1997-2002, French investments in 23 European countries	Conditional and mixed logit	R&D centres stimulate co-location, headquarters independent
Mayer, Méjean and Nefussi (2007)	Two step-decision with entry as the first step and location as the second step	1992-2002, French investments in 88 countries	Conditional and nested logit	Larger and more productive firms invest abroad. There, the firms' financial networks are decisive.
Basile, Castellani and Zanfei (2008)	EU-wide regional study	1991-1999, investments in 50 NUTS I regions in eight EU countries	Mixed logit	EU Structural and Cohesion funds play a role in attracting foreign multinationals
Hilber and Voicu (2008)	Focus on location choice within Romania	1990-1997, Romania, NUTS III	Conditional logit	Service agglomeration as the main driver of inward FDI
Hafner (2008)	Firms grouped by industries and department divisions	2006, Germany, NACE 2-digit	Logit	Industry-specific agglomeration economies matter for low-tech-firms, skilled labour and technological spillovers are important at the department level

Supporting the findings for the Western economies, Hilber and Voicu (2007) show that the investment decision of foreign firms in Romania depends also on positive spillovers within clusters that prevail in the service as well as in the manufacturing sector. Somehow

against previous expectations especially for Eastern Europe, wage differentials do not exhibit a significant influence in this study.[16] However, Bellak, Leibrecht and Riedl (2008) stress that nominal wages and salaries are a poor indicator for labour market effects, since they do not only represent an additional cost factor, but mirror at the same time a region's (in)abundance with human capital.

The focus of the only study for Germany differs from the cited studies above and from the approach followed in Chapter 4 in the sense that it is survey-based. Furthermore, the questionnaire does not allow identifying the location of the interviewed firms at a regional level. Hafner (2008) concentrates instead on agglomeration economies at the industry versus agglomeration economies at the department level. He finds that spillovers within industries especially attract low-tech firms (which is in opposition to the Barrios, Görg and Strobl (2006) results), whereas spillovers between industries have in general a positive effect at the department level.

Two other influential studies in the field do not focus on a single country but provide evidence for location choices by considering a number of European countries. Basile, Castellani and Zanfei (2008) investigate the role of the EU Cohesion policy at the NUTS I level across eight EU countries. They find that the EU funds have indeed helped laggard regions to attract foreign multinationals. Defever (2006) investigates the location choices among 23 European countries and indentifies substantial differences across individual functions, such as Research and Development (R&D) as a pre-production upstream activity and wholesale and retail trade as a post-production downstream activity.

The most recent strand of literature does not only assess regional determinants of location choice but combines this analysis with the characteristics of the investing firms. Inui, Matsuura and Poncet (2008) find that less productive Japanese investors favour nearby locations in China over more distant locations in OECD countries and are also more sensitive to institutional quality, market access and existing informational networks than high productive firms. Mayer, Méjean and Nefussi (2007) formally integrate insights into the heterogeneity of firms à la Melitz (2003) into a location choice model. Firms decide in a first step whether to invest domestically or in a foreign country and in a second step where to locate given that their productivity is high enough to cover the higher fixed costs abroad. The

[16] Cieslik (2005) finds the same for Poland using count data.

authors confirm that the propensity to invest abroad increases with productivity while financial interdependencies matter as well for domestic investments.

1.4 Research Questions and Chapter Outline

The recent developments in trade and FDI theory and empirics underline the importance of a proper specification of the empirical equation with the employed variables derived from a theoretical model. Only then, one can draw correct inferences that allow giving strong policy conclusions. To this end, the present thesis consists of three self-contained essays that start with providing a theoretical framework and that aim at deriving thereof reliable answers to the proposed research questions.

- The first two essays combine various aspects of trade creation and trade diversion in the process of European integration with recent improvements in gravity modelling. A special focus lays on avoiding the omitted variables problem that arises in studies ignoring Anderson and van Wincoop's multilateral price terms. Accounting for these through a set of observable trade cost variables, the chapters provide consistent estimates that help answering two important questions which emerge in the light of the continuous elimination of trade barriers in Europe: *first, has the regional integration process caused and will in the future cause positive trade effects for the participating countries? And second, have positive effects inside Europe been at the expense of the ROW?*
- The third essay builds upon a new trade theory model adapted to the location choice of foreign multinational firms within Germany. The model assumes that firms decide for a certain location in dependence of its underlying profits, which are, in turn, influenced by a set of regional characteristics. The conditional and the nested logit model fit this decision-making process well. The results of the estimation endorse policy makers with new information when reflecting about ways to increase a region's relative competitiveness by shedding light on the question: *which are the main characteristics that drive inward FDI flows into the German federal states?*

To answer these questions, this thesis proceeds as follows: in Chapter 2, a new version of a theory-based gravity equation is developed to properly account for the relative price

indices initially proposed by Anderson and van Wincoop (2003). The partially time-varying character of the multilateral resistance variables overcomes the bias present in earlier studies that solely rely on country or country pair fixed effects. Applying the augmented gravity equation to the process of EU integration during the 1990s, robust evidence is found that the FTAs with the CEECs have substantially increased intra-group trade, in the case of the Czech and Slovak Republic and Slovenia at the expense of the ROW. Since decreasing multilateral trade resistance negatively influences a country's bilateral imports but may be positively correlated with a bilateral FTA, earlier East-West studies, which ignore the relative price term's time-varying character, tend to be downward biased. Indeed, the results indicate that once we correct for the omitted variable bias, the FTAs with the CEECs created between 7 and 20 percentage points more new trade compared to the scenario where only time-invariant country pair effects were included.

Chapter 3 highlights the trade effects of monetary integration in Europe. The purpose is to assess the implications of the EMU accession of eight CEECs on their share of EMU-12 imports. Overcoming biases related to endogeneity, omitted variables and sample selection, the results indicate that the common currency has boosted intra-EMU imports by 7%. Under the assumption that the same relationship between the explanatory variables and imports will hold for EMU-CEEC trade, one can predict the future impact of the Euro. The findings of this exercise suggest that except for the least integrated countries, Poland, Latvia and Lithuania, all CEECs can expect increases in the EMU-12 import share.

Chapter 4 assesses the determinants of location choices of foreign multinational firms at the level of German federal states. Based on a monopolistic competition model, firms decide for a certain location if the expected profits are higher than the profits associated with all other available locations. A conditional and a nested logit model resemble the structure of the location choice process of individual investors well. By using affiliate-level data between 1997 and 2005, the results confirm that firms react positively to local demand, a common border and existing firm networks, while unit labour costs exhibit the expected negative impact. These effects vary in their relevance across manufacturing and service affiliates, and between upstream and downstream activities.

CHAPTER 2 TRADE EFFECTS OF THE EUROPE AGREEMENTS: A THEORY-BASED GRAVITY APPROACH[17]

2.1 Introduction to Chapter 2

Since 1989 Europe has been the stage of an ongoing process of regional integration involving 15 EU member states and ten CEECs. The EU admission of eight CEECs on 1st May 2004 represented a temporary peak in the integration process, but it was not the end of it. Bulgaria and Romania also joined the EU in January 2007 after almost 15 years of preferential trade relations guided by FTAs that became known to the public as the EAs. Since the EAs had to go through a long process of ratification by each individual member state, the European Community (EC) gave provisions on trade and trade-related measures effective by means of IAs at an earlier stage.[18] Subsequent to the gradual reduction of trade barriers, one could observe a relative increase in the EU's total imports from the CEECs as compared to its imports from the ROW.[19] This relative boost raised questions about the extent to which the geographical restructuring of trade flows has taken place and how much of it can actually be attributed to the FTAs signed and implemented in the course of the 1990s.

After the fall of the Iron Curtain, economists started to examine the "natural" trade patterns of the CEECs (see e.g. Bussière, Fidrmuc and Schnatz 2005 for an overview and

[17] This chapter goes in parts back to Spies and Marques (2008). Originally published on www.informaworld.com.
[18] As being subject to Art. 133 of the EU treaty (Common Trade Policy), the IAs fell under the Community's Competence (see Box 2.1). Details on the exact dates of entry into force of the agreements are provided in Table A2.1 in Appendix A2.1.
[19] Compare also Figure 2.1.

Egger, Pfaffermayr and Schmidt 2007 for a recent contribution to this stream of literature) without explicitly quantifying the impact of FTAs. Other studies attempted to assess the impact of the arrangements directly through the use of dummy variables. The reported coefficients on the intra- and extra-group trade impact of East-West integration are within a wide range (compare Table 1.2 and Table 2.6). With the exception of the analysis by De Benedictis, De Santis and Vicarelli (2005), a major shortcoming of all of these studies is that they suffer from an omitted variable bias.

Anderson and van Wincoop (2003) stress that bilateral trade does not only depend on bilateral trade costs but also on a trading pair's resistance to trade with the ROW. In this chapter, a new version of a theory-based gravity equation is employed to correct for biases stemming from the omission of Anderson and van Wincoop's relative price terms. The results indicate that earlier East-West studies that solely rely on country pair fixed effects underestimate the trade-promoting effect of the EU's FTAs. Describing multilateral trade resistance through all factors that also influence the bilateral resistance to trade, it turns out that the FTAs with the CEECs have boosted EU imports from the CEECs by 72% (up to 80% for the new members Bulgaria and Romania), whilst not decreasing imports from the ROW by more than 13%.

In Chapter 2.2, the process of East-West integration and the evolution of trade flows during the 1990s are briefly sketched. Chapter 2.3 develops the theoretical model, which builds the basis for the estimated equation. Chapter 2.4 discusses this study's approach of measuring multilateral trade resistance in the context of other approaches known in the literature. Chapter 2.5 deals with econometric and data issues. The estimation results are presented and interpreted in Chapter 2.6. Chapter 2.7 concludes.

2.2 Trade Flows and East-West Integration

Soon after the end of the cold war, policy makers and economists developed an increased interest in the trade integration of the CEECs into the EU (see Box 2.1 for an abstract of the history of the integration process). Especially at the beginning of this process, authors have frequently used the gravity model to predict the 'normal' or 'expected' level of trade between the CEECs and the EU. While early studies on East-West integration detect highly unexhausted trade potentials of the CEECs' trade with the EU (see e.g. Hamilton and Winters 1992; Baldwin 1994), more recent studies state that the CEECs have meanwhile

returned to their "natural" trade patterns (see e.g. Egger, 2002; Fidrmuc and Fidrmuc 2003 and Bussière, Fidrmuc and Schnatz 2005).

The political distortions in place at the start of the liberalisation process make it difficult to analyse the geographical restructuring of trade flows after the fall of the iron curtain in the framework of the Vinerian terms of trade creation and trade diversion. Nevertheless, most studies formally assessing the ex-post impact of any kind of integration arrangement implement different sets of dummy variables into a gravity equation to measure the effects of preferential liberalisation on intra- and extra-group trade (see e.g. Bayoumi and Eichengreen 1995 or for a more recent study Carrère 2006).[20]

A few authors have employed this method to assess the effect of the FTAs signed and implemented between the CEECs and the EU in the 1990s. Early cross-sectional studies that specifically point at the geographical restructuring of trade flows arising from the implementation of the EAs report insignificant or even negative coefficients for East-West integration (Laaser and Schrader 2002 and Paas 2003). Studies relying on panel data, however, find significant positive estimates in the range of 11% to 130% (Martín and Turrión 2001; Adam, Kosma and McHugh 2003; De Benedictis, De Santis and Vicarelli 2005 and Herderschee and Qiao 2007). Although these studies provide a wide range of estimates, they find, when using panel estimation techniques a positive impact of East-West integration on trade (compare Table 1.1 and Table 2.6).

[20] For a survey on other methods to measure the EU's trade effects, see e.g. Marques (2008).

Box 2.1: The CEECs' Long Way into the EU

While the various sectoral agreements and special arrangements during the state of cold war were restrictive, a first step paving the way towards freer trade was a joint EC-Comecon declaration in 1988 followed by the conclusion of Trade and Economic Cooperation Agreements in the period until 1992. With these first generation agreements quantitative restrictions on imports from the formerly centrally planned economies were removed and the CEECs were hence treated under the Most Favoured Nation (MFN) clause. Despite of this effort, the European Council in Strasbourg in 1989 affirmed that the bilateral trade relations should be strengthened beyond the already existing agreements.

At the Dublin meeting in 1990 the European Council found the EAs to be the most suitable instrument to develop the relations first with the Czechoslovakia, Hungary and Poland which were thought to be closer to the objectives of democracy and a market-orientated economy than the other CEECs (van der Klugt 1993: 1-2). The EAs' objectives were trade liberalisation, political dialogue, legal approximation and cooperation in the areas of industry, environment, transport and customs. Although signed with each CEEC separately, the agreements' structures were almost identical with some minor differences in the details of certain provisions. With respect to trade, the EAs aimed at establishing a free trade area by the year 2002. They foresaw a reciprocal but asymmetric liberalisation process for manufacturing products spread over a period of ten years with liberalisation always being more rapid on the part of the EU. While quotas and duties on less sensitive products were eliminated on both sides immediately, tariffs on the most sensitive industrial goods, i.e. textiles and iron and steel manufactures were upheld longest. Since the EAs were so-called mixed agreements including commitments under the scope of the authority of both the Community and its member states they had to go through a longsome process of ratification by the European Parliament and the parliament of each individual member state.

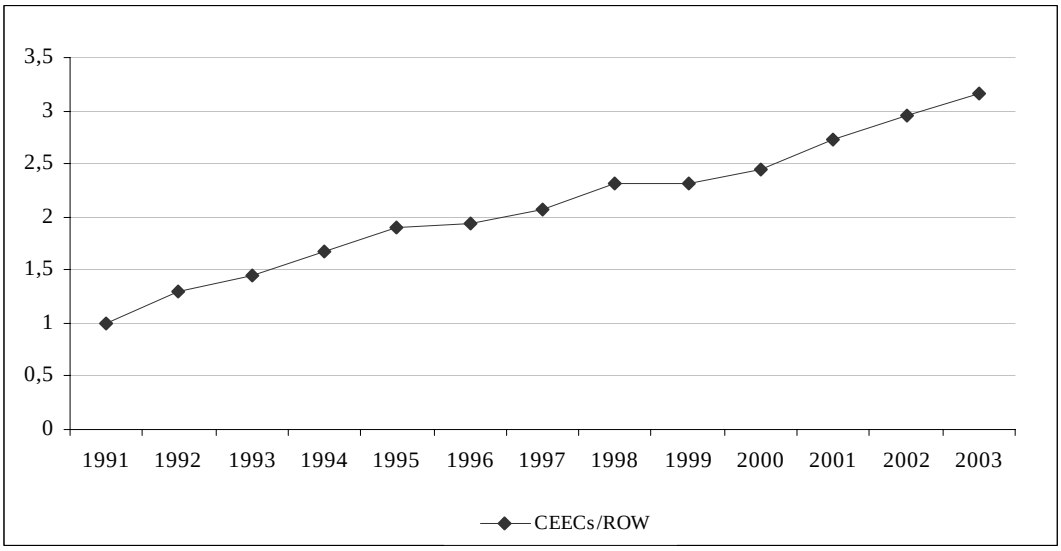
Pending on the completion of these formalities, the European Economic Community (EEC) and the European Coal and Steel Community (ECSC) gave provisions on trade and trade-related measures effective by means of IAs already at an earlier stage. As being subject to Art. 133 of the EU treaty (Common Trade Policy), the IAs fell under the Community's exclusive competence. In order to avoid disruptions of the trade relations, the parties agreed that the IAs should apply until the entry into force of the EAs. A major shortcoming of the IAs and EAs was seen in their hub-and-spoke nature. The bilateral liberalisation could turn the CEECs into satellite economies around the EU centre with little intra-regional trade and a high vulnerability to adverse shocks (see e.g. De Benedictis, De Santis and Vicarelli 2005 or Baldwin and Wyplosz 2004).

This hesitancy concerning East-West integration from the side of the EU changed when the European Council explicitly sanctioned EU membership for the CEECs and defined the criteria a candidate country must meet ("Copenhagen Criteria") at its Copenhagen summit in 1993 (Baldwin and Wyplosz 2004: 23). The "Luxembourg Group" comprising Hungary, Poland, the Czech Republic, Slovenia and Estonia started negotiations in late 1997 whereas the other CEECs – among those Romania and Bulgaria – had to wait until the Helsinki summit in 1999 ("Helsinki Group") (De Benedictis, De Santis and Vicarelli 2005: 7). Negotiations on EU accession officially terminated with Bulgaria on 16 June 2004 and with Romania on 16 December 2004.

A simple calculation allows for a first insight into the relative change in the aggregate imports of EU-15 countries from the CEECs and from the ROW during the EU integration process of the candidate countries.[21] To render the sizes of the two geographical regions comparable, the yearly import values have been normalised with respect to the base year (1991). Taking the quotient allows then to assess relative changes. To be precise, the relative imports from the CEECs (M_{CEECs}) with respect to the ROW (M_{ROW}) in each sample year[22] measured with 1991 as the base year has been calculated as follows:

$$\frac{M_{CEECst} / M_{CEECs91}}{M_{ROWt} / M_{ROW91}} \tag{2.1}$$

Figure 2.1: Relative Changes in EU-15 Imports



Source: Own calculations. Data from OECD.

Looking at Figure 2.1 it can be readily seen that the growth of EU-15 imports from the CEECs has been over three times higher than the growth of imports from the ROW. Moreover, the relative boost seems to have taken place steadily and continuously since the fall

[21] Clearly, the EU-15 is much more important for the CEECs than the other way around. Due to restrictions concerning the availability of trade data, this study is constrained to look at EU-15 imports from the CEECs. Theoretically, such an approach does not differ from taking CEECs' exports to the EU-15. Import data is, however, found to be more reliable (Baldwin 2006a).

[22] The sample period is 1991-2003.

of the iron curtain until the eve of the CEECs' EU membership. These stylised facts match the findings of the empirical literature on this subject. The questions whether part of the higher import growth can actually be attributed to the IAs and EAs and whether these have deflected trade with the ROW have to be assessed within a formal framework.

2.3 Theoretical Foundation of the Gravity Equation

Even though the gravity equation's initial success stemmed from its good empirical properties, it possesses nowadays "more theoretical foundations than any other trade model" (Baldwin 2006a). The repeated ignorance of which has, however, produced a number of commonly accepted mistakes in gravity model estimation, so that some importance is attached to laying out briefly the derivation of the equation, which will be tested.[23]

Assuming identical, homothetic CES preferences and "iceberg" type transport costs, country *i*'s aggregate total value of imports from country *j* can be expressed as

$$M_{ij} = N_j Y_i \left(\frac{p_{ij}}{P_i} \right)^{1-\sigma} \tag{2.2}$$

with N_j representing the variety of products sold by country *j* and Y_i being country *i*'s nominal expenditure. $\frac{p_{ij}}{P_i}$ is the relative price determining the share of country *i*'s expenditure spent on country *j*'s goods with P_i being country *i*'s price index for all import-competing goods and p_{ij} standing for the 'landed' price. σ is the above-unity elasticity of substitution between goods originating from country *i* and country *j*.[24] Since prices on individual goods are hardly available, the landed price is defined as

$$p_{ij} = t_{ij} P_j e_{ij}, \tag{2.3}$$

[23] Appendix A2.2 describes the case for a restricted country sample.
[24] Usual estimates of σ range from 5 to 8. Consequently a rise in the relative prices by 1% would cause the total import value to fall by 4 to 7%.

a function of bilateral trade costs t_{ij} and country *j*'s producer price index P_j. Besides these traditional components of the landed price, the nominal exchange rate e_{ij} (in price quotation) is modelled here as an additional trade cost determinant.[25] Substituting (2.3) into (2.2) yields

$$M_{ij} = N_j Y_i \left(t_{ij} re_{ij}\right)^{1-\sigma} \qquad \text{with} \qquad re_{ij} = \frac{e_{ij} P_j}{P_i} \tag{2.4}$$

as the real exchange rate. Equation (2.4) already looks close to commonly estimated gravity equations. However, as stated by Anderson and van Wincoop (2003), bilateral trade does not solely depend on bilateral trade costs, but also on the average resistance to trade with the ROW. Only by considering these multilateral terms, it can be explained why a certain region is pushed towards trading with a given partner when barriers towards all trade partners increase. Employing general equilibrium conditions has the convenient side effect of eliminating the number of varieties N_j, for which data is not available. Producer prices in country *j* must then adjust, such that the market clearing condition is satisfied,

$$Y_j = \sum_{i=1}^{I} M_{ij} \,. \tag{2.5}$$

Substituting the import demand equation (2.4) into the market clearing condition (2.5), one can solve for N_j as follows:

$$N_j = \frac{Y_j}{\sum_{i=1}^{I} \left(re_{ij} t_{ij}\right)^{1-\sigma} Y_i} \,. \tag{2.6}$$

[25] An exchange rate variable was for the first time formally introduced into the gravity equation by Bergstrand (1985).

Plugging (2.6) into (2.4) leads to the testable gravity equation,

$$M_{ij} = \frac{Y_i Y_j \left(t_{ij} re_{ij}\right)^{1-\sigma}}{\sum_{i=1}^{I} Y_i \left(t_{ij} re_{ij}\right)^{1-\sigma}}. \tag{2.7}$$

If we further define world income as $Y^W = \sum_{i=1}^{I} Y_i$ and the share of country *i*'s income in world income as $s_i = \frac{Y_i}{Y^W}$, equation (2.7) can be rewritten as

$$M_{ij} = \frac{Y_i Y_j}{Y^w} \frac{\left(t_{ij} re_{ij}\right)^{1-\sigma}}{\sum_{i=1}^{I} s_i \left(t_{ij} re_{ij}\right)^{1-\sigma}} \tag{2.8}$$

where country *i*'s total imports from country *j* are not only dependent on the relative incomes of the two countries and on their bilateral exchange rate and trade costs, but also depend on the importers' share of world income and on their average trade costs and exchange rate with respect to all exporters.

2.4 Measuring Multilateral Trade Resistance in Gravity Equations

Before turning to this chapter's approach to capture Anderson and van Wincoop's price terms (2.4.2), the biases introduced by their omission together with conversant ways of accounting for them are discussed (2.4.1).

2.4.1 Common Ways of Capturing Multilateral Trade Resistance

The existence of unobservable and omitted factors that simultaneously influence imports and the explanatory variables on the Right Hand Side (RHS) introduces an unobserved heterogeneity bias (Cheng and Wall 2004). Baier and Bergstrand (2007a) specify that the FTA coefficient tends to be underestimated in cross-sectional studies if there are e.g.

welfare-reducing domestic policy regulations that induce countries to select into FTAs. Anderson and van Wincoop (2003) drew attention to the biases resulting from ignoring multilateral trade resistance and modelled it using price terms (compare equations (1.11) and (1.12) in Box 1.1).

The empirical measurement of price effects is tricky and has so far been addressed in four ways. First, Baier and Bergstrand (2001) approximate the relative price terms through GDP deflators. Since published price indexes do not reflect most factors that influence a country's multilateral trade resistance, the coefficient estimate is close to zero and thus economically not important in explaining the growth in bilateral trade. Second, Anderson and van Wincoop (2003) themselves propose to measure the terms directly with a nonlinear least-squares estimator. Since this method proves to be computationally costly, Feenstra (2002) proposed a third approach to capture price effects via importer and exporter dummies that has become most popular. Introducing an individual or bilateral fixed effect allows to control for time-invariant variables that simultaneously affect trade flows and RHS variables.

Baldwin (2006a) formally demonstrates that only including country (pair) fixed effects is in a panel setting, however, an insufficient solution to the omitted variable bias, since the time-varying part of the multilateral trade resistance is still ignored. This time-varying residual may well be correlated with other time-varying trade cost measures causing a bias that becomes more important with the length of the sample. In which direction does the bias go? Ex-ante predictions are difficult: if the omitted term is positively correlated with the probability to select into an FTA (e.g. a high multilateral trade resistance increases a country's incentive to form an FTA) and positively correlated with the dependent variable (high multilateral resistance pushes a country towards trading with a specific partner), one would expect an upwardly biased FTA coefficient in conventional estimations. Since every implemented FTA alters not only the bilateral but also the multilateral trade resistances (by lowering the trade costs t_{ij} and the relative price terms P_j and P_i) and lessens thereby the positive effect on the bilateral trade volume, it is also possible that omitting these effects downward biases the estimated trade impact over time.

Recently, various authors suggested a fourth approach that accounts for the overall trade resistance through time-varying exporter and importer dummies (see e.g. Baltagi, Egger and Pfaffermayr 2003 and Broto, Ruiz and Vilarrubia 2006). Whilst this method allows capturing all the unobserved characteristics in a very intuitive way, the amount of dummies needed makes the estimation for the full sample computationally unfeasible. Furthermore, the

time-country interactions absorb the GDP effect, such that one cannot estimate the trade impact of these traditional gravity variables. A similar difficulty occurs with Bun and Klaassen's (2007) suggestion to include country pair-specific time trends: the dummies absorb explanatory power of other bilateral time-varying variables.

2.4.2 A Novel Way to Capture Multilateral Trade Resistance

In fact, equation (2.8) introduces a novel way of modelling multilateral trade resistance in gravity equations that presents several advantages with respect to the existing literature. Hence, a fifth approach is proposed where, in contrast to the work by Anderson and van Wincoop (2003), multilateral resistance is not directly described through relative price terms, but through all variables that also influence the bilateral resistance to trade. Their partially time-varying character overcomes the bias present in earlier estimations that solely rely on country (pair) fixed effects to proxy for the multilateral resistance terms. At the same time standard panel data estimation techniques can be applied on the full sample. Note, however, that to the extent that there are unobserved or unobservable sources of time-varying multilateral trade resistance, the applied procedure does not fully correct the omitted variable bias. The loss is, however, believed to be minor since the most common trade cost variables are explicitly captured.

The multilateral terms in the denominator of equation (2.8) are defined as averages over all partner countries to account for the fact that when estimating the equation there will be a number of importers (*i* countries). Hence, the joint share of the importers' income in world income is defined as $\sum_{i=1}^{I} \frac{Y_i}{Y^W}$ and the real exchange rate of each importer's currency against the average of all exporters' currencies takes the form $\frac{1}{J}\sum_{j=1}^{J} re_{ij} \forall i$. Furthermore, as proposed by Baier and Bergstrand (2007b), the trade cost variables are defined as multilateral and world resistances,

$$MWR_{ij} = \frac{1}{I}\sum_{i=1}^{I} t_{ij} + \frac{1}{J}\sum_{j=1}^{J} t_{ij} - \frac{1}{IJ}\sum_{i=1}^{I}\sum_{j=1}^{J} t_{ij} \qquad \forall i, j . \tag{2.9}$$

The first two terms on the RHS represent the multilateral trade resistances of the respective trading partners. Holding bilateral trade costs constant, a rise in these terms implies a lower ratio of bilateral to multilateral trade costs and thus a boost of bilateral trade. The last term, however, resembles the world's resistance to trade and as such, lowers the trade value between every pair of countries.[26] The opposite interpretation of the multilateral and world resistance terms holds, of course, true for trade stimulating factors, like cultural proximity or trade arrangements.

In line with the basic idea behind gravity models, that the intensity with which a pair of countries trades is subject to pull and push factors, a broad interpretation of the bilateral and multilateral trade resistance terms is adopted. Hence, the unobservable trade cost variable t_{ij} is defined as a function of a set of observable variables that influence trade costs,[27]

$$t_{ij} = (D_{ij})^{\delta_1}[e^{\delta_2 LL_{ij} - \delta_3 B_{ij} - \delta_4 CL_{ij} - \delta_5 DEP_{ij} - \delta_6 FTA_{ij} + \delta_7 FTA_i}] \tag{2.10}$$

with D_{ij} as the great-circle distance between the importing and the exporting country, LL_{ij} as a dummy variable equalling 1 if one country and 2 if both countries in a trading pair are landlocked and 0 otherwise, and B_{ij} as a dummy variable controlling for the length of the common border between countries *i* and *j*. Supposing that cultural proximity beats down the landed price through transaction cost savings, the dummy variable CL_{ij} equals 1 when the importer and the exporter have the same official language and 0 otherwise. Finally, DEP_{ij} is a dummy taking the value of 1 whenever country *j* is a non-independent entity being legally associated with an independent state and 0 otherwise.[28] To separate the ex-post effects of the FTAs with the individual CEECs, a set of stepwise dummy variables has to be included into the theoretically derived gravity equation (compare Box 2.1). FTA_{ij} equals 1 for the contracting parties for the years following the entry into force of the IAs and 2 for the years

[26] To give an example, for the distance variable this means that a higher distance of the trading partners *i* and *j* towards all other countries in the sample increases country *i*'s imports from *j*, whilst a high world distance (everyone is far away from everyone) lowers trade between every country pair. In the case of dummy variables, the relevant economic interpretation is given by the proportion of "1" versus the proportion of "0" values of the dummies for the various country pairs.

[27] Compare Melitz (2007) for a similar interpretation of the bilateral trade cost variable.

[28] This includes French Polynesia and New Caledonia for France, Aruba and the Netherlands Antilles for the Netherlands and Bermuda and the Cayman Islands for the United Kingdom (UK).

following the entry into force of the EAs to capture the impact of the FTAs on intra-group trade (intra-bloc bias).[29] FTA_i equals 1 for non-contracting parties for the years following the entry into force of the IAs and 2 for the years following the entry into force of the EAs to capture the impact of the FTAs on trade of group members with non-members (extra-bloc openness).[30]

Following this specification, we will be able to examine whether the FTAs signed in the 1990s between the EU-15 and the CEECs increased trade between the EU and the associated countries at the expense of lower trade with third countries while overcoming the biases present in earlier East-West studies. Taking into account the modifications of the theoretically derived equation discussed above, the log-linearised[31] reduced-form gravity equation is given by

$$\ln M_{ijt} = \alpha + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln re_{ijt} + \beta_4 (\ln) t_{ij(t)} + \beta_5 \ln \sum_{i=1}^{I} s_{it} + \beta_6 \ln \frac{1}{J} \sum_{j=1}^{J} re_{ijt} + \beta_7 (\ln) MWR_{ij(t)} + \varepsilon_{ijt} \qquad (2.11)^{32}$$

where $\frac{1}{Y^W}$ is absorbed into the constant term α[33], common to all years and all country pairs, ε_{ijt} is the log-normally distributed error term and the expected coefficient signs are

$$\beta_1 > 0, \beta_2 > 0, \beta_3 < 0, \beta_4 = \sum_{\delta=1}^{T} (1-\sigma)\delta_1 < 0, (1-\sigma)\delta_2 < 0, (1-\sigma)\delta_3 > 0, (1-\sigma)\delta_4 > 0,$$
$$(1-\sigma)\delta_5 > 0, (1-\sigma)\delta_6 > 0, (1-\sigma)\delta_7 < 0, \beta_5 > 0, \beta_6 > 0, \beta_7 = \sum_{\rho=1}^{T} (1-\sigma)\rho_1 > 0, (1-\sigma)\rho_2 > 0,$$
$$(1-\sigma)\rho_3 < 0, (1-\sigma)\rho_4 < 0, (1-\sigma)\rho_5 < 0, (1-\sigma)\rho_6 < 0.$$

[29] This estimation method is sometimes called the difference-in-difference approach, where one group gets treatment (the CEECs) and the other group not (the ROW). The estimate therefore gives the before-and-after difference of the treated compared to the before-and-after difference of the control group (Baldwin 2006a).
[30] The countries are grouped by dates of entry into force of the IAs and EAs. See Table A2.1 in Appendix A2.1 for details.
[31] The brackets after β_4 and β_7 indicate that the dummy variables included in t_{ij} and MWR_{ij} will not be log-linearised whereas distance of course, will.
[32] Please find the complete list of variables in Table A2.2 in Appendix A2.3.
[33] Since Y^W is constant, we implicitly assume no world growth although countries *i* and *j* may grow. As a consequence, we assume that the positive growth of some countries is cancelled out by the negative growth of others so that the world as a whole does not grow.

Finally, this study controls for a possible selection bias by including three variables that approximate the Heckman correction term: HC1 is a variable containing the number of years of a trading pair in the sample; HC2 and HC3 are dummies, taking the value of 1 if the trading pair is observed over the entire period 1991 to 2003 and if the trading pair is present in the sample in *t-1*, respectively (and 0 otherwise).[34]

2.5 Econometric Issues

For the empirical implementation, this chapter considers the EU-15 countries' imports from a worldwide sample of 204 countries[35] over the period 1991-2003, forming an unbalanced panel data set with roughly 32245 observations. In order to capture relevant relationships between variables over time and in order to monitor unobservable country pair heterogeneity, static (2.5.1) and dynamic (2.5.2) panel data methodology will be applied.

2.5.1 Static Panel Estimation

As outlined in Chapter 2.4.1, not controlling for unobserved heterogeneity yields biased estimates. In principle, these unobserved effects can be modeled either as random and hence, stochastically fluctuating across countries or as fixed and therewith specific to a certain country or country pair. Since the random effects model only produces consistent estimates when the unobservable bilateral effects are not correlated with the error term, a Hausman test is conducted to test for that correlation. As the test clearly rejects the null hypothesis of no correlation, the country pair effects will be treated as fixed. The relevant Fixed Effects (FE) regression thus gives unbiased estimates of the time-varying variables (reported in columns (1) and (2) of Table 2.1). Nevertheless, to provide comparability, this chapter also presents the estimated parameters of the Random Effects (RE) in columns (3) and (4) of Table 2.1. The use of fixed effects still presents another problem as it does not allow for the estimation of time-invariant variables. To overcome this constraint, we use the Fixed Effects Vector Decomposition (FEVD) regression method (reported in columns (5) and (6) of Table 2.1). The FEVD estimator equals a stepwise fixed effects estimation technique as developed by

[34] The empirical estimation also contains an EU dummy, controlling for the accession of Austria, Sweden and Finland in 1995. The data sources and definitions of all variables entering the tested gravity equation are listed in Table A2.2 in Appendix A2.3.
[35] For the complete country list, see Appendix A2.5.

Plümper and Troeger (2007), which disentangles observed from unobserved heterogeneity and renders thereby the estimation of the time-invariant variables possible (econometric details are provided in Appendix A2.4). An additional advantage of the FEVD estimator as compared to the basic fixed effects estimator comes from the estimation of hardly time-varying variables, such as, for example, the FTA dummies. Plümper and Troeger (2007) argue that although the within-groups transformation does not eliminate these variables, their estimation becomes inefficient in the FE approach, leading to too high standard errors.

Another estimator that has recently gained popularity in the context of gravity modelling is the Hausman-Taylor (HT) estimator (Hausman and Taylor 1981). Since the estimator instruments possibly endogenous variables, it accounts for the potential problem of reverse causality between FTAs and trade flows. A drawback, however, is the selection of valid instruments. Since the instruments simultaneously have to fulfil the conditions of correlation with the endogenous variables and independence from the unit effects, their quality is sometimes poor. This results in efficiency losses. With little success, we have looked for high quality instruments to perform an HT estimation. The most likely problem in the present case of models is that the variables determining FTAs and trade flows are to a large extent the same (see also Baier and Bergstrand 2007a). When specifically looking at the process of European integration of the CEECs, however, an economic explanation seems plausible as well: whilst the EU-15 has been the biggest trading partner for the CEECs, their relevance for the EU-15 was only minor at the start of the transformation process. Hence, high trade intensity was potentially not the basis for decision-making when signing the IAs.[36]

2.5.2 Dynamic Panel Estimation

A valuable extension to the static approach is a dynamic specification of the gravity equation. By including lagged imports as an additional explanatory variable, one can account for potential inertia of trade flows related to sunk costs. The dynamic version of equation (2.11),

$$\ln M_{ijt} = \alpha + \delta \ln M_{ij,t-1} + \beta(\ln)\sum x_{ijt} + \varepsilon_{ijt} \qquad \text{with} \quad \varepsilon_{ijt} = \mu_{ij} + \nu_{ijt} \tag{2.12}$$

[36] For an application and description of the HT estimator, see Chapter 3 of this thesis.

cannot be estimated by standard static panel estimation techniques, because even if the ν_{ijt} were serially uncorrelated, the lagged dependent variable $M_{ij,t-1}$ in first-differenced $\Delta M_{ij,t-1} = M_{ij,t-1} - M_{ij,t-2}$ (or mean-deviated $\tilde{M}_{ij,t-1} = M_{ij,t-1} - \frac{1}{T-1}\left(M_{ij2} + ... + M_{ijT}\right)$) correlates with the transformed error in $\Delta\nu_{ijt} = \nu_{ijt} - \nu_{ij,t-1}$ ($\tilde{\nu}_{ijt} = \nu_{ijt} - \frac{1}{T-1}\left(\nu_{ij2} + ... + \nu_{ijT}\right)$), eventually leading to biased and inconsistent estimates. With the first difference transform, however, deeper lags of the regressors remain orthogonal to the error term, and thus, available as instruments. Hence, first-differencing the model and using $M_{ij,t-2}$ as an instrument for $\Delta M_{ij,t-1}$ leads to consistent estimates, but as shown by Arellano and Bond (1991), the efficiency can be considerably improved by exploiting all the orthogonality conditions that exist between lagged levels of M_{ijt} and the disturbances ν_{ijt}. In their difference GMM estimator lagged levels of the dependent variable and first differences of the strictly exogenous variables are used as instruments. One potential drawback of the estimator is, however, that lagged levels are poor instruments for first differences in the case that the dependent variable follows a random walk (Blundell and Bond 1998).[37]

This chapter therefore proceeds with testing for a unit root. Maddala and Wu (1999) propose to take the average of the p-values for N independent unit root tests. The single test statistic provided can either be based on individual augmented Dickey-Fuller or Phillips-Perron tests. In both cases, the single test statistic rejects the null hypothesis of a unit root in the dependent variable at the 1%-significance level. However, for the analysis and data at hand the test has two serious drawbacks. First, it assumes under the null hypothesis that all individual series are non-stationary against the alternative that at least one series is stationary. Second, the assumption of cross-sectional independence is likely to be violated in gravity models. Trade data reflect the economic situation in the reporter and the partner country and their GDPs enter in all trading pairs that involve a respective individual country. The parametric testing procedure proposed by Pesaran (2004) confirms the presumption of dependence of the error terms across the cross-sectional units in the sample. There are, hence, some reasons to test for a unit root in the individual series by trading pair.[38] Both the

[37] Specifically, the difference GMM exhibits a downward bias and low precision in short panels when the autoregressive parameter is high.

[38] Bond, Nauges and Windmeijer (2005), however, state that in the cases where T is treated as fixed, the presence of non-stationary integrated series does not distort the nature of the asymptotic distribution results in

augmented Dickey-Fuller and the Phillips-Perron test find imports to be stationary at the 10%-significance level for around one quarter of the individual series.

As a consequence and following the proposition by Blundell and Bond (1998), the system GMM estimator should be employed instead, which adds the equation in levels to the first-differenced equation and identifies more moment conditions by additionally using the lagged differences of the predetermined variables as instruments.[39] In simple words, instead of instrumenting differences with levels as in the Arellano and Bond (1991) estimator, Blundell and Bond (1998) instrument levels with differences. In situations where the dependent variable follows a unit root process, it is plausible to assume that past changes are more predictive to current levels than past levels to current changes, so that substantial efficiency gains can be achieved over the basic difference GMM estimator. The estimation technique does, however, not come without restrictions either. Roodman (2006) explains that introducing fixed effects or any other dummy variable that equals zero or one for almost all individuals violates the orthogonality assumptions in the level equation. This is a heavy concern since our main variable of interest, the EA dummy, is specified only for a small number of countries (the dummy equals zero for 96% of all observations). Hence, the level equation will be excluded from the estimation, which yields difference instead of system GMM results.

2.6 Results

This chapter starts with commenting the results of estimating equation (2.11), while laying a special focus on the effect of including multilateral resistance terms. The basic regressions (2.6.1) and the robustness checks (2.6.2) provide evidence that the FTA elasticities move up, once the time-varying part of the relative price terms is appropriately accounted for. This finding is finally put into the context of earlier studies in the field of East-West integration (2.6.3).

the same way as done for long time-series. Fidrmuc (2006) studies unit roots in gravity models and comes to the conclusion that the possible bias due to non-stationarity is small and that the estimates of the fixed effects model are close to the ones obtained by employing panel cointegration techniques.

[39] A variable is said to be predetermined if it is correlated with past error terms. In contrast, endogenous variables are correlated with past and present error terms.

2.6.1 Regression Results

The results of the regressions with and without the multilateral and world resistance terms are presented in Table 2.1. For each regression method explained in Chapter 2.5.1, the first column shows the regression results omitting the multilateral terms. Except for some FTA dummies, all parameter estimates of the FE model show the expected signs and are highly significant. As for the traditional gravity variables, the positive parameter estimates for GDP indicate that the import value increases with the importer's GDP, owing to a higher import demand, and with the exporter's GDP, owing to a higher export supply. The coefficients are, however, somewhat away from the theoretically predicted unitary elasticity.[40] Note that the theoretically justified inclusion of the real exchange rate exhibits empirical importance as well. A 10% depreciation[41] of the importing country's currency against its trading partner's currency reduces the import value from the latter by 2.8%.

Moving to the FEVD regression in column (5), we find that the distance coefficient of -1.30 lies within the usual range.[42] When at least one of the countries in a trading pair is landlocked, bilateral imports decrease by 74%.[43] Being legally dependant on the importing country and sharing a common language significantly boost the propensity to trade. EU membership does not have a significant influence on imports in this setting. Since there is little time variation in the EU dummy (only for Austria, Finland and Sweden, the variable jumps from 0 to 1 in 1995), most explanatory power is already absorbed in the country pair FEs.

[40] Anderson (1979) shows that the presence of non-tradable goods implies coefficients lower than unity. The fact that the coefficient of the importer's GDP is lower than that of the exporter's GDP suggests a larger non-tradables sector in the EU-15 than in the ROW, on average. Given the large number of developing countries in the sample, this implication is realistic.

[41] Please note that throughout this thesis, price quotation is used. A rise in the real exchange rate implies consequently a depreciation of country *i*'s currency against country *j*'s currency and lowers its import demand.

[42] The elasticity of transport costs to distance is usually associated with an estimate in the range of $0.2 < \delta_1 < 0.4$ (Limão and Venables 2001). Combined with an average estimate of $\sigma = 7$, a distance coefficient between -1.2 and -2.4 would be suggested.

[43] Since being landlocked is captured by a dummy variable, the import elasticity is given by exp(-1.33)-1=74%.

Table 2.1: Estimation Results

Dependent variable: $\ln M_{ijt}$						
	FE		**RE**		**FEVD**	
	(1)	(2)	(3)	(4)	(5)	(6)
	w/o MWR	with MWR	w/o MWR	with MWR	w/o MWR	with MWR
$\ln Y_{it}$	0.22**	0.43***	1.02***	1.12***	0.22***	0.43***
	(0.10)	(0.13)	(0.03)	(0.03)	(0.01)	(0.01)
$\ln Y_{jt}$	0.67***	0.71***	1.14***	1.15***	0.67***	0.71***
	(0.08)	(0.08)	(0.01)	(0.01)	(0.00)	(0.00)
$\ln re_{ijt}$	-0.28***	-0.37***	-0.08***	-0.07***	-0.28***	-0.37***
	(0.07)	(0.07)	(0.01)	(0.01)	(0.00)	(0.00)
$\ln D_{ij}$			-0.85***	-1.82***	-1.30***	-2.31***
			(0.05)	(0.20)	(0.01)	(0.03)
B_{ij}			0.00	-0.00**	0.00***	-0.00***
			(0.00)	(0.00)	(0.00)	(0.00)
LL_{ij}			-0.56***	-0.90	-1.33***	-0.81
			(0.07)	(3.59)	(0.02)	(0.50)
DEP_{ij}			0.75*	1.69***	0.98***	1.21***
			(0.45)	(0.56)	(0.12)	(0.14)
CL_{ij}			1.39***	0.77***	1.07***	0.94***
			(0.14)	(0.15)	(0.03)	(0.03)
EU_{ijt}	-0.01	-0.00	0.26***	-0.14**	-0.01	-0.00
	(0.04)	(0.06)	(0.07)	(0.06)	(0.05)	(0.03)
EU_{it}	-0.30***	-0.32***	-0.24***	-0.28***	-0.30***	-0.32***
	(0.08)	(0.08)	(0.06)	(0.06)	(0.05)	(0.05)
FTA_{irobut}	0.47***	0.59***	0.27***	0.14**	0.47***	0.59***
	(0.08)	(0.09)	(0.06)	(0.07)	(0.07)	(0.08)
FTA_{ihupot}	0.26**	0.31***	0.24***	0.26***	0.26***	0.31***
	(0.10)	(0.11)	(0.08)	(0.09)	(0.08)	(0.09)
FTA_{iczslt}	0.39***	0.47***	0.16**	0.11	0.39***	0.47***
	(0.10)	(0.11)	(0.08)	(0.08)	(0.08)	(0.09)
FTA_{isvt}	0.04	0.11*	0.05	-0.15***	0.04	0.11*
	(0.04)	(0.06)	(0.05)	(0.06)	(0.03)	(0.05)
$FTA_{ibalticst}$	0.49***	0.58***	0.56***	0.66***	0.49***	0.58***
	(0.08)	(0.09)	(0.07)	(0.07)	(0.06)	(0.08)
FTA_{it} (Ro, Bu)	0.11*	0.12*	0.04	-0.06	0.11	0.12*
	(0.06)	(0.06)	(0.05)	(0.05)	(0.07)	(0.07)
FTA_{it} (Hu, Po)	-0.08	-0.10	-0.02	0.00	-0.08	-0.10
	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)
FTA_{it} (Cz, Sl)	-0.14**	-0.14**	-0.27***	-0.31***	-0.14*	-0.14*
	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.07)
FTA_{it} (Sv)	-0.03	-0.08**	-0.07***	-0.22***	-0.03	-0.08**
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
FTA_{it} (Baltics)	0.14***	0.13***	0.12***	0.26***	0.14**	0.13**
	(0.05)	(0.05)	(0.04)	(0.04)	(0.06)	(0.06)
$\ln \sum_{i=1}^{I} s_{it}$		0.07		-1.56***		0.07
		(0.23)		(0.12)		(0.14)
$\ln \frac{1}{J} \sum_{j=1}^{J} re_{it}$		1.00***		-0.30***		1.00***
		(0.23)		(0.05)		(0.02)
$\ln MWRD_{ij}$				1.16***		1.46***
				(0.21)		(0.04)

$MWRLL_{ij}$				0.32		-0.45
				(3.62)		(0.51)
$MWRB_{ij}$				0.00*		0.03***
				(0.00)		(0.00)
$MWCL_{ij}$				2.09***		1.90***
				(0.29)		(0.08)
$MWRDEP_{ij}$				-12.74***		0.35
				(3.50)		(1.26)
$MWRFTA_{ijt}$		-0.24***		0.18***		-0.24***
		(0.09)		(0.06)		(0.08)
$MWREU_{ijt}$		-0.04		0.36***		-0.04
		(0.08)		(0.11)		(0.06)
HC1			0.47***	0.43***	0.61***	0.52***
			(0.04)	(0.04)	(0.01)	(0.01)
HC2			-1.85***	-1.45***	-1.82***	-1.74***
			(0.20)	(0.20)	(0.05)	(0.05)
HC3	0.11	0.12	0.14	0.11	0.11	0.12
	(0.11)	(0.10)	(0.10)	(0.10)	(0.11)	(0.11)
Observations	32245	32245	32245	32245	32245	32245
Wald test		8.69***		175.60***		1506.04***
R^2	0.91	0.91	0.71	0.72	0.91	0.91

Note: This table presents the estimation results of equation (2.11). The dependent variable is the log of imports of the individual EU-15 countries from 204 countries between 1991 and 2003. The independent variables are as described in Chapter 2.4.2 and based on the variables listed in Table A2.2 in Appendix A2.3. Columns (1) and (2) report the panel fixed effects, columns (3) and (4) the panel random effects and columns (5) and (6) the panel fixed effects vector decomposition regression results. The respective first columns are without multilateral terms, the respective second columns include multilateral terms. The R^2 in columns (3) and (4) is calculated as the squared correlation between the observed and the predicted response. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

Looking at the results of the regressions, including the multilateral terms, we find that the relative size of the importing EU-15 countries is not significantly different from zero. The average exchange rate variable shows a positive sign and a unit coefficient, indicating that imports from a certain trading partner increase proportionally to a depreciation of the importing country's currency against all currencies. Column (6) reveals that a 10% rise in country *i*'s geographical distance from all trading partners (remoteness) pushes it to trade 15% more with country *j*. Dependency and being landlocked does not seem to matter on a multilateral basis and border effects also play quantitatively a minor role in this sample. The coefficient on the multilateral language variable does not show the expected opposite sign of its bilateral counterpart. This may be due to the last term on the RHS of equation (2.9), the world resistance term, dominating the multilateral terms. Thus, in the world as a whole, there are many common languages facilitating trade between every pair of countries and outweighing possible negative consequences for bilateral trade of the multilateral language variables.

Turning to the interpretation of the FTA coefficients, the results display the meaningfulness of the agreements for the CEECs' integration into the EU. In the FE regression without the multilateral terms, four out of five dummy variables argue for a significant boost of the EU-15 countries' imports brought about by the agreements. Most trade has been created by the FTAs signed with the Baltic countries (63% above the normal level), closely followed by the Romanian and Bulgarian FTAs (60% above the normal level). These arrangements are also the ones featuring extra-bloc openness. They increased EU imports from the ROW by 12% and 15%, respectively.[44] The result for the Czech and Slovak Republic agreement is somewhat mixed. While it led to 48% more imports than what would have been predicted by the baseline scenario gravity model, it has reduced imports from third countries by 13%. For the agreements with Hungary, Poland and Slovenia effects on third countries could not be detected.

In general, the results keep holding true when the multilateral resistance terms are included. The Wald test confirms their joint relevance at the 1%-significance level. Nevertheless, it has to be noted that the coefficients of the FTA dummies (as well as the GDP and distance measures) move up in the second set of regressions. As laid out by Baldwin and Taglioni (2006), estimates of currency union dummies are likely to be biased if the relative price terms are omitted. Since we rely on a FEs model, even in the first regression, only the time-variant part of Anderson and van Wincoop's price terms is ignored. Not accounting for their time-varying character means, however, that the omitted variables enter into the error term. Since the ignored multilateral variables are correlated with their bilateral counterparts they bias the estimates of the latter.[45] The results presented in Table 2.1 confirm this hypothesis. The two time-varying multilateral FTA terms are negatively correlated with bilateral trade, but may indeed exhibit a positive impact on the decision to form an FTA. The average exchange rate, in turn, has a positive effect on the dependent variable. Moving to the estimation results of the full model in columns (2), (4) and (6) of Table 2.1, this chapter finds that the agreements with the CEECs actually have created between 7 and 20 percentage points more trade than suggested by the regression, ignoring the time-varying component of the relative price terms (plus the coefficient for the FTA with Slovenia becoming significant). In

[44] Note, however, that the FTA_{it} (Ro, Bu) coefficient is not significant in the FEVD estimation (for the specification without multilateral terms).

[45] Baltagi, Egger and Pfaffermayr (2003) find that only the fully specified model with importer and exporter time-varying effects does not underestimate the impact of summed GDP and income similarity on trade. They stress the possibility of misleading inference in underspecified models.

the case of Slovenia, we also find stronger evidence for reduced EU-15 imports from the ROW. For the FTAs with Romania and Bulgaria and with the Baltic States, there is no evidence that the large trade creation with the EU-15 was at the expense of third countries. To the contrary, in both specifications, the ROW also gained import shares in the course of the implementation of the two arrangements.

2.6.2 Robustness Checks

Although the country groupings used in Table 2.1 follow the historical criterion of signing and entry into force of the IAs and EAs (see Table A2.1 in Appendix A2.1), it could be argued that an economic criterion, based on structural similarity, might be more appropriate. Such a criterion would point towards the three country groupings commonly used in the East-West European trade literature: the Visegrad (Czech and Slovak Republics, Hungary and Poland) countries, the Balkans (Bulgaria, Romania and Slovenia) and the Baltic (Estonia, Latvia and Lithuania) states.

Table 2.2 shows the trade effects obtained from the regression results for these alternative country groupings, allowing thereby for a better comparison to previous studies.[46] The parameter estimates of the explanatory variables underline the robustness of the previous estimation results shown in Table 2.1. In both country groupings, the FTA coefficients move up with the inclusion of the again jointly significant multilateral resistance terms. For all CEECs taken together (column (2)), the IAs and EAs boosted EU imports from that region 72% above the otherwise predicted level without negatively affecting third countries.

[46] In order to save space the full results table for the robustness check is not presented here, but can be made available upon request.

Table 2.2: Estimation Results – Alternative Country Groupings

Dependent variable: $\ln M_{ijt}$				
	FTA: all CEECs		**FTA: 3 CEEC groups**	
	(1) w/o MWR	(2) with MWR	(3) w/o MWR	(4) with MWR
$FTA_{iCEECst}$	0.42***	0.54***		
	(0.02)	(0.04)		
FTA_{it} (CEECs)	0.10***	0.06***		
	(0.01)	(0.02)		
$FTA_{ivisegradt}$			0.38***	0.54***
			(0.05)	(0.06)
$FTA_{ibalkant}$			0.32***	0.44***
			(0.03)	(0.05)
$FTA_{ibalticst}$			0.39***	0.48***
			(0.04)	(0.05)
FTA_{it} (Visegrad)			-0.06	0.00
			(0.04)	(0.05)
FTA_{it} (Balkan)			0.10***	0.07**
			(0.03)	(0.03)
FTA_{it} (Baltics)			0.04	0.01
			(0.03)	(0.03)
Observations	32245	32245	32245	32245
Wald test		1472.41***		1520.44***
R^2	0.91	0.91	0.91	0.91

Note: This table presents estimation results based on the panel fixed effects vector decomposition estimator. In columns (1) and (2), the CEECs are taken as a group, in columns (3) and (4), the Visegrad countries comprise Poland, Hungary, the Czech and the Slovak Republic, the Balkans comprise Romania, Bulgaria and Slovenia and the Baltics comprise Latvia, Lithuania and Estonia. The respective first columns are without multilateral terms, the respective second columns include multilateral terms. Other coefficients are omitted but the full list is as in Table 2.1. Since the dates of entry into force of the agreements differ for the countries in the aggregate, we took the "mean" years in assigning the values of 1 and 2 to the dummies measuring the extra-bloc openness. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

For the purpose of comparing the proposed approach to recent studies that account for Anderson and van Wincoop's price terms via time-varying dummy variables, the regression was repeated including country pair-specific time trends as suggested by Bun and Klaassen (2007) instead of the multilateral trade cost variables. In order to make the regression computationally possible, we had to restrict the sample to OECD countries and limit the dummies to take triannual steps. Since this transformation dropped the number of observations considerably, a comparison can only be made to a FEs regression with MWR terms on an identical sample.

Table 2.3 contains the estimation results of the specification with a country pair-specific time trend (column (1)) as compared to the specification with multilateral trade resistance terms (column (2)).

Table 2.3: Estimation Results – Country Pair-Specific Time Trend

Dependent variable: $\ln M_{ijt}$		
	Country pair-specific trend	**MWR**
	(1)	(2)
$\ln Y_{it}$	0.73***	1.03***
	(0.08)	(0.12)
$\ln Y_{jt}$	0.31***	0.66***
	(0.08)	(0.06)
$\ln re_{ijt}$	0.01	0.00
	(0.04)	(0.05)
EU_{ijt}	-0.01	0.04
	(0.03)	(0.07)
EU_{it}	-0.16***	-0.10*
	(0.06)	(0.06)
$FTA_{iCEECst}$	0.16***	0.26***
	(0.04)	(0.04)
FTA_{it} (CEECs)	0.13***	-0.09***
	(0.02)	(0.02)
$\ln \sum_{i=1}^{I} s_{it}$		-1.21***
		(0.19)
$\ln \frac{1}{J} \sum_{j=1}^{J} re_{it}$		0.39*
		(0.20)
$MWREU_{ijt}$		-0.04
		(0.08)
$MWRFTA_{ijt}$		-0.13
		(0.08)
HC3		-0.05**
		(0.02)
Observations	5826	5826
R^2	0.82	0.52

Note: This table presents estimation results based on the panel fixed effects estimator. Column (1) reports the results with a country pair-specific time trend, column (2) with multilateral resistance terms. The dependent variable is the log of imports of the individual EU-15 countries from OECD and CEE countries between 1991 and 2003. Time-invariant variables are included into the regression, but not reported. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

With a time trend, the coefficient of the FTA_{ijt} variable is reduced to 0.16 (0.26 for the FE estimation with MWR variables). Since both the FTA variables and the country pair dummies are defined bilaterally and time-variant, the dummy might partly absorb the explanatory power of the FTA variables. Baldwin and Taglioni (2006) mention in this context that time-varying pair dummies will make it impossible to estimate factors that affect bilateral trade costs even if they are time-varying as well. Note also that the MWR specification indicates trade losses of the EU-CEECs agreement for OECD countries.

To investigate further how income, distance and adjacency interact with signing and implementing an FTA, multiplicative terms between the trade dummies and some of the gravity variables are included in the next robustness check. For the CEECs (FTA=1), the FTA effect is given by the sum of the coefficient of the FTA dummy and of the coefficient of the interaction term (Table 2.4).

Table 2.4: Estimation Results – Interaction Terms

Dependent variable: $\ln M_{ijt}$				
	Basic	**Distance**	**Border**	**GDP**
	(1)	(2)	(3)	(4)
$\ln Y_{it}$	0.43***	0.43***	0.43***	0.42***
	(0.01)	(0.01)	(0.01)	(0.01)
$\ln Y_{jt}$	0.71***	0.71***	0.71***	0.71***
	(0.00)	(0.00)	(0.00)	(0.01)
$\ln D_{ij}$	-2.28***	-2.25***	-2.29***	-2.29***
	(0.03)	(0.04)	(0.03)	(0.03)
B_{ij}	-0.00***	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
$FTA_{iCEECst}$	0.54***	-0.40**	0.54***	-1.13***
	(0.04)	(0.17)	(0.04)	(0.23)
FTA_{it} (CEECs)	0.06***	0.50***	0.06***	0.07***
	(0.02)	(0.09)	(0.02)	(0.02)
$FTA_{iCEECst} * \ln D_{ij}$		0.13***		
		(0.02)		
FTA_{it} (CEECs)* $\ln D_{ij}$		-0.05***		
		(0.01)		
$FTA_{iCEECst} * B_{ij}$			-0.00***	
			(0.00)	
FTA_{it} (CEECs)$*B_{ij}$			0.00**	
			(0.00)	
$FTA_{iCEECst} * \ln Y_{jt}$				0.07***
				(0.01)
Observations	32245	32245	32245	32245
R^2	0.91	0.91	0.91	0.91

Note: This table presents estimation results based on the panel fixed effects vector decomposition estimator. Column (1) reports the results of the basic regression, the other columns report the results on the interaction of the FTA dummy variable with distance (column (2)), border (column (3)) and GDP (column (4)). Other coefficients are omitted but the full list is as in Table 2.1. The interaction term between FTA_{it} (CEECs) and $\ln Y_{it}$ has been dropped due to collinearity. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

The results prove to be robust to the introduction of these interactions, indicating that a rise in exporter GDP and geographical distance lowers the trade gain of an FTA. This is a sensible result, as small economies typically gain the most from liberalising trade and higher distances among integrating partners increase trade costs, thus lowering trade gains.

Finally, in addition to the static approach, the dynamic specification of equation (2.11) is adopted as a last robustness check, where the lagged dependent variable is included among the regressors to control for the persistence of import flows (Table 2.5).

Table 2.5: Estimation Results – Dynamic Specification

Dependent variable: $\ln M_{ijt}$		
	(1) w/o MWR	(2) with MWR
$\ln M_{i,t-1}$	0.28*** (0.03)	0.28*** (0.03)
$\ln Y_{it}$	0.21** (0.09)	0.25*** (0.09)
$\ln Y_{jt}$	0.54*** (0.06)	0.55*** (0.06)
$\ln re_{ijt}$	-0.24*** (0.05)	-0.30*** (0.05)
EU_{ijt}	0.02 (0.03)	0.02 (0.04)
EU_{it}	-0.25*** (0.05)	-0.25*** (0.05)
$FTA_{iCEECst}$	0.27*** (0.04)	0.40*** (0.05)
FTA_{it} (CEECs)	0.06*** (0.02)	0.05*** (0.02)
$\ln \sum_{i=1}^{I} s_{it}$	-0.04 (0.13)	0.36** (0.15)
$\ln \frac{1}{J} \sum_{j=1}^{J} re_{it}$		0.62*** (0.16)
$MWREU_{ijt}$		0.01 (0.06)
$MWRFTA_{ijt}$		-0.36*** (0.08)
Observations	25778	25778
Wald test		32.58***
R^2	0.75	0.68

Note: This table presents the estimation results of the dynamic version of equation (2.11). The estimations are based on the difference GMM estimator. Column (1) is without multilateral terms, column (2) includes multilateral terms. Time-invariant variables are included in the regressions, but dropped due to collinearity. The R^2 is calculated as the squared correlation between the observed and the predicted response. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

As discussed in Chapter 2.5.2, inferences have to be drawn with caution, since the detected non-stationarity introduces a weak instruments problem.[47] In addition to this, the results are not directly comparable to the static results at least for two reasons: first, first differencing magnifies gaps in unbalanced panels and causes a loss of about 6500 observations. Second, differencing the stepwise (0/1/2) FTA dummy variable wipes out the trade liberalising effects except for the years the IAs and the EAs entered into force. The estimated coefficient of 0.40 (49%) for the FTA_{ijt} and 0.05 (5%) for the FTA_{it} variable represent therefore only the initial impact their implementation had on changes in EU imports, but can to a large extent not capture the gradual nature of tariff reductions under the agreements (Herderschee and Qiao 2007: 15). Nevertheless, the results reveal that the current imports depend on their previous levels, which provides a rationale for a dynamic approach. The remaining coefficients generally behave similarly in both, the static and the dynamic specifications.

2.6.3 Comparison to Earlier Studies

To allow for comparison to other East-West studies, we refer to the overall (static) FTA impact as reported in Table 2.2, column (2). The estimated FTA coefficient for all CEECs of 0.54 (thus, indicating a trade creation elasticity of 72%) lies at the upper bound of previous parameter estimates (compare Table 2.6).

Table 2.6: Trade Creation Elasticities in Previous Studies

	TC elasticity	Estimation technique
This chapter	72%	FE and FEVD
Martín and Turrión (2001)	130%	Two-step FE
Laaser and Schrader (2002)	286%[a]/14%[b]	Cross-section
Paas (2003)	-30%	Cross-section
Adam, Kosma and McHugh (2003)	32%	Two-step FE
De Benedictis, De Santis and Vicarelli (2005)	11%	System GMM
Herderschee and Qiao (2007)	35%	FE and system GMM
Caporale, Rault, Sova and Sova (2008)	23%	FE and FEVD

Note: [a] Baltic States' exports to members of the Baltic sea region, [b] Baltic States' exports to the rest-EU (estimate not significant).

[47] As OLS estimation gives an upward biased coefficient and within-groups estimation a downward biased coefficient of the lagged dependent variable, the consistent estimate is expected to lie in between. Since the difference GMM estimate of 0.28 in columns (1) and (2) is even below the within-groups estimate of 0.34, the weak instruments problem seems severe. The detailed results of these robustness checks are not presented but can be made available upon request.

The differences in the trade creation elasticities seen in Table 2.6 stem from different specifications of the gravity equation, varying estimation techniques, country samples and time spans. Paas (2003) and Laaser and Schrader (2002) use cross-sectional data and find that integration among the members of the BSR is more intense than between the CEECs and the EU. Ignoring the time dimension results, however, in a substantial loss of information. This is especially true for FTAs that rather imply a gradual than an all-at-once liberalisation process.

In an early panel data study, Martín and Turrión (2001) estimate a coefficient of 0.83 for intra-group and 1.99 on extra-group export shares. Close to our procedures appear the approaches of Adam, Kosma and McHugh (2003), Caporale, Rault, Sova and Sova (2008) and Herderschee and Qiao (2007). The studies rely, however, on time-invariant country (pair) specific fixed effects to account for the multilateral resistance terms. Since part of the resistance, namely the multilateral FTA variable, is time-varying and negatively correlated with the dependent variable, the results are likely to be downward biased. Herderschee and Qiao (2007) also provide evidence of trade developments on an individual country level. In line with our estimated impact of the individual FTAs, the authors find that Poland, Romania and Estonia experience the biggest trade gains whereas the EA with Slovenia is measured to have had the lowest impact on the country's exports to the EU.

De Benedictis, De Santis and Vicarelli (2005) – looking on a sample of the EU-15 and eight CEECs – appropriately account for multilateral trade resistance by including a country pair-specific time trend. Part of their lower estimate of 11% may be explained by the small country sample (compare the respective robustness check in Table 2.3) and the exclusion of Romania and Bulgaria. The FTAs with the two countries lead to a 60% and 80% increase in EU imports in our regressions without and with MWR, respectively (see Table 2.1). Equally important should be the estimation properties. First, the authors' use of a bilateral time trend may absorb some of the explanatory power of the time-varying bilateral FTA variables. Second, the study applies a system GMM estimator reasoning that taking orthogonal deviations helps to circumvent the loss of observations when first-differencing. By subtracting the average of all future observations, the effect on the FTA variable is, however, essentially the same – it cancels out at all but one point in time. Depending on the exact specification, the estimate that De Benedictis, De Santis and Vicarelli (2005) provide may only capture the trade effect in 2003, the last year of their sample.[48]

[48] In case, the authors impeded the transformation of the FTA dummy, the last point does not apply.

2.7 Conclusions of Chapter 2

This chapter has paid particular importance to theoretically deriving a new version of a correctly specified gravity equation to avoid biases present in previous studies. The specification proposed gives important insights. First, it can be shown that the exchange rate variables frequently employed empirically do stand on a sound theoretical ground and exhibit econometric importance. Second, new measures for multilateral trade resistance are introduced which mostly show the expected coefficient signs in the empirical estimation. Third, looking at the agreements on an individual country basis, we conclude that the FTAs have supported and accelerated the CEECs' integration into the EU. The process has not been free of charge, however, as we also find evidence that although each FTA created new trade within the trade bloc, the increase has in the case of the Czech Republic, Slovakia and Slovenia been at the expense of imports from the ROW. Finally, as for the aggregate trade effects of the IAs and EAs, the result is at the upper bound of previous estimates. However, we believe that earlier studies relying on fixed effects underestimate the agreements' effect since they only partly eliminate the omitted variable biases.

In a modern application of Viner's theory, other issues arise which go beyond the scope of this chapter. For example, it has to be questioned to what extent the classic concepts of trade creation and trade diversion, which have been conceived in a world without capital mobility, do make sense in a scenario in which the fastest growing component of trade is the one stemming from capital mobility, i.e. from foreign affiliates of MNEs. The EU Commission (2006) now recognises that trade re-orientation is in large part led by the international fragmentation of production of EU multinationals, which have delocalized labour-intensive parts of their production processes in the East, and then re-imported intermediates through special custom regimes (OPT). These issues (vertical FDI, trade in intermediates, OPT), are points still to be empirically analysed when talking about trade effects of regional integration, but were not the main focus of the present analysis.

A2 Appendix

A2.1 Schedule of Signature and Entry into Force of EU-CEECs Agreements

Table A2.1: Dates of Entry into Force of the Interim and the Europe Agreements

Dummy			Country	Interim Agreement	Europe Agreement
FTA_{CEECs}	$FTA_{visegrad}$	FTA_{hupo}	Hungary	March 1992	February 1994
			Poland	March 1992	February 1994
		FTA_{czsl}	Czech Republic	March 1992	February 1995
			Slovakia	March 1992	February 1995
	FTA_{balkan}	FTA_{robu}	Romania	December 1993	February 1995
			Bulgaria	May 1993	February 1995
		FTA_{sv}	Slovenia	July 1997	February 1999
	$FTA_{baltics}$	$FTA_{baltics}$	Estonia	January 1995	February 1998
			Lithuania	January 1995	February 1998
			Latvia	January 1995	February 1998

Source: Council of the European Union.

A2.2 Adjusting the Model to a Limited Number of Importing Countries

For this chapter, the theoretical framework has to be adapted to the case of EU-15 countries' imports (countries *i*) from a worldwide sample of countries (countries *j*). Say, that there exist *r* other importing countries $\sum_{r=1}^{R} country_r = \sum_{j=1}^{J} country_j - \sum_{i=1}^{I} country_i$, whose import prices can be described analogously to country *i* as

$$p_{rj} = t_{rj} P_j e_{rj} . \qquad \text{(A2.1)}$$

Under general equilibrium conditions, output in country *j* must then equal the aggregate expenditure spent by countries *i* and *r* on varieties produced in *j*,

$$Y_j = \sum_{i=1}^{I} M_{ij} + \sum_{r=1}^{R} M_{rj} \ . \tag{A2.2}$$

Making a few mathematical transformations, we can solve for N_j

$$N_j = \frac{Y_j}{\sum_{i=1}^{I} \left(re_{ij} t_{ij}\right)^{1-\sigma} Y_i + \sum_{r=1}^{R} \left(re_{rj} t_{rj}\right)^{1-\sigma} Y_r} \ . \tag{A2.3}$$

Plugging (A2.3) into (4), country *i*'s imports arise as

$$M_{ij} = \frac{Y_i Y_j}{Y^W} \frac{\left(re_{ij} t_{ij}\right)^{1-\sigma}}{\sum_{i=1}^{I} \left(re_{ij} t_{ij}\right)^{1-\sigma} s_i + \sum_{r=1}^{R} \left(re_{rj} t_{rj}\right)^{1-\sigma} s_r} \ . \tag{A2.4}$$

For our empirical estimation this means that $\frac{1}{Y^W} \frac{1}{\frac{\sum_{r=1}^{R} s_r \left(re_{rj} t_{rj}\right)^{1-\sigma}}{\sum_{i=1}^{I} s_i \left(re_{ij} t_{ij}\right)^{1-\sigma}} + 1}$ will be absorbed in the constant. This is equivalent to assuming (i) a co-movement of the sum of "*r*" countries' GDPs, average exchange rates and trade costs against *j* and of the sum of "*i*" countries' GDPs, average exchange rates and trade costs against *j* and (ii) a constant world growth.

A2.3 Variable List and Definitions

Table A2.2: List of Variables – Chapter 2

Variable	Definition	Source
M_{ijt}	Yearly imports of country *i* from country *j*	OECD ITCS
$Y_{i(j)t}$	Importer and exporter GDP (in current US$)	UN NAMAD
re_{ijt}	Bilateral real exchange rate	UN NAMAD (nom. exchange rates), IMF IFS (price indices and GDP deflators), own calculations
D_{ij}	Great circle distances between the respective trading pairs	CIA World Factbook, own calculations based on the haversine formula
LL_{ij}	Dummy = 1 if one and = 2 if both countries in a trading pair are landlocked	CIA World Factbook
B_{ij}	Dummy controlling for the border length between countries *i* and *j*	CIA World Factbook
DEP_{ij}	Dummy = 1 if country *j* legally depends on country *i*	CIA World Factbook
CL_{ij}	Dummy = 1 if the trading partners share a common official language	CIA World Factbook
EU_{ijt}	Dummy = 1 for EU member states	
EU_{it}	Dummy = 1 for non-EU member states	
FTA_{ijt}	Dummy = 1 for contracting parties for the years following the entry into force of the Interim and = 2 for the years following the entry into force of the Europe Agreements	Council of the European Union
FTA_{it}	Dummy = 1 for non-contracting parties for the years following the entry into force of the Interim and = 2 for the years following the entry into force of the Europe Agreements	Council of the European Union
s_{it}	Share of country *i*'s GDP in world GDP (in current US$)	UN NAMAD

Note: When available the producer price index has been used for the calculation of the real exchange rate. This has been the case for 65 out of 204 countries, among those the ten CEECs. In all other cases we reverted to the consumer price index or the GDP deflator.

A2.4 The Fixed Effects Vector Decomposition Estimator

In the first stage the FEVD procedure estimates a standard FE model by conducting a within-groups transformation,

$$\tilde{M}_{ijt} = \delta \tilde{X}_{ijt} + \tilde{\varepsilon}_{ijt} \tag{A2.5}$$

which removes the bilateral effects μ_{ij} and the time-invariant variables T_{ij}. From this, one obtains the estimated unit effects $\hat{\mu}_{ij}$, including all time-invariant variables, the overall constant term and the mean effects of the time-varying variables. In the second stage, $\hat{\mu}_{ij}$ is decomposed into an explained part (by the observed time-invariant and rarely changing variables) and an unexplained part h_{ij},

$$\hat{\mu}_{ij} = \lambda T_{ij} + h_{ij} . \tag{A2.6}$$

In the last stage, the full model including the residual h_{ij} from stage two but leaving out μ_{ij} is re-estimated using POLS,

$$M_{ijt} = \alpha + \delta X_{ijt} + \lambda T_{ij} + \upsilon \hat{h}_{ij} + \varepsilon_{ijt} . \tag{A2.7}$$

Hence, if the orthogonality assumption between the time-invariant variables and the unobserved bilateral effects is correct, the estimator is consistent.

A2.5 Country List

Afghanistan	Colombia	Haiti	Marshall Islands
Albania	Comoros	Honduras	Mauritania
Algeria	Congo D. Rep.	Hong Kong	Mauritius
American Samoa	Congo Rep.	Hungary	Mayotte
Andorra	Costa Rica	Iceland	Mexico
Angola	Côte d'Ivoire	India	Micronesia
Antigua & Bar.	Croatia	Indonesia	Moldova
Argentina	Cuba	Iran Islamic Rep.	Mongolia
Armenia	Cyprus	Iraq	Morocco
Aruba	Czech Republic	Ireland	Mozambique
Australia	Denmark	Israel	Myanmar
Azerbaijan	Djibouti	Italy	Namibia
Bahamas	Dominica	Jamaica	Nepal
Bahrain	Dominican Republic	Japan	Netherlands
Bangladesh	Ecuador	Jordan	Netherlands Ant.
Barbados	Egypt	Kazakhstan	New Caledonia
Belarus	El Salvador	Kenya	New Zealand
Belgium	Equatorial Guinea	Kiribati	Nicaragua
Belize	Eritrea	Korea Dem. Rep.	Niger
Benin	Estonia	Korea Rep.	Nigeria
Bermuda	Ethiopia	Kuwait	N. Mariana Isl.
Bhutan	Faeroe Islands	Kyrgyz Republic	Norway
Bolivia	Fiji	Lao PDR	Oman
Bosnia-Herz.	Finland	Latvia	Pakistan
Botswana	France	Lebanon	Palau
Brazil	French Polynesia	Lesotho	Panama
Brunei	Gabon	Liberia	Papua New G.
Bulgaria	Gambia	Libya	Paraguay
Burkina Faso	Georgia	Liechtenstein	Peru
Burundi	Germany	Lithuania	Philippines
Cambodia	Ghana	Luxembourg	Poland
Cameroon	Greece	Macao	Portugal
Canada	Greenland	Macedonia FYR	Qatar
Cape Verde	Grenada	Madagascar	Romania
Cayman Islands	Guam	Malawi	Russian Fed.
Central Afr. Rep.	Guatemala	Malaysia	Rwanda
Chad	Guinea	Maldives	Samoa
Chile	Guinea-Bissau	Mali	San Marino
China	Guyana	Malta	S. Tome & Pr.

Saudi Arabia	Sri Lanka	Thailand	United States
Senegal	St. Kitts & Nevis	Timor-Leste	Uruguay
Serbia-Mont.	St. Lucia	Togo	Uzbekistan
Seychelles	St. Vincent	Tonga	Vanuatu
Sierra Leone	Sudan	Trinidad & Tob.	Venezuela
Singapore	Suriname	Tunisia	Vietnam
Slovak Republic	Swaziland	Turkey	Virgin Isl. (U.S.)
Slovenia	Sweden	Turkmenistan	W. Bank & Gaza
Solomon Islands	Switzerland	Uganda	Yemen Rep.
Somalia	Syrian Arab Rep.	Ukraine	Zambia
South Africa	Tajikistan	United Arab Em.	Zimbabwe
Spain	Tanzania	United Kingdom	

CHAPTER 3 ENLARGING THE EMU TO THE EAST: WHAT EFFECTS ON TRADE?[49]

3.1 Introduction to Chapter 3

As a result of the European Commission's convergence report in May 2006, Slovenia was the first of the new EU member states to adopt the Euro. Other countries will follow in years to come. While research into exchange rate regimes traditionally focused on consequences for the macroeconomic performance of countries (see Ghosh, Gulde and Wolf 2002 for an exhaustive overview and Belke and Gros 2002 and Belke and Setzer 2003 for labour market effects), a more recent line of research draws attention to the real impacts of exchange rate issues (see Bayoumi and Eichengreen 1992 and 1998 and Frankel and Rose 1998 for the effects on business cycle synchronisation). In a controversial but highly influential paper, Rose (2000) assessed the contribution of currency unions in promoting international trade. His point estimate of a 3.35 times higher trade volume with a common currency compared to the baseline scenario without a common currency has been subject to much critique. In a recent paper, Baldwin (2006a) summarises follow-up studies and specifically points his critique at possible estimation biases related to omitted variables, endogeneity and sample selection.

Among the numerous papers trying to reduce the "Rose effect", a few deal explicitly with the Euro Area. The first studies by Micco, Stein and Ordoñez (2002) and Flam and

[49] This chapter goes in parts back to Belke and Spies (2008). Originally published on www.springerlink.com.

Nordstrom (2006a) estimate respectively 6% and 9% more trade among EMU members compared to other EU member states.[50] Controlling for the general trend of greater economic integration among the Euro Area countries over the past five decades, Berger and Nitsch (2005) even find that the EMU effect disappears completely. In the most recent study, Bun and Klaassen (2007) introduce a time trend and estimate a Euro effect of only 3%.

However, very few authors point at the trade effects of the forthcoming EMU enlargement.[51] While trade barriers between the old and new EU member states were already removed during the 1990s[52], sharing a common currency may further deepen real economic integration – directly through reduced trade costs and indirectly through intensified competition due to enhanced price transparency. The question as to whether these changes have indeed led to an additional geographical restructuring of trade flows, involving trade creation and trade diversion, is, however, an empirical one. Empirical findings on intra-EMU trade effects of the introduction of the Euro by the CEECs[53] are of great interest for politicians and for researchers in the field of Optimum Currency Areas (OCAs) at least for two reasons: first, they may have important policy implications. If a common currency boosts trade even among highly integrated regions, currency unions become more attractive, and hence, the ECB and government authorities may encourage applicants to execute all necessary steps for an early adoption of the Euro.[54] Second, any increase in the Euro Area trade resulting from an EMU enlargement provides empirical support for Rose's finding that establishing a common currency stimulates trade among union members substantially.

This chapter starts by applying a specification that accounts for recent insights into the theoretical foundation as well as the appropriate econometric set-up of gravity models. While earlier studies only use time-invariant country pair fixed effects to address the price terms, as emphasised by Anderson and van Wincoop (2003), the remaining omitted variable bias is corrected for by also incorporating time-variant multilateral resistance to trade.[55] As suggested by Egger (2002) and Carrère (2006), we apply the HT instrumental variables

[50] In this chapter, the terms EMU and Euro Area are used as substitutes and refer throughout the chapter to the twelve EMU member states that introduced the common currency in 1999 and 2001.
[51] We are only aware of the studies by Maliszewska (2004) and Brouwer, Paap and Viaene (2008) dealing with this issue empirically.
[52] Trade and trade-related measures became effective by means of the IAs, ratified between 1992 and 1995 (compare Chapter 2).
[53] In this chapter, we conceive the CEECs as the group formed by the Baltic States (Estonia, Latvia and Lithuania), the Czech Republic, Hungary, Poland, Slovakia, and Slovenia.
[54] Breuss, Fink and Haiss (2004) discuss the desirability of enlarging the EMU to the East in the context of different interpretations of the OCA theory.
[55] Compare Chapter 2 for details on this method.

estimator to account for any possible endogeneity of RHS variables, and specifically the EMU dummy. Further, we use the FEVD estimator developed by Plümper and Troeger (2007), which has – to our knowledge – hardly been applied before in the context of gravity modelling.[56] Both techniques have the great advantage of allowing for an estimation of the traditional time-invariant gravity variables, such as distance and language while controlling for the unobserved individual effects in an efficient way.

Based on the estimates of the early impact of the Euro on intra-EMU imports, this chapter aims to assess the implications of the EMU accession of eight CEECs on their share in the twelve Euro Area member states' imports as of end-of-year 2004. Assuming that the same relationship between income, distance, common borders and other country characteristics and bilateral trade will hold for future EMU member states, we calculate the potential import increases following the accession of the CEECs to the Euro Area. The predictions based on the parameters estimated out-of-sample suggest that except for the least integrated countries, Poland, Latvia and Lithuania, all CEECs can expect further gains in the EMU-12 import share once they adopt the Euro.

After developing some stylised facts and linking them to the predictions of the OCA theory in Chapter 3.2, the chapter continues with the specification of the gravity equation that is going to be tested (Chapter 3.3). Chapter 3.4 contains the description of the applied econometric methods and the data set. Chapter 3.5 starts with the presentation of the baseline estimation results (Chapter 3.5.1) and proceeds with reporting the trade predictions for an enlargement of the Euro Area (Chapter 3.5.2). Chapter 3.6 contains a summary as well as policy implications of the obtained results.

[56] Compare Chapter 2 for an application of the FEVD estimator in the context of East-West integration.

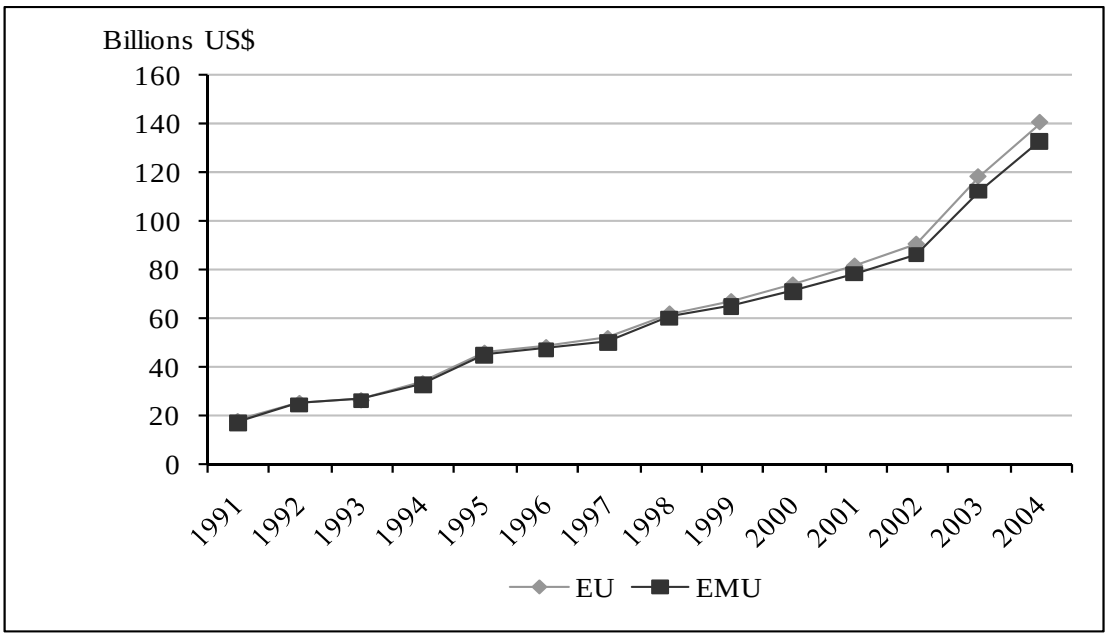
3.2 Development of Trade Flows and the Role of Monetary Integration

To give a first intuition of the trade consequences of currency unions, this chapter presents some preliminary facts (3.2.1) and links them to the two different versions of OCA theory (3.2.2).

3.2.1 Stylised Facts

We start with some stylised facts concerning trade flows between the Euro Area and the Central and Eastern European EU member countries. For this purpose, Figure 3.1 plots the EMU-12 and the EU-15 imports from the CEECs between 1991 and 2004. The figure conveys initial empirical evidence of a parallel increase in the import values of the EU-15 and the EMU-12 from the CEECs over the past 15 years.[57] While there has been a steady rise in the import value over the 1990s, one can observe a higher growth rate imminently prior to the EU accession of the eight CEECs.

Figure 3.1: EU and Euro Area Imports from the CEECs



Source: Own calculations. Data from OECD.

Even though most obstacles to free trade have been fully removed, sharing a single currency may stimulate real integration further through various channels (see Chapter 3.2.2).

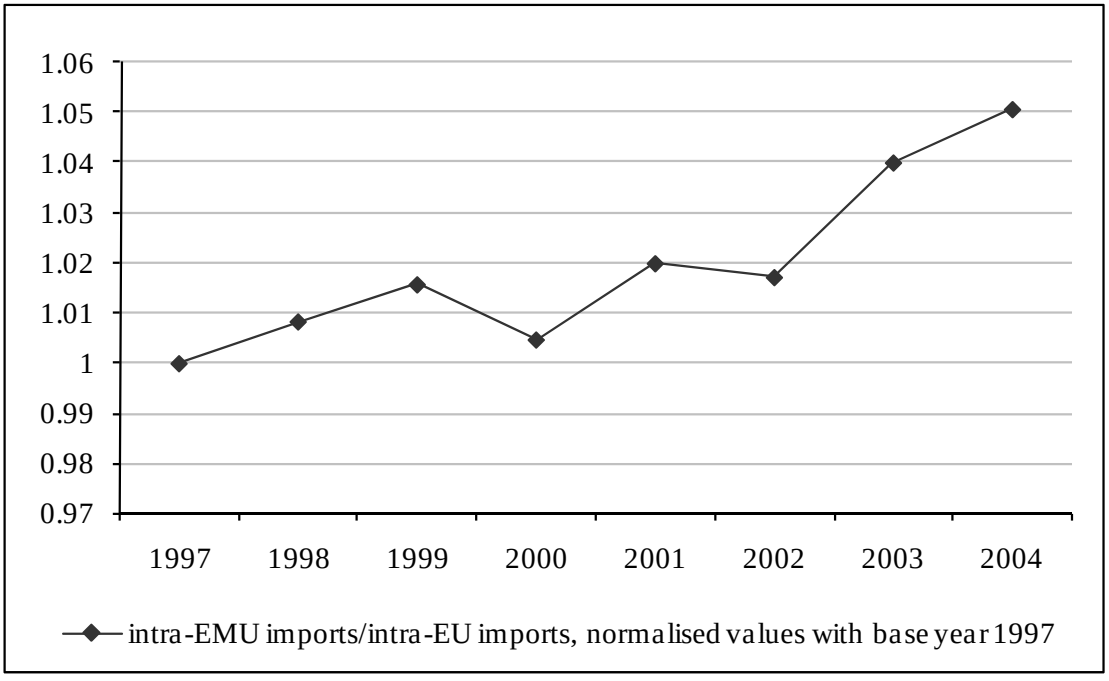
[57] For reasons of data availability (see Chapter 2.2), we look here at EMU-12 imports from the CEECs.

A simple calculation helps to portray the relative change in intra-EMU trade and intra-EU trade. To render the sizes of the two geographical regions comparable, the respective yearly import values have been normalised with regard to the base year (1997). Taking the quotient then allows us to assess relative changes. To be precise, the development of intra-EMU imports (M_{EMU}) and intra-EU imports (M_{EU}) since 1997 has been calculated as follows:

$$\frac{M_{EMUt} / M_{EMU97}}{M_{EUt} / M_{EU97}}. \tag{3.1}$$

Figure 3.2 clearly shows that the increase of intra-EMU imports was over 5% higher than the rise in intra-EU imports during the same period. After an initial slowdown in 1999, the EMU experienced an especially strong relative increment in 2001, when Greece entered the currency union, and in 2003. The graph also suggests an announcement effect, since intra-EMU imports already increased relative to intra-EU imports in the two years before the common currency was formally adopted.

Figure 3.2: Increase in Intra-EMU Imports Relative to Intra-EU Imports



Source: Own calculations. Data from OECD.

The crude figure seems to roughly confirm prior studies which provide estimates mostly in the range of 5 to 10% (Baldwin 2006a). However, the graph also shows that it is crucial to include the most recent year available, since much of the increase in imports has only occurred since 2002.

Seen on the whole, the stylised facts match our a priori expectations well. While the imports of the EU-15 and the Euro Area from the CEECs have developed synchronously up to now, those EU member states that share a common currency seem to trade relatively more with each other than with Denmark, Sweden and the UK. This result at the outset argues in favour of a similar development in the case of the EMU accession of the CEECs, thus calling for a more formal investigation.

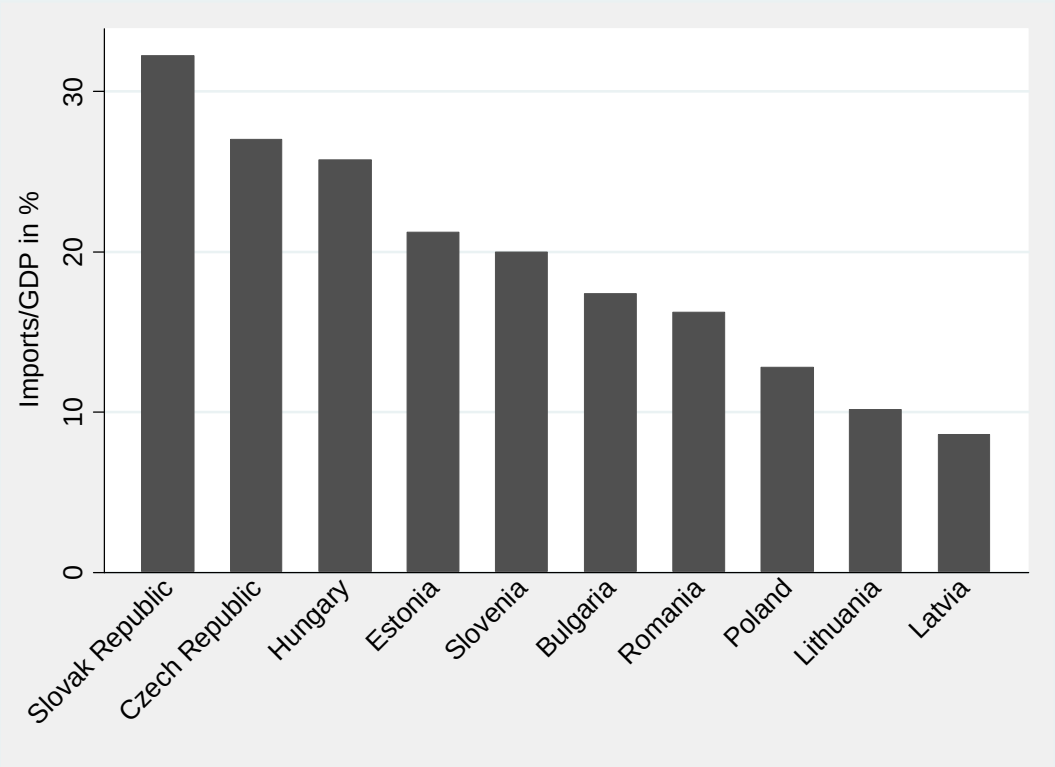
3.2.2 Optimum Currency Areas and Trade

The theoretical question as to whether a single currency is beneficial for the participating countries dates back to Mundell (1961).[58] On the one hand, he proposed that a single medium of exchange should reduce transaction costs and thereby facilitate international trade. On the other hand, he also stated that a single currency may be problematic in the case of coexisting asymmetric shocks and nominal rigidities. He therefore suggested perfect labour mobility as an indispensable condition to lowering the stability losses associated with giving up monetary independence. Mundell himself challenged his early proposal of a small currency union by introducing the foreign exchange market and international risk sharing (Mundell 1973). In his later model this means that the greater the number of countries involved, the better they can mitigate shocks by reserve pooling and portfolio diversification. There are, consequently, theoretical arguments speaking in favour of an enlargement of the Euro Area.[59] McKinnon (1963) specifically suggested small open economies as being suitable candidates for currency unions.

Based on the ratio of Euro Area imports over the CEECs' GDPs, Figure 3.3 gives a visual impression of the degree of Euro Area openness of the CEECs in the year 2004.

[58] For a comprehensive discussion, see Breuss, Fink and Haiss (2004) and Gros and Thygesen (1998).
[59] Another strand of arguments points towards the importance of institutional quality. Alesina and Barro (2002) show that countries opt into currency unions in order to facilitate trade when participation allows them to upgrade the quality of their monetary institutions.

Figure 3.3: EMU Openness of the CEECs in 2004



Source: Own calculations. Data from OECD and UN.

In accordance with the traditional OCA theory arguments mentioned above, the Czech Republic, Slovakia and Hungary should benefit most from their individual EMU accession since the Euro Area displays a high trade exposure towards them. However, the seminal study by Frankel and Rose (1998) challenged the OCA textbook view by stressing the possibility of endogenous currency unions. They argue that two countries would move even closer to matching the OCA criteria once they share a common currency. There are several transmission mechanisms that can spur this effect: in addition to the traditional trade cost reduction, the efficiency gains studied within the OCA framework also include higher price transparency, which stimulates competition and eventually leads to higher trade volumes. Finally, one may argue that the EMU and its pro-competitive effects have served as a catalyst for structural reforms.[60] The cost savings related to monetary integration can be viewed like any other reduction of bilateral non-tariff trade barriers. Changes in intra- and extra-EMU trade should therefore also be interpreted against the background of trade creation and trade diversion. Trade creation implies that lower cost suppliers inside the currency union substitute

[60] Although there is no obvious link between monetary and institutional integration, one may argue that the commitment shown by adopting a common currency may have signalling effects towards greater harmonisation in other areas as well.

higher cost domestic producers as a result of diminished trade costs. Trade diversion takes place when low cost suppliers outside the currency union are replaced by higher cost Euro Area producers (Viner 1950).[61]

In accordance with the possible ex-post trade effects of currency unions, it seems equally apt to argue a priori that the rise of imports due to the adoption of the Euro is expected to be higher for countries that have not yet exploited their full trade potential with the EMU-12 member states. Based on this different variant of OCA theory, Figure 3.3 indicates that Latvia, Lithuania and Poland were, in 2004, relatively less open towards trading with the EMU-12 and may therefore expect a bigger trade effect from the Euro. Which view is correct is above all an empirical question. The answer is left to the econometric investigation.

3.3 Empirical Specification

To disentangle the effects of a single currency from other factors influencing trade flows, we estimate a log-linearised reduced-form gravity equation for country *i*'s imports from country *j* (M_{ijt}) of the form

$$\begin{aligned}\ln M_{ijt} = {} & \alpha + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln re_{ijt} + \beta_4 \ln d_{ij} + \beta_5 Z_{ij} + \beta_6 EMU_{ijt} \\ & + \beta_7 \ln avre_{ijt} + \beta_8 \ln avd_{ij} + \beta_9 avZ_{ij} + \beta_{10} avEMU_{ijt} + \varepsilon_{ijt} \end{aligned} \quad (3.2)$$

where Y_{it} is the importer's GDP influencing its import demand and Y_{jt} is the exporter's GDP influencing its export supply.[62] re_{ijt} stands for the real exchange rate of country *i*'s currency vis-à-vis country *j*'s currency and allows us to control for changes in the value of the currency which induce expenditure shifts not directly attributable to the EMU. d_{ij}, the great-circle distance between the importing and the exporting country, is generally used as a proxy for transportation costs. Z_{ij} represents a set of dummy variables serving as proxies for additional trade costs. To be precise, we consider whether country *i* or *j* is landlocked (LL_{ij}) and whether they share a common border (B_{ij}) or language (CL_{ij}) as factors hampering or

[61] For details, see Chapter 1.2.1.
[62] See Table A3.1 in Appendix A3.1 for variable definitions and sources.

facilitating trade. By including dummies for EU and EA participation, we additionally control for integration efforts other than monetary integration.[63]

Finally, EMU_{ijt} represents a dummy variable measuring the intra-EMU trade effects of the single currency. Specifically, the variable captures all transaction cost savings due to the eliminated exchange rate uncertainty, namely the absence of exchange controls, foreign exchange transactions and currency hedging. It additionally picks up the lower mark-ups suppliers are expected to set because of increased competition and higher price transparency. As in the trade liberalisation literature, these savings may lead to trade creation inside the currency union. Therefore, EMU_{ijt} is defined to take the value of 1 for both countries of a trading pair being EMU members and 0 otherwise. We set this variable equal to 1 in the first set of regressions (Table 3.1) – also accounting for a possible announcement effect – over the period 1998-2004. In the second set of regressions (Table 3.2), we introduce yearly EMU dummies to see in which year the common currency impact was strongest.

As stated by Anderson and van Wincoop (2003), bilateral trade does not solely depend on bilateral trade costs, but also on the average resistance to trade with the ROW. To account for this finding, we introduce the correspondent multilateral term to all variables that facilitate or hamper bilateral trade. To be precise, multilateral resistance (MR_{ij}) is given by the sum of average bilateral resistances (BR_{ij}) of countries *i* (*j*) towards all trading partners except for the specific trading partner *j* (*i*).

$$MR_{ij(t)} = \frac{1}{N-1}\sum_{k=1,K\neq j}^{N} BR_{ij(t)} + \frac{1}{M-1}\sum_{l=1,l\neq j}^{M} BR_{ji(t)} \tag{3.3}$$

Since the $avEMU_{ijt}$ variable is supposed to capture the trade effects of the common currency on outside countries, it is set to 0 for all EMU member states. If one interprets the saved transaction costs of the single currency as a discriminatory liberalisation of trade, it involves a trade-diverting switch of supply sources – like in any other Preferential Trade Arrangement (PTA).

[63] The multilateral counterparts of these two variables are defined in the same way as the average EMU dummy.

The parameter coefficients of the multilateral trade cost variables are expected to take the opposite sign of their bilateral counterparts. Hence, the bigger a trading pair's joint resistance to trade with the ROW, the lower the bilateral trade costs relative to the multilateral trade costs and the larger country *i*'s imports from country *j*. E.g., for the $avre_{ijt}$ this means that, holding the bilateral real exchange rate between country *i* and country *j* constant, a depreciation of country *i*'s currency with respect to all other currencies in the sample, leads country *i* to import more from country *j*.[64] Similar arguments apply to the variables avd_{ij} and avZ_{ij}. Since a part of the multilateral variables does not only change from a cross-sectional perspective but also over time (e.g. the average exchange rate), we are able to remove those biases which are present in studies that only include country (pair) fixed effects to describe Anderson and van Wincoop's (2003) price terms. To summarise, the expected coefficient signs are

$$\beta_1 > 0, \beta_2 > 0, \beta_3 < 0, \beta_4 < 0, \beta_5 = \sum_{z=1}^{Z} \tau_1 < 0, \tau_2 > 0, \tau_3 > 0, \beta_6 > 0, \beta_7 > 0, \beta_8 > 0,$$

$$\beta_9 = \sum_{avZ=1}^{avZ} \tau_4 > 0, \tau_5 < 0, \tau_6 < 0, \beta_{10} < 0.$$

Finally, we overcome a possible selection bias by including three variables that approximate the Heckman correction term: HC1 is a variable containing the number of years of a trading pair in the sample while HC2 and HC3 are dummies taking the value of 1 if the trading pair is observed over the entire period 1991 to 2004 and if the trading pair is present in the sample in *t-1*, respectively (and 0 otherwise).

3.4 Estimation Methodology and Data

The estimations are based on a panel data set containing all countries which were members of the OECD over the period 1991 to 2004 – also including those CEECs which have already joined (Hungary, Poland, the Czech Republic and Slovakia) – plus Romania and Bulgaria and the four CEECs (Estonia, Latvia, Lithuania and Slovenia) that have not yet become full OECD members.

[64] Since taking the sum of the average exchange rates of both trading partners would have offsetting effects, we consider in this case simply the average exchange rate of country *i* towards all trading partners except the particular trading partner *j*.

The advantages of using panel data in the context of this chapter are straightforward. They allow us to capture relevant relationships between variables over time and to monitor unobservable country pair individual effects. In column (1), Tables 3.1 and 3.2, the POLS estimation of equation (3.2) is displayed as a starting point. Cheng and Wall (2004) demonstrate that not controlling for country pair heterogeneity yields biased estimates. In the further estimations, the country pair effects are treated as fixed, since the RE model only yields consistent estimates when the unobservable bilateral effects are not correlated with the error term. The conducted Hausman test, however, rejected the null hypothesis of no correlation. The relevant FE regression thus gives unbiased estimates of the coefficients of the time-varying variables (reported in column (2) of Tables 3.1 and 3.2). The first drawback of this procedure is well known: since the within-groups estimator ignores the between-groups variance, estimates for the coefficients of the time-invariant explanatory variables cannot be provided. Only very recently, researchers have started discussing a second drawback: although coefficients are provided for variables that hardly change over time, the FE absorbs most of their explanatory power and estimates of these variables become inefficient (Plümper and Troeger 2007). A third problem is related to the possible endogeneity of preferential arrangements. Thinking in terms of the traditional OCA theory, this way of reasoning may hold for monetary arrangements even to a larger extent than for trade arrangements. Fearing the loss of the exchange rate and an autonomous monetary policy as tools to respond to external shocks, policy makers might only opt into a currency union when the level of integration (here reflected by the level of imports) is already high beforehand.

We address these problems via two estimation techniques we apply in addition to the FE estimator. Both the FEVD estimator and the HT estimator (reported in columns (3) and (4) of both tables, respectively) allow for an estimation of time-invariant (e.g. distance) and almost time-invariant variables (e.g. the EMU dummy).[65] Furthermore, the FEVD estimator explicitly addresses the problem of inefficiency. The HT estimator is an instrumental variable panel estimator capable of correcting for any bias caused by the mentioned reverse causality.

[65] Please find a detailed description of the FEVD estimator in Appendix A2.4 and of the HT estimator in Appendix A3.2.

3.5 Results

This chapter starts by estimating equation (3.2) to provide ex-post evidence on the effect of the single currency on the intra-EMU-12 imports. The basic regression results on the full sample are presented in Chapter 3.5.1, followed by various robustness checks discussed in Chapter 3.5.2. The trade predictions of a Euro adoption by the CEECs can be found in Chapter 3.5.3.

3.5.1 Trade Effects of the Euro

The outputs from the regressions on the full country sample are displayed in Table 3.1, columns (1)-(4). In the out-of-sample estimation in column (5), the CEECs were not included in the regressions when fitting the model. The full sample estimates in columns (3) and (4) are consistent and efficient, so we refer to them when interpreting the results. In the FEVD estimation all coefficients, except for the bilateral real exchange rate and the multilateral landlocked and border variable, show the expected sign and are highly significant.[66] Once the correlation between the regressors and the unobservable country pair effects is properly accommodated, the HT estimator turns the coefficients of some of the time-invariant variables (specifically, the bilateral border, landlocked, common language and the multilateral common language variable) insignificant.[67]

The estimates of the traditional gravity variables GDP and distance lie within the usual range. While a 10% rise in bilateral distance lowers imports by 14.1% (17.5% in the HT estimation), the same increase in multilateral distance (or remoteness) induces country *i* to import 9.3% more from a certain trading partner *j* (14.5% in the HT estimation). The unexpected positive sign of the bilateral real exchange rate (a rise of the variable reflects a depreciation of the importing country's currency) may be due to temporarily irreversible import contracts and reflect a J-curve effect.[68] This effect does not seem to be important on a multilateral basis. A 10% depreciation of country *i*'s currency against all but country *j*'s

[66] It is noteworthy that the multilateral common language variable has in the OECD country sample considered here the expected negative impact. This finding strengthens the argumentation of Chapter 2.6.1 that in the world as a whole, there are numerous common languages facilitating trade at a global level. In this chapter, where due to the smaller country sample, world resistance to trade is not accounted for, the reduced multilateral resistance exhibits the theoretically predicted negative impact on bilateral imports.

[67] Among others, Egger (2002) finds a similar effect when applying the HT estimator.

[68] Including up to two lags of the exchange rate variable to investigate the possibility of a J-curve effect further turns the coefficient of the exchange rate variable and of all of its lags insignificant. The results of this exercise are not reported here but can be made available upon request.

currency pushes it to import from country *j* 4.5% more. The other multilateral counterparts of the bilateral variables are also significant at the 1%-level in the FEVD regression and indicate their relevance for the gravity estimation.

Table 3.1: Estimation Results with EMU Dummy for the Entire Period (1998-2004)

Dependent variable: $\ln M_{ijt}$					
	POLS	**FE**	**FEVD**	**HT**	
	Full sample	Full sample	Full sample	Full sample	Out-of-sample
	(1)	(2)	(3)	(4)	(5)
$\ln Y_{it}$	0.88***	0.68***	0.68***	0.68***	0.71***
	(0.04)	(0.11)	(0.01)	(0.10)	(0.09)
$\ln Y_{jt}$	0.89***	0.71***	0.71***	0.71***	0.49***
	(0.03)	(0.07)	(0.00)	(0.07)	(0.07)
$\ln re_{ijt}$	-0.01	0.13**	0.13***	0.13***	0.15***
	(0.01)	(0.06)	(0.00)	(0.04)	(0.04)
$\ln D_{ij}$	-1.27***		-1.41***	-1.75***	-1.29***
	(0.11)		(0.01)	(0.16)	(0.18)
B_{ij}	-0.00		0.00***	-0.00	0.00
	(0.00)		(0.00)	(0.00)	(0.00)
LL_{ij}	-0.16*		-0.23***	-0.15	-1.18***
	(0.10)		(0.02)	(0.13)	(0.17)
CL_{ij}	0.23*		0.13***	0.01	0.36**
	(0.12)		(0.02)	(0.15)	(0.16)
EU_{ijt}	0.08	0.03	0.03	0.03	-0.02
	(0.09)	(0.05)	(0.03)	(0.05)	(0.05)
EA_{ijt}	0.16*	0.22***	0.22***	0.22***	0.33***
	(0.10)	(0.06)	(0.02)	(0.05)	(0.07)
EMU_{ijt}	0.13**	0.07**	0.07***	0.07**	0.13***
	(0.05)	(0.03)	(0.02)	(0.03)	(0.03)
$\ln \frac{1}{J}\sum_{j=1}^{J} re_{it}$	1.22***	0.45**	0.45***	0.45**	0.36*
	(0.41)	(0.23)	(0.10)	(0.22)	(0.18)
MRD_{ij}	0.55***		0.93***	1.45***	0.76***
	(0.15)		(0.02)	(0.23)	(0.21)
MRB_{ij}	0.00***		0.01***	0.01***	0.01***
	(0.00)		(0.00)	(0.00)	(0.00)
$MRLL_{ij}$	-0.10***		-0.14***	-0.18***	0.11
	(0.03)		(0.01)	(0.05)	(0.07)
$MRCL_{ij}$	-0.02		-0.40***	-0.45	0.23
	(0.26)		(0.04)	(0.34)	(0.41)
$MREMU_{itj}$	0.22*	0.69***	0.69***	0.69***	0.45***
	(0.12)	(0.09)	(0.04)	(0.08)	(0.08)
$MREU_{ijt}$	-0.74***	-0.22*	-0.22***	-0.22*	0.03
	(0.21)	(0.12)	(0.06)	(0.12)	(0.13)
$MREA_{ijt}$	0.34	-0.07	-0.07	-0.07	0.09
	(0.23)	(0.11)	(0.06)	(0.10)	(0.11)
HC1	0.09***		0.10***	0.09*	0.16***
	(0.03)		(0.00)	(0.05)	(0.05)

HC2	0.00 (0.00)				
HC3	-0.18*** (0.04)	-0.03 (0.03)	-0.03 (0.02)	-0.03 (0.03)	-0.01 (0.03)
Observations	5262	5262	5262	5262	4103
R^2	0.89	0.98	0.98	0.83	0.80

Note: This table presents the estimation results of equation (3.2). The dependent variable is the log of imports of the individual EMU-12 countries from OECD and CEE countries between 1991 and 2004. The independent variables are as described in Chapter 3.3 and based on the variables listed in Table A3.1 in Appendix A3.1. Column (1) reports the pooled OLS, column (2) the panel fixed effects, column (3) the panel fixed effects vector decomposition and column (4) the Hausman-Taylor regression results. In column (5), the CEECs are excluded from the sample. The R^2 in columns (3) and (4) is calculated as the squared correlation between the observed and the predicted response. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

The consistent EMU estimate indicates 7% more imports attributable to savings in transaction costs and lower mark-ups. The result is well in line with our preliminary analysis (compare Figure 3.2) and amidst the range of estimates found in other post-Rose studies. Bun and Klaassen's (2007) preferred estimate suggests a Euro effect of only 3% more imports. However, their use of time-varying trading pair dummies makes it "impossible to estimate factors that affect bilateral trade costs even if they are time varying". (Baldwin and Taglioni 2006: 23). Indeed, the Euro estimate jumps up to 6% when the authors employ country-specific time-varying dummies, suggesting that the pair dummies absorb at least some of the variation of the EMU variable. The results are also believed to be reliable with an eye on the fact that the inclusion of multilateral variables enables us to remove not only the time-invariant part of the omitted variable bias, but to address additionally the time-varying character of Anderson and van Wincoop's relative price terms. Interestingly enough, the significant positive multilateral EMU estimate indicates that the common currency did not divert trade from non-members – on the contrary, outside countries profited highly from trading with the currency bloc. This result does not come unexpectedly. Many of the empirical studies, including Baldwin and Di Nino (2006) and Baldwin (2006b), also find significant pro-trade effects of a unilateral Euro usage. The empirical evidence therefore suggests that the EMU has so far acted like a unilateral rather than a preferential liberalisation.[69] This finding contradicts the OCA theory insofar as the latter asks a country to give up its monetary autonomy to be able to benefit from the efficiency gains in a currency

[69] Transitory factors, like the appreciation of the Euro since 2002 or the relative strength of the US and some of the Eastern and Asian economies help explain why imports from outside the Euro Area have even grown faster than intra-EMU imports over the underlying timeframe, but should already be captured by the exchange rate and GDP variables.

union (see Chapter 3.2.2). If countries can, however, get better market access without sacrificing their main macroeconomic tool then the UK and Denmark took the right decision voting against EMU membership. This may have important policy implications for the CEECs as well, even though they do not have the possibility to opt out.

Turning to the regression results with yearly EMU dummies (Table 3.2), conducted again for the full country sample in columns (1)-(4) and out-of-sample in column (5), one can readily become acquainted with the robustness of the coefficient estimates. Both the FEVD and the HT estimator confirm the presumption of an announcement effect. In 1998, the prospect of a common currency had already boosted intra-EMU-12 imports by 8%. The results further suggest a positive impact of the Euro across all years until 2002, with the strongest effect on trade in 2001, the year Greece entered the currency union and one year before the physical notes and coins were introduced.[70]

In contrast to the descriptive statistics illustrated in Figure 3.2, the formal econometric analysis shows that the Euro did not stimulate trade significantly further since 2003. On the contrary, the FEVD estimator even yields significant coefficients indicating a negative impact of the Euro in last two sample periods. The observation of no further gains for member countries in 2003 and 2004 suggests that the Euro's trade-creating potential has already been fully exploited.[71] Further efficiency gains may be realised with the accession of new member states.

Generally, the out-of-sample estimates reported in column (5) of Tables 3.1 and 3.2 confirm the sign and magnitude of the full sample regressions. It is noticeable, however, that eliminating the CEECs from the control group, the EMU coefficient moves up.[72] Hence, the current Euro Area member states did not gain as much from introducing the Euro relative to the full country sample including the CEECs as compared to the OECD sample without the CEECs.

[70] Faruqee (2004) reports 2001 and 2002 as the years with the strongest Euro effect. See Chapter 1.3.2.
[71] Despite the correspondence with the appreciation of the Euro, it would be incorrect to interrelate this period with the non-positive 2003 and 2004 EMU estimates. The real exchange rate controls for any expenditure shift attributable to exchange rate movements. For the impact of the Euro appreciation on trade, see also the report by the European Commission (2007).
[72] The result fully holds when the fixed exchange rate regimes of the CEECs is controlled for by including a volatility measure. The results of this exercise are not reported here, but can be made available upon request.

Table 3.2: Estimation Results with Yearly EMU Dummies

Dependent variable: $\ln M_{ijt}$					
	POLS	**FE**	**FEVD**	**HT**	
	Full sample	Full sample	Full sample	Full sample	Out-of-sample
	(1)	(2)	(3)	(4)	(5)
$\ln Y_{it}$	0.88***	0.75***	0.75***	0.75***	0.74***
	(0.04)	(0.12)	(0.01)	(0.11)	(0.10)
$\ln Y_{jt}$	0.90***	0.75***	0.75***	0.76***	0.53***
	(0.03)	(0.07)	(0.00)	(0.07)	(0.07)
$\ln re_{ijt}$	-0.01	0.13**	0.13***	0.12***	0.14***
	(0.01)	(0.06)	(0.00)	(0.04)	(0.04)
$\ln D_{ij}$	-1.27***		-1.38***	-1.68***	-1.27***
	(0.11)		(0.01)	(0.16)	(0.18)
B_{ij}	-0.00		0.00***	-0.00	0.00
	(0.00)		(0.00)	(0.00)	(0.00)
LL_{ij}	-0.16		-0.20***	-0.15	-1.14***
	(0.10)		(0.02)	(0.12)	(0.17)
CL_{ij}	0.23*		0.15***	0.05	0.37**
	(0.12)		(0.02)	(0.15)	(0.16)
EU_{ijt}	0.06	-0.01	-0.01	-0.01	-0.03
	(0.09)	(0.05)	(0.03)	(0.05)	(0.05)
EA_{ijt}	0.15	0.23***	0.23***	0.23***	0.34***
	(0.10)	(0.06)	(0.02)	(0.05)	(0.07)
EMU_{ij1998}	0.24***	0.07***	0.07*	0.07***	0.11***
	(0.05)	(0.02)	(0.04)	(0.02)	(0.02)
EMU_{ij1999}	0.24***	0.05*	0.05	0.05*	0.09***
	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
EMU_{ij2000}	0.33***	0.15***	0.15***	0.15***	0.17***
	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
EMU_{ij2001}	0.25***	0.16***	0.16***	0.16***	0.19***
	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
EMU_{ij2002}	0.14**	0.07*	0.07**	0.07**	0.12***
	(0.06)	(0.04)	(0.03)	(0.03)	(0.03)
EMU_{ij2003}	0.01	-0.02	-0.02	-0.02	0.07*
	(0.05)	(0.04)	(0.03)	(0.04)	(0.04)
EMU_{ij2004}	-0.06	-0.07	-0.07**	-0.07	0.07
	(0.06)	(0.06)	(0.03)	(0.05)	(0.05)
$\ln \frac{1}{J}\sum_{j=1}^{J} re_{it}$	1.14***	0.47**	0.47***	0.48**	0.36*
	(0.41)	(0.23)	(0.10)	(0.22)	(0.19)
MRD_{ij}	0.54***		0.82***	1.29***	0.70***
	(0.15)		(0.02)	(0.23)	(0.21)
MRB_{ij}	0.00**		0.00***	0.01***	0.01***
	(0.00)		(0.00)	(0.00)	(0.00)
$MRLL_{ij}$	-0.10***		-0.41***	-0.17***	0.10
	(0.03)		(0.04)	(0.05)	(0.07)
$MRCL_{ij}$	-0.01		-0.13***	-0.40	0.22
	(0.26)		(0.01)	(0.33)	(0.40)
$MREMU_{itj}$	0.24**	0.63***	0.63***	0.63***	0.42***
	(0.12)	(0.09)	(0.04)	(0.08)	(0.08)

$MREU_{ijt}$	-0.75***	-0.28**	-0.28***	-0.27**	-0.02
	(0.21)	(0.13)	(0.06)	(0.12)	(0.13)
$MREA_{ijt}$	0.30	-0.04	-0.04	-0.04	0.10
	(0.23)	(0.11)	(0.06)	(0.10)	(0.11)
HC1	0.09***		0.09***	0.08*	0.15***
	(0.03)		(0.00)	(0.05)	(0.05)
HC2	0.00				
	(0.00)				
HC3	-0.17***	-0.05	-0.05**	-0.05*	-0.02
	(0.04)	(0.03)		(0.03)	(0.03)
Observations	5262	5262	5262	5262	4103
R^2	0.89	0.98	0.98	0.85	0.81

Note: This table presents the estimation results of equation (3.2), but with yearly EMU dummies. Column (1) reports the pooled OLS, column (2) the panel fixed effects, column (3) the panel fixed effects vector decomposition and column (4) the Hausman-Taylor regression results. In column (5), the CEECs are excluded from the sample. The R^2 in columns (4) and (5) is calculated as the squared correlation between the observed and the predicted response. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

3.5.2 Robustness Checks

In order to place the finding of positive trade effects for non-member states in the context of earlier studies, the $MREMU_{ijt}$ variable is replaced by a traditional (0/1) dummy variable, which takes the value of 1 if only one country of the trading pair belongs to the Euro Area and 0 otherwise. Table A3.2 in Appendix A3.3 shows the results of this exercise. The estimate for the EMU_{it} dummy broadly confirms the results from Tables 3.1 and 3.2 that excluded countries are not harmed by the currency club and that they enjoy, on the contrary, even higher increases in exports to the EMU.

Baldwin (2006a) emphasises the importance of the correct choice of the control group in difference-in-difference estimations. Since there are many unobservable factors that cannot be controlled for by the econometrician, he argues, the control group should be as close as possible to the treatment group. To account for this, in Table A3.3 in Appendix A3.3 the sample has been gradually reduced. In column (1), estimations are based on the EU-25 and in column (2) on the EU-15 member states. In addition, in column (3), the first two years have been taken out in order to avoid disruptions related to a change in data collection by the EU (see Baldwin 2006a). First of all, it is important to note that the key gravity variables remain stable in sign and significance level. Interestingly and in contrast to the findings by Micco, Stein and Ordoñez (2002), the coefficient of the EMU dummy variable moves up once the control group is downsized. This result confirms the out-of-sample estimations from Tables

3.1 and 3.2 and suggests that the boost in intra-Euro Area imports has been stronger as compared to the EU-15 member states than as compared to all OECD countries. The observation that the increase in the EMU coefficient is accompanied by a significant negative impact of the exchange rate in the reduced samples of columns (2) and (3) may deliver an argument for the UK, Denmark and Sweden to think about a Euro adoption. Furthermore, even though trade diversion cannot be detected here either, the multilateral EMU variable turns out to be insignificant. Against the background of the strong positive influence the variable exhibits in column (1), this may give a hint that it is especially the CEECs that unilaterally benefit from trading with the common currency area.

Another point of discussion in the literature is the role of exchange rate volatility in such kind of models. The inclusion of a variable measuring exchange rate volatility comes along with both virtues and drawbacks. On the one hand, a volatility measure allows controlling for the exchange rate regimes the CEECs had up to the end of the covered time period. On the other hand, the variable may pick up part of the common currency effect otherwise captured by the EMU dummy. As a robustness check, equation (3.2) has been re-estimated including a bilateral as well as an average exchange rate volatility variable. The results are presented in column (1) of Table A3.4. in Appendix A3.3. Contrary to what might have been expected, the influence of volatility on trade is significantly positive in this sample.[73] Increasing the average volatility by one standard deviation around its mean raises EMU imports by 3.8%. Also, against previous expectations the average volatility measure is significantly negative. To investigate this further, the multilateral resistance terms are omitted in column (2). Here, the results indicate no (significant) influence of exchange rate volatility. How can this be explained? Interestingly, Clark, Tamirisa and Wei (2004) also find a change in coefficient when moving from a simple country pair FE regression to a specification with time-varying FE or alternatively, when including the sum of the effective exchange rate volatility of the country pairs. They argue that exchange rate volatility is not robust to broader aspects of exchange rate volatility, especially those related to multilateral resistance. Although the bilateral volatility measure does not exhibit the expected influence on trade, the overall

[73] Empirical findings on the trade-volatility link are mixed (see e.g. Tenreyro 2004 and Baldwin, Skudelny and Taglioni 2005). Clark, Tamirisa and Wei (2004) discuss the possibility that advanced economies with developed and liquid foreign exchange markets can more easily hedge against exchange rate risks. When reducing the country sample to the EU-15, imports become less associated with volatile exchange rates (the variable is only significant at the 10%-significance level and the coefficient drops). The results of this exercise are not reported here, but can be made available upon request.

impact is still negative (0.28+(-0.34)=-0.06). The Wald test indicates that the multilateral variables are jointly significant and hence, the full model is preferred on statistical grounds.

3.5.3 Trade Effects of the Euro Area Enlargement

Although some of the insights gained through a downsized sample in the last chapter are very useful for evaluating the common currency's effects, the trade predictions for the CEECs in this chapter are based on the full sample and out-of-sample estimates of Tables 3.1 and 3.2. This is simply for the reason that the average of all OECD countries should be a better control group for the "treated" CEECs than the advanced economies of the EU-15.

When calculating predictions, two approaches of simulation can be distinguished: in in-sample predictions the countries under consideration, i.e. the CEECs, are included in the regression. This approach is appropriate when the parameters of the CEECs do not substantially differ from those of the other OECD member states. The method has been subject to critique by Egger (2002) who states that systematic differences between predicted and observed trade flows are likely due to a misspecification of the model. An alternative is out-of-sample predictions, where the countries under consideration are left out when fitting the model. This approach seems justified when the parameters of the two country samples differ and was, for that reason, frequently used in the early stages of transition. Methods using FE bear limitations when it comes to the calculation of out-of-sample trade flow predictions. Much information needed to predict accurately EMU imports from the CEECs is contained in the country pair-specific terms. The determination of this term for the countries not included in the sample when fitting the model is arbitrary. This problem can be circumvented by applying the HT estimator, which is, hence, used for the further analysis.

In order to predict the impact of EMU accession for the CEECs based on the full sample as well as out-of-sample, two scenarios are constructed and investigated over the time frame 1991-2004. In the baseline scenario we predict the EMU-12 imports from the CEECs in a world without the Euro while in the counterfactual scenario, we base our import predictions on the estimated model controlling for the EMU. In order to measure the EMU impact correctly, a few adjustments have to be made: in the counterfactual scenario, the bilateral and the multilateral EMU variables take the value of 1 and 0, respectively. In addition to this, we adjust the real exchange rate variable, such that from the time of the Euro adoption only real changes are allowed whereas the nominal exchange rate is held constant. Under the assumption that the same relation between the explanatory variables and imports will also

hold for future EMU members, we take the coefficients from the fitted model and apply these to the CEEC dataset. To be precise, by using the saved parameter estimates from the estimation based on the full country sample (columns (1) and (2) in Table 3.3) and from the estimation based on the country sample excluding the CEECs (columns (3) and (4) in Table 3.3) and combining these with the observations on the CEECs, we obtain the corresponding values for the import variable. Comparing the 2004 simulations on EMU-12 imports of the baseline (without the Euro) with the counterfactual scenario (with the Euro), we obtain a prediction of the extent to which a future EMU accession of the CEECs will further stimulate trade.

Table 3.3: Euro Impact in 2004

	Estimations based on the full country sample		**Estimations based on non-CEEC country sample (Out-of-sample)**	
	(1)	(2)	(3)	(4)
	in %	in bns US$	in %	in bns US$
Czech Republic	1.34	0.38	10.91	1.37
Estonia	18.54	0.30	20.16	0.75
Hungary	17.75	2.1	40.75	2.04
Latvia	-21.59	-0.60	-19.93	-1.29
Lithuania	-15.26	-0.57	-8.78	-0.65
Poland	-34.24	-13.74	-19.00	-8.13
Slovak Republic	-4.39	-0.31	11.21	0.43
Slovenia	52.12	4.23	66.51	8.34

Note: This table presents the results of the full sample and out-of-sample predictions based on the regression results of columns (4) and (5) of Table 3.1, respectively. The table entries display the cumulated imports of the Euro Area from a specific CEEC as listed in column (1). The differences are calculated as the result of the counterfactual scenario with Euro minus the result of the baseline scenario without Euro. The percentages are calculated as the percentage change between the counterfactual and the baseline scenario.

Source: Own calculations.

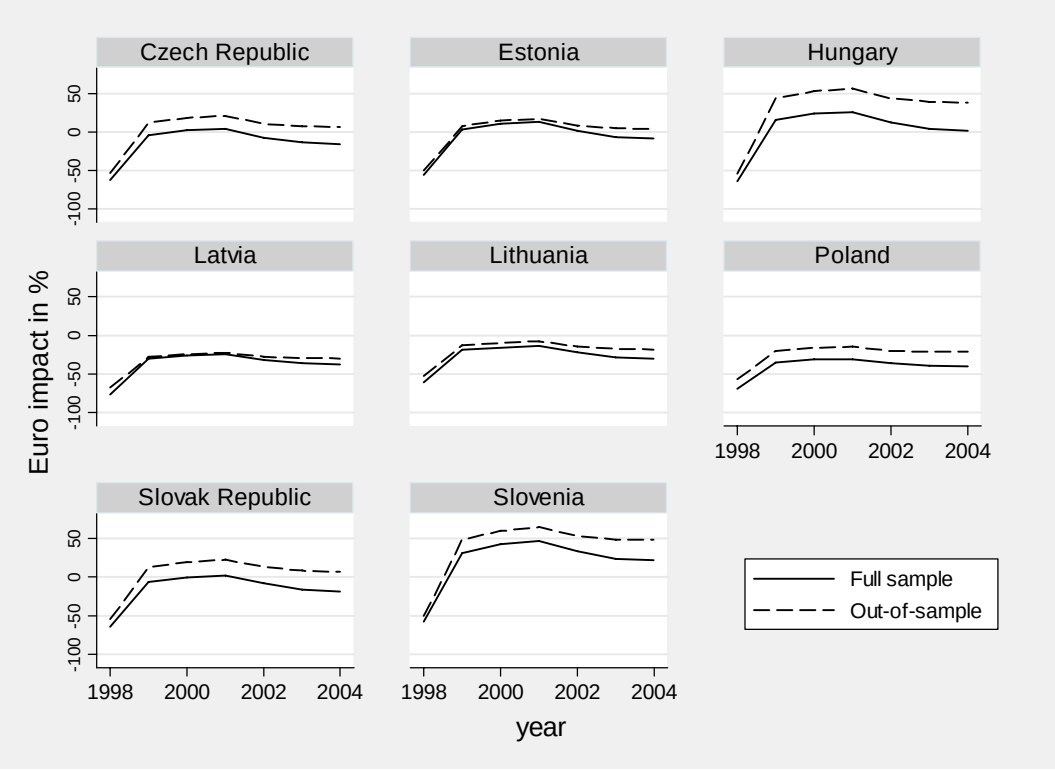
Table 3.3 shows the results of the calculation of the impact of introducing the Euro in eight CEECs. The figures represent the additional cumulative EMU-12 imports from them. The full sample estimation indicates that EMU membership will boost EMU-12 imports from four CEECs beyond the level attained through their EU accession – however, Poland, Latvia, Lithuania and Slovakia cannot expect further gains when adopting the Euro.[74] Given the results for the multilateral EMU dummy variable of Tables 3.1 and 3.2, the relative low or even negative impact of the Euro adoption for some countries does not come as a surprise.

[74] This result is in contrast to a study by Maliszewska (2004), who finds – based on a POLS model – positive impacts of the Euro throughout.

Since trade is not diverted from third countries – on the contrary, they benefited even more from the common currency area – the passage to full EMU membership may, in this setting, have a negative effect on their performance.

Figure 3.4 reports the results of the same exercise with yearly EMU dummies. As the coefficients in Table 3.2 indicate, the Euro effect reaches its peak two to three years after the introduction of the common currency. After that, the curves follow a flat or even falling course for all CEECs with a continuous negative performance for Latvia, Lithuania and Poland.

Figure 3.4: Euro Impact – Yearly Dummies



Note: This figure shows the results of the full sample and out-of-sample predictions based on the regression results of columns (4) and (5) of Table 3.2, respectively. For each CEEC, the lines display the evolution of the Euro impact between 1998 and 2004.

Source: Own calculations.

Comparing these results with the fitted models in columns (4) and (5) from Tables 3.1 and 3.2, the higher out-of-sample predictions (i.e., those based on parameter estimates gained from a country sample which does not include the CEECs) in Table 3.3 and Figure 3.4 are not surprising. The Euro impact for current Euro Area member states is estimated to be higher, when the CEECs are excluded from the control group. In Table 3.3, Slovakia is additionally

found to benefit from adopting the Euro through an 11% gain in EMU-12 imports. The overall performance of the CEECs is also slightly better: while the simple average of the out-of-sample estimates yields a gain in EMU-12 imports of 12.7%, the full sample calculation predicts only a 1.8% increase on average.[75] The trade-weighted averages report a slightly lower Euro effect of 12.4% and -2.8% for the out-of-sample and the full sample calculations, respectively.[76] The illustrated predictions in Figure 3.4 confirm the calculations based on the results reported in Table 3.3.[77]

The finding that countries with a higher share in EMU-12 imports have to settle for a lower Euro effect may, at first sight, contradict the old OCA theory; however, one has to keep in mind that trade integration should be related to country size as done in Figure 3.3. Table 3.3 and Figure 3.4 give some intuition with respect to the hypothesis that the EMU impact is higher for well-integrated economies. The negative prediction for the less-open Polish, Latvian and Lithuanian economies in both regressions clearly speaks in favour of the validity of the classical OCA theory. In contrast, the simulation results for the Czech Republic and Slovakia, the countries with the highest imports-over-GDP ratios reveal a relatively low EMU impact and strengthen, therefore, the validity of the OCA endogeneity hypothesis (compare Figure 3.3).

To elucidate this further, we also investigate the issue on a more formal level. For this purpose, we conduct a statistical Spearman rank correlation analysis of the relation between the rank order of the CEECs concerning trade openness in 2004 and the rank order of these countries with respect to their fictitious gains from adopting the Euro in 2004 (Table 3.4). The first two rows represent the correlation when the EMU is set over the whole period the last two rows correspond to the predictions with yearly EMU dummies.

[75] Note that the growth effects due to the introduction of the Euro are long-run equilibrium effects and not annual growth rates.
[76] We used the 2004 share of each CEEC in total EMU-12 imports from all CEECs as weights.
[77] Given these findings, a deeper analysis of the characteristics of the CEECs and the other non-EMU-12 OECD member states would be needed to finally evaluate the appropriateness of the control group when the EMU-12 countries are treated. Such an exercise would include a close look at geographical, demand and supply, trade costs and other conditions and goes beyond the scope of this analysis. However, although the points of critique on in-sample and out-of-sample approaches discussed above limit the detail of the conclusions, the out-of-sample results head in the same direction as the full sample estimation.

Table 3.4: Spearman Rank Correlation between Openness and EMU Effect

		Full sample (1)	Full sample excl. CEECs (Out-of-sample) (2)
EMU dummy	**2004**	0.45	0.55
	1991-2004	0.54***	0.54***
Yearly EMU dummies	**2004**	0.47	0.67**
	1991-2004	0.56***	0.57***

Note: This table presents the results of the Spearman rank correlation analysis between the CEECs' trade openness and their predicted gains from the Euro adoption. Column (1) reports the results based on the full sample estimation, column (2) reports the results of the out-of-sample estimation. In rows (1) and (2), the EMU dummy is set equal to one for the whole period, in rows (3) and (4), yearly EMU dummies are introduced. The respective first rows give the results for 2004, the respective second rows give the results for the whole period 1991-2004. Significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

For both the full country sample and the out-of-sample scenario, we do not find a significant relationship with the exception of yearly EMU dummies in the out-of-sample estimations (see row (1) and row (3) in Table 3.4). Only by calculating the rank correlation coefficient over the entire time span (1991-2004) do we find a significant positive relation between the CEECs' openness and their gain in the EMU's import share. Hence, there is some evidence that a high degree of openness beforehand determines a positive trade impact of EMU membership. This result does not only give support to the traditional OCA theory, but also has important implications for the timing of the CEECs' accession to the Euro Area. While the open economies should opt for an early introduction of the single currency, Poland, Latvia and Lithuania may prefer to concentrate first on stronger real integration.

3.6 Conclusions of Chapter 3

This chapter's motivation has been twofold: first, it attempted to address all the commonly accepted mistakes in gravity estimation to obtain unbiased currency effects on trade. Using the HT estimator the possibility of reverse causality between membership in a currency bloc and the import value was taken into account. By including multilateral time-variant variables we corrected for the omitted variable bias present in earlier studies that only rely on country pair FEs. Finally, with the proxies for the Heckman correction term, we addressed the possibility of selection bias. With this specification, we obtained a point estimate for the EMU dummy of 0.07, much lower than Rose's result but well in line with Micco, Stein and Ordoñez (2002) and Flam and Nordstrom (2006a).

Second, the procedure allows us to derive some policy implications. As the yearly EMU estimates for 2003 and 2004 indicate that the Euro did not contribute to any increase in imports in these years, it seems that the EMU-12 has already exhausted its trade-creating potential. The important announcement effects appear to have been consumed to a large extent by now without many further gains to be expected. For the EMU candidates, it might be worthwhile noting that these announcement effects could also be reversed again if EMU membership were suddenly not be implemented. On the one hand, this fact may deliver an argument for current members to opt for a quick entry of the CEECs, once they have fulfilled the Maastricht criteria, although their importance for the EMU-12 is by far lower than the other way around. On the other hand, the Spearman rank correlation suggests that gains from EMU membership are larger if openness towards the Euro Area was substantial beforehand. The predictions finally indicate that the Czech Republic, Estonia, Slovenia, Hungary (as well as Slovakia in the out-of-sample estimation) can expect further gains in the EMU-12 import share once they adopt the Euro. Therefore, these countries, too, may put efforts into fulfilling the accession criteria in the near future. The fact that outside countries even benefit more from trading with a currency union suggests that the less-open economies, Poland, Latvia and Lithuania, may do better not to enter the EMU in the near future.

A3 Appendix

A3.1 Variable List and Definitions

Table A3.1: List of Variables – Chapter 3

Variable	Definition	Source
M_{ijt}	Yearly imports of country *i* from country *j* (in current US$)	OECD ITCS
$Y_{i(j)t}$	Importer and exporter GDP (in current US$)	UN NAMAD
re_{ijt}	Bilateral real exchange rate in price quotation	UN NAMAD (nom. exchange rates), IMF IFS (producer price index)
vol_{ijt}	Standard deviation of the first differences of the logs of monthly nominal bilateral exchange rates	IMF IFS
D_{ij}	Great circle distance between the two countries of a trading pair	CIA World Factbook (latitudes and longitudes), own calculations based on the haversine formula
LL_{ij}	Dummy = 1 for one country and = 2 for both countries of the trading pair being landlocked	CIA World Factbook
B_{ij}	Dummy controlling for the length of a common border	CIA World Factbook
CL_{ij}	Dummy controlling for the number of common official languages	CEPII
EMU_{ijt}, EU_{ijt}, EA_{ijt}	Dummy = 1 for both countries of a trading pair being EMU, EU or EA members	

A3.2 The Hausman and Taylor Estimator

By using instrumental variables to address the problem of correlation of the unobservable bilateral effects with some of the explanatory variables (as detected by the Hausman test), the estimator additionally allows us to control for potential endogeneity biases caused by RHS variables. In an RE model of the form

$$M_{ijt} = \delta_1 X_{1ijt} + \delta_2 X_{2ijt} + \lambda_1 T_{1ij} + \lambda_2 T_{2ij} + \mu_{ij} + \varepsilon_{ijt} \qquad \text{(A3.1)}$$

X_{1ijt} and T_{1ij} are $1\times k_1$ and $1\times g_1$ vectors of observations on exogenous variables and X_{2ijt} and T_{2ij} are $1\times k_2$ and $1\times g_2$ vectors of observations on endogenous variables, causing a bias in the standard RE estimation. Hausman and Taylor (1981) therefore propose the use of information already contained in the model to instrument the endogenous variables. In the

first step, the consistent δ_1 and δ_2 are used to obtain the within residuals. Regressing these on T_{1ij} and T_{2ij}, using X_{1ijt} and T_{1ij} as instruments, yields intermediate, even though consistent estimates of λ_1 and λ_2. With the two sets of residuals (within and overall) it is possible to estimate the variance components, which are used to perform the General Least Squares (GLS) transform. The model is identified as long as $k_1 \geq g_2$. Since the estimator is consistent but not efficient, we correct the variance-covariance matrix at this stage by using standard errors that are robust to arbitrary autocorrelation and heteroskedasticity. The HT estimator is then obtained by

$$\breve{M}_{ijt} = \delta_1 \breve{X}_{1ijt} + \delta_2 \breve{X}_{2ijt} + \lambda_1 \breve{T}_{1ij} + \lambda_2 \breve{T}_{2ij} + \breve{\mu}_{ij} + \breve{\varepsilon}_{ijt} \qquad \text{(A3.2)}$$

using $\tilde{\tilde{X}}_{1ijt}$, $\tilde{\tilde{X}}_{2ijt}$, $\overline{X}_{1ijt}$, $\overline{X}_{2ijt}$ and T_{1ij} as instruments, where $\breve{\omega}$ represents the GLS transform of a variable, $\overline{\omega}$ stands for the within-groups mean and $\tilde{\omega}$ for the within transform of a variable ω.

The selection of variables included in X_{2ijt} and T_{2ij} is not straightforward. We follow the proposition by Hausman and Taylor (1981) and use economic intuition.[78] First, and in response to the critique by Baldwin (2006a), we treat the dummy variables for membership in a preferential arrangement as endogenous, including the variable reflecting EMU membership. In reference to the possibility of export-led growth, a second source of endogeneity bias may stem from the exporter's GDP variable. Its simultaneous instrumentation with the bilateral exchange rate variable improves the model so much that the over-identification test can no longer reject the null hypothesis of the orthogonality conditions being satisfied (the instruments are valid) ($\chi^2_{(11)} = 1.56$). However, we find that instrumenting the importer's GDP variable improves the model further and fully eliminates the endogeneity bias.

[78] The validity of the instruments can be tested. When the null hypothesis of $p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} \overline{X}_{1ijt}, \mu_{ij} = 0$ and $p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} T_{1ij}, \mu_{ij} = 0$ cannot be rejected, $\overline{X}_{1ijt}$ and T_{1ij} are uncorrelated with the random effect μ_{ij} and no further instrumentation is needed.

In the respective robustness check, the exchange rate volatility may also induce an endogeneity bias. On the one hand countries hedge against exchange rate risks to increase bilateral trade, on the other hand a higher trade volume encourages authorities to take measures against currency fluctuations. Indeed, the instrumentation of the volatility measures is necessary since the over-identification test can no longer reject the null hypothesis of non-systematic difference between the FE and the HT estimator ($\chi^2_{(13)} = 0.10$).[79]

A3.3 Robustness Checks

Table A3.2: Trade Diversion Dummy

Dependent variable: $\ln M_{ijt}$	
	TD dummy
$\ln Y_{it}$	0.69***
	(0.11)
$\ln Y_{jt}$	0.71***
	(0.07)
$\ln re_{ijt}$	0.13**
	(0.06)
EU_{ijt}	0.03
	(0.05)
EA_{ijt}	0.21***
	(0.06)
EMU_{ijt}	0.06**
	(0.03)
EMU_{it}	0.22***
	(0.03)
$\ln \frac{1}{J}\sum_{j=1}^{J} re_{it}$	0.47**
	(0.23)
$MREU_{ijt}$	-0.23*
	(0.12)
$MREA_{ijt}$	-0.09
	(0.11)
HC3	-0.03
	(0.03)
Observations	5262
R^2	0.98

Note: This table presents estimation results based on the panel fixed effects estimator. The regression includes a trade diversion dummy instead of a multilateral EMU variable. Time-invariant variables are included in the regressions, but not reported. The full list of variables is as in Table 3.1. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

[79] Since the instrumentation of the trade cost variables could not further improve the model, the time-invariant HC1 variable is treated as endogenous.

Table A3.3: Reduced Sample

Dependent variable: $\ln M_{ijt}$			
	EU-25	**EU-15**	**EU-15, t>1992**
	(1)	(2)	(3)
$\ln Y_{it}$	0.56***	0.46***	0.47***
	(0.16)	(0.10)	(0.11)
$\ln Y_{jt}$	0.84***	0.67***	0.63***
	(0.13)	(0.11)	(0.13)
$\ln re_{ijt}$	0.08	-0.73***	-0.62***
	(0.30)	(0.19)	(0.22)
EU_{ijt}	0.08	0.02	0.03
	(0.06)	(0.05)	(0.05)
EA_{ijt}	0.10		
	(0.08)		
EMU_{ijt}	0.08**	0.10***	0.12***
	(0.03)	(0.02)	(0.03)
$\ln \frac{1}{J}\sum_{j=1}^{J} re_{it}$	0.39	0.85***	0.63**
	(0.35)	(0.19)	(0.26)
$MREMU_{itj}$	0.86***	0.03	0.06
	(0.15)	(0.09)	(0.09)
$MREU_{ijt}$	0.27	0.02	-0.01
	(0.20)	(0.19)	(0.18)
$MREA_{ijt}$	0.05	0.17	0.25**
	(0.18)	(0.11)	(0.12)
HC3	-0.04	-0.03	0.14***
	(0.03)	(0.02)	(0.04)
Observations	3209	2050	1810
R^2	0.98	0.99	0.99

Note: This table presents estimation results based on the panel fixed effects estimator. The dependent variable is the log of imports of the individual EMU-12 countries from the EU-25 countries (column (1)) and the EU-15 countries (column (2)) between 1991 and 2003 and from the EU-15 countries between 1993 and 2003 (column (3)). Time-invariant variables are included in the regressions, but not reported. The full list of variables is as in Table 3.1. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

Table A3.4: Exchange Rate Volatility

Dependent variable: $\ln M_{ijt}$		
	FE	**FE w/o MR**
	(1)	(2)
$\ln Y_{it}$	0.69***	0.68***
	(0.11)	(0.10)
$\ln Y_{jt}$	0.68***	0.89***
	(0.07)	(0.08)
$\ln re_{ijt}$	0.14**	0.25***
	(0.06)	(0.06)
vol_{ijt}	0.28***	0.00
	(0.10)	(0.03)
EU_{ijt}	0.04	0.13***
	(0.05)	(0.04)
EA_{ijt}	0.28***	0.32***
	(0.06)	(0.06)
EMU_{ijt}	0.08**	0.03
	(0.03)	(0.03)
$\ln \frac{1}{J}\sum_{j=1}^{J} re_{it}$	0.42*	
	(0.23)	
$MRvol_{ijt}$	-0.34***	
	(0.10)	
$MREMU_{itj}$	0.78***	
	(0.09)	
$MREU_{ijt}$	-0.28**	
	(0.13)	
$MREA_{ijt}$	-0.17	
	(0.11)	
HC3	-0.04	-0.01
	(0.03)	(0.03)
Observations	5114	5114
Wald test	20.66***	
R^2	0.98	0.98

Note: This table presents estimation results based on the panel fixed effects estimation. In addition to the list of variables as in Table 3.1, exchange rate volatility is included, measured as the standard deviation of the first differences of the logs of monthly nominal bilateral exchange rates. Column (1) is with multilateral terms, column (2) excludes multilateral terms. Time-invariant variables included in the regressions, but not reported. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

CHAPTER 4 NETWORK AND BORDER EFFECTS: WHERE DO FOREIGN MULTINATIONALS LOCATE IN GERMANY?

4.1 Introduction to Chapter 4

The reunification of the formerly separated Eastern and Western German states in 1990 entailed exceptional interregional differences within one country. Today, almost 20 years after the fall of the Berlin wall, a huge rift persists along various characteristic lines: low productivity, high unemployment and low network effects keep drawing down the attractiveness of the East German federal states for private investment in general, and for FDI in particular. Over the period 1997-2005, only around 10% of all MNE affiliates were established in East Germany, half of which in Berlin. Buch and Toubal (2008) confirm a low integration of East Germany into international markets with respect to trade and migration as well. Although these measures report a considerable dispersion also across West German federal states, it seems fair to state that multinational activity has not yet contributed to closing the East-West gap.

In response to the NEG framework by Krugman (1991), a range of empirical studies emerged investigating the regional and urban determinants in the location decisions of firms (e.g. Crozet, Mayer and Mucchielli 2004 for France; Barrios, Görg and Strobl 2006 for Ireland and Basile 2004 for Italy). In Germany, media and academic research have been heavily concerned with firms shifting their production facilities to low cost countries while staying comparably silent about the determinants and effects of inward FDI. Although recent

papers find a significant positive impact of inward FDI on domestic firms (e.g. Arndt and Mattes 2008) and on the local economy (e.g. Bitzer and Görg 2008), there exists – to the best of my knowledge – no study investigating the regional determinants of the location choices of foreign multinationals in Germany.

In accordance with advances in location choice theory, this chapter adopts a monopolistic competition framework and assumes that a firm decides for a certain location if the achievable profits outweigh the profits that can be gained in all other available locations (for similar approaches compare also Head and Mayer 2004; Inui, Matsuura and Poncet 2007 and Mayer, Méjean and Nefussi 2007). Among the variables influencing a firm's profit, the fixed costs of market entry have often been ignored. Most studies that are based on a NEG framework refrain from specifying this term of the profit function despite the notion of Helpman, Melitz and Yeaple (2004) that the fixed costs of establishing an affiliate abroad involve a plant- and a country-(or region-)level part. As shown by Fujita and Thisse (1996), the location choice of an MNE might depend crucially on information spillovers arising from industry clusters. Although the authors originally thought of spillovers as improving the production function, they can – if specific to each German federal state – drive a wedge between the entry costs into the potential markets. In addition to network effects, adjacency to the source country may drive down fixed costs through information advantages. Thus, if fixed costs are a decisive parameter for market entry of foreign multinationals and vary across German federal states, they might explain part of the regional dispersion of the locations of MNEs' affiliates. Hence, this chapter lays some importance on identifying these costs.

The fixed costs specification through nation clusters and common borders suggests that the determinants of inward FDI vary among investors from different countries of origin as well as across sectors. Recent studies support a more differentiated examination of MNE activity. In particular, the distinct role of trade affiliates (as opposed to foreign production plants or to other export modes) has called a lot of attention in the theoretical (compare Krautheim 2007 and Felbermayr and Jung 2008) and the empirical literature (Hanson, Mataloni and Slaughter 2001). Interregional differences may, consequently, also translate into a distinct sectoral composition of multinational activity.

This chapter aims at explaining the regional dispersion of foreign multinationals' affiliates by exploiting the firm-level Micro database Direct Investment (MiDi) of the Deutsche Bundesbank. The MiDi is a full sample survey of foreign firms' affiliates in

Germany.[80] Merging the FDI data at the level of individual affiliates with information on German federal states extracted from the Federal Statistical Office gives a very rich database that allows assessing the impact of the theoretically derived regional drivers of inward FDI. The conditional logit and the nested logit model are employed to estimate the relative probability with which a multinational investor chooses a certain location. By relaxing the restrictive Independence of Irrelevant Alternatives (IIA) assumption the nested logit is able to account for expected differences between East and West German federal states as location alternatives.

The analyses of Chapter 4 add to the existing literature in three aspects: first, the combination of FDI data at the affiliate-level with regional data at the level of German federal states allows for a thorough assessment of the determinants of location choices of MNEs within Germany. Second, by explicitly modelling the fixed costs of firm entry, a border dummy and agglomeration variables are formally included into the empirical set-up. Third, the empirical evidence equips policy makers with useful information on how to attract MNEs in general and MNEs that have specific home countries and that operate within certain sectors.

The chapter proceeds as follows: Chapter 4.2 lays out the theoretical model which motivates the empirical specification. Chapter 4.3 describes the estimation strategy with the conditional logit (Chapter 4.3.1) and the nested logit (Chapter 4.3.2) model. After presenting some descriptive statistics on the dependent variable in Chapter 4.4.1, the independent variables are explained in Chapter 4.4.2. Chapter 4.5 discusses the results of the empirical examination. Chapter 4.6 concludes.

4.2 Theoretical Background

Multinational firms face a set of location options when deciding to undertake an investment abroad. The selection of a particular location depends on the potential profits associated with that location exceeding the potential profits associated with all other available locations. This chapter follows Redding and Venables (2004), Amiti and Javorcik (2008) and Mayer, Méjean and Nefussi (2007) in adopting a Dixit-Stiglitz-type monopolistic competition

[80] Investments below a certain threshold do not need to be reported. Since 2002, this threshold corresponds to a balance sheet total up to and including three million €.

model and extends it with regard to the specification of fixed costs and internal market access. The total profits of a single representative firm located in region *i* but selling in all potential markets *j* can be described as[81]

$$\Pi_i = \sum_j \left[(1-t_i)(p_{ij} - c_i\phi_{ij})x_{ij}\right] - f_{ik} \tag{4.1}$$

with p_{ij} representing the prices to which the firm sells its output x_{ij} in the *j* available markets. The firm's profits are reduced by the taxes t_i a firm has to pay in region *i*, by the marginal costs of production $c_i = w_i^{\alpha} r_i^{\beta}$ (with labour and land as the two production factors and wages and land rents as their prices), by the iceberg-type transport costs ϕ_{ij} and by the sunk fixed costs of the investment, f_{ik}. According to Helpman, Melitz and Yeaple (2004), fixed costs are higher for foreign than for domestic firms, because the former face an informational disadvantage when entering a new market.[82] The fixed costs

$$f_{ik} = (N_{ik} Z_i^{1-\sigma})^{\frac{1}{1-\sigma}} \tag{4.2}$$

depend on the inverse of the costs of entry into a foreign market Z_i and on the costs of duplicating overhead production N_{ik}. Variables in Z_i are region- and origin country specific, whereas the number of firms, N_{ik}, may also vary among industries (the index of the source country is omitted for the sake of simplicity). Both variables are assumed to reduce the informational disadvantage of foreign firms and facilitate thereby the entry into a specific market *i*.[83] In line with the propositions of Fujita and Thisse (1996) (compare Chapter 1.2.4), N_{ik} is an agglomeration variable that entails spillovers among firms from the same sector and

[81] Firm heterogeneity with respect to location choice cannot be assessed with the available information in the MiDi. For this reason, the simple model assumes one representative firm.
[82] In contrast to the proximity-concentration literature, firms have to cover fixed costs only when setting up an additional affiliate abroad; exporting the output to any other market is only subject to variable transport costs.
[83] A high number of firms in an industry also reflects low plant-level economies of scale. This interpretation corresponds more closely to Helpman, Melitz and Yeaple's definition of the plant-level part of fixed costs.

the same country of origin. In the present set-up, a high elasticity of substitution $\sigma(\sigma > 1)$ and thus, intense competition will, however, reduce each firm's willingness to share information with new entrants. Hence, the positive externalities among firms in a certain location decrease with σ.

$$x_{ij} = \frac{E_i P_i^{\sigma-1}}{\phi_{ii}^{\sigma-1} p_i^{\sigma}} + \sum_l \frac{E_l P_l^{\sigma-1}}{\phi_{il}^{\sigma-1} p_i^{\sigma}} \tag{4.3}$$

is the effective demand level for the products sold by an affiliate on all potential markets depending positively on the expenditure shares E_i and E_l and negatively on the mill price p_i. It is assumed that a multinational firm can either sell its output in the chosen region *i* or in all other regions *L (l ∈ L)*, but not abroad. In either case, goods face iceberg-type trade costs $\phi_{ii}(\phi_{il})$ before reaching their final destination. With the underlying demand curve, a firm will charge the prices

$$p_{ii} = \frac{c_i \sigma}{\sigma - 1} \phi_{ii} \qquad \text{and} \tag{4.4a}$$

$$p_{il} = \frac{c_i \sigma}{\sigma - 1} \phi_{il} \tag{4.4b}$$

in the home market *i* and in all other markets *L* respectively; the mark-up over the marginal costs depending negatively on the elasticity of substitution. A few mathematical transformations lead to the following testable equation

$$\Pi_i = (1 - t_i) \frac{(w_i^{\alpha} r_i^{\beta})^{1-\sigma}}{\sigma} \left(\frac{\sigma}{\sigma - 1} \right)^{1-\sigma} \left(\frac{E_i P_i^{\sigma-1}}{\phi_{ii}^{\sigma-1}} + \sum_l \frac{E_l P_l^{\sigma-1}}{\phi_{il}^{\sigma-1}} \right) - f_{ik} \tag{4.5}$$

which motivates the following log-linear empirical specification where variables are allowed to vary over time

$$\ln \Pi_{it} = \gamma_0 + \gamma_1 \ln t_{it} + \gamma_2 \ln w_{it} + \gamma_3 \ln r_{it} + \gamma_4 \ln MA_{it} + \gamma_5 \ln \phi_{iit} + \gamma_6 \ln \sum_l \frac{MA_{lt}}{\phi_{il}} + \gamma_7 \ln N_{ikt} + \gamma_8 Z_i + \nu_i + \varepsilon_{ikt}. \quad (4.6)$$

Equation (4.6) subsumes the demand and the price indices into an internal and an external market access variable (MA_{it} and MA_{lt}). It also includes region dummies to account for unobserved heterogeneity among location alternatives such as the competition intensity σ.

Although equation (4.6) describes the profits of a representative firm, the magnitude of the independent variables may in fact vary for investors from different countries and operating in different sectors. In an empirical paper, Hanson, Mataloni and Slaughter (2001) emphasise that the motives underlying the establishment of wholesale and manufacturing affiliates differ and propose, therefore, a distinction of distribution- and production-related FDI activities. In this spirit, Krautheim (2007) shows that the decision between various entry modes (in particular, these are exports and FDI through wholesale affiliates or through production plants) depends on their distinct cost structures. Although the present analysis assumes that the fundamental investment decision has already been taken, and that the only choice that has to be made is the affiliates' location, a sectoral view seems appropriate. A simple discrimination of manufacturing from service industries misses out the specific role of wholesalers and retailers. In line with Defever (2006), this study additionally distinguishes upstream and downstream activities. Downstream activities correspond to the post-production distributional activities of wholesalers and retailers. Upstream activities subsume the pre-production stage activities of R&D centres and headquarters. Weichenrieder and Mintz (2007) argue that, apart from taxes, the economically efficient bundling of activities in one country motivates the existence of holdings. In this sense, holdings act as local or third country headquarters and can be perceived as undertaking upstream activities. Despite of the notion of Weichenrieder and Mintz (2007), their classification as a pre-production service is at best an approximation of upstream activities. In fact, their heterogeneous nature would require a more detailed information about actual occupations and tasks for which data is not available in the MiDi.

In sum, in the profit-maximising location choice of a firm, this chapter assumes fixed costs to play a predominant role. The adopted specification assumes that existing firm networks and adjacency to the country of origin mitigate the information disadvantages of

foreign over domestic firms and facilitate thereby the entry into a specific regional market. As such, the determinants are expected to vary across different source countries and across sectors. Against the background of the recently raising interest in occupational and sectoral differences in firm internationalisation, manufacturing and services and upstream and downstream activities will separately be examined.

4.3 Empirical Methodology

After formally deriving a testable equation, the identified push and pull factors with a special focus on the fixed costs of market entry will be assessed empirically. To this end, the following chapter introduces the econometric concepts of the conditional (4.3.1) and the nested logit model (4.3.2). Both estimation procedures fit the present questions particularly well since they allow presenting the choice of a certain location as the profit maximising decision of a multinational firm.

4.3.1 The Conditional Logit Model

While the actual profits associated with each location cannot be observed, information about the location choice and regional characteristics is available. The derived observable and unobservable variables (compare equation (4.6)) influence the profit of each alternative location and therefore the probability to invest in region *i*. The firm-level database MiDi contains information about the federal state, in which an MNE's affiliate is located, about its sector and the source country of the investment. Since it does not contain any information about the foreign mother, the location choice is assumed to be made upon regional characteristics only (for a more detailed description of the dependent and explanatory variables see Chapter 4.4). The conditional (fixed effects) logit model resembles well a firm's location decision in a particular market by estimating the relative probability of choosing a certain location *i* in dependence of its own characteristics x_i and of the characteristics x_l of all alternative locations *L* (see e.g. Train 2003 for a detailed description),

$$P_i = \frac{\exp(\gamma x_i)}{\sum_l \exp(\gamma x_l)}. \qquad (4.7)$$

The iid error terms follow an extreme value distribution which ensures the somewhat restrictive IIA property. Equation (4.7) reveals that the ratio of probabilities of investing in two locations is independent of the characteristics of the other alternatives. Hence, all alternatives exhibit the same degree of substitutability. This assumption is likely to be violated with data on location decisions in Germany since the motives for undertaking a direct investment in different regions could differ. E.g., investors may take advantage of the persistent gap between Eastern and Western federal states to pursue differing strategies with affiliates in the two regions. Hence, it seems apt to assume that these investors do not perceive all German federal states as being equal substitutes one to another. If this assumption was true, the standard conditional logit model would, due to its IIA property, underestimate the probability of investing in some states and overestimate the probability of investing in other states. Although region-specific fixed effects help to mitigate unobserved correlations among alternatives, the strategy is costly and does not resolve problems associated with cross-sectoral, cross-country or inter-temporal differences in the perceived attractiveness of German federal states (see Chapter 4.5.1 for a discussion).

4.3.2 The Nested Logit Model

The restrictive IIA property inherent to the conditional logit model calls for a more flexible approach that allows for at least some correlation of the error terms. The nested logit model relaxes the IIA assumption by partitioning the set of alternatives into subsets. Within the specified nests, the unobserved factors ε_i are allowed to be correlated while independence continues to hold across nests. A plausible nesting structure for the present analysis is the division of the entire set of alternatives into Eastern and Western federal states. Investors choose then between East and West Germany in the upper level and between regions within the two subsets in the lower level model.[84] The probability of choosing region *i* then depends on the product of two probabilities: the probability of choosing region *i* conditional on having decided for nest *n* ($P_{i|n}$) times the marginal probability of choosing nest *n* (P_n). This can formally be expressed as

[84] The division into an upper and a lower level decision does not imply a sequential decision making process. Even when investors have decided for a certain nest, they still have some probability to choose a region from another nest, although this probability decreases in the preference towards the chosen nest.

$$P_{in} = \frac{\exp(\gamma x_{in})}{\sum_{l \in n} \exp(\gamma x_{\ln})} \frac{\exp(\rho z_n + \lambda_n IV_n)}{\sum_m \exp(\rho z_m + \lambda_m IV_m)} \tag{4.8}$$

where $IV_n = \ln\left[\sum_{i \in n} \exp(\gamma x_{\ln})\right]$ is called the Inclusive Value (IV) and gives the expected profit an average investor receives from choosing a location *i* within nest *n*. Its estimated parameter λ_n reflects the degree of independence between the unobserved portions of the profit functions. For $\lambda_n = 1$, the alternatives are completely independent and the nested logit model collapses into the conditional logit model described above. For $\lambda_n = 0$, alternatives within nests are perfect substitutes and only the nest choice matters for the location decision. McFadden (1978) shows that the nested logit specification is consistent only with random utility maximisation if λ_m is significantly estimated to lie in the range of [0;1] $\forall m$.

A potential problem arises with respect to the availability of data. By construction, the sample is restricted to multinational firms and excludes domestic firms and exporters. Hence, it is not possible to model a discrete choice process with a first step decision on the entry mode and a second step decision on the chosen location as proposed by Mayer, Méjean and Nefussi (2007). As Basile, Castellani and Zanfei (2008) point out, however, this shortcoming does not affect the explanatory variable coefficients if the error terms of the two nests (entry mode and location choice) are uncorrelated. In this case, changes in the profitability of one entry mode entail proportional changes in the profitability of each location choice without affecting the odds ratios.

4.4 Data and Variables

Chapter 4.4.1 provides a short description of the MiDi and how the dependent variable has been extracted from the database. It continues with giving some descriptive evidence of the distribution of MNE affiliates across German federal states. Chapter 4.4.2 explains the construction of the explanatory variables measuring the location choice determinants.

4.4.1 The Dependent Variable

The data on inward FDI come from the firm-level MiDi provided by the Deutsche Bundesbank (for details on this database see Lipponer 2008). The MiDi is a full sample survey of foreign firms' affiliates in Germany. Investments with a volume below a certain threshold (currently three million €) need not be reported, and the reporting limits have changed over time. To avoid changes in the explanatory variables resulting from changes in reporting limits, all observations that are not covered by the most restrictive reporting requirements are dropped. At the regional level, this study distinguishes FDI projects into 16 German federal states which correspond to the Nomenclature des unités territoriales statistiques (NUTS) I regions of the EU. Note, that firms report their FDI to the regional branches of the Bundesbank in the state where they are headquartered. Yet, the location of the firms' headquarters may not coincide with the state in which they have their main production units.[85] While this fact may lead to incorrect inferences with respect to the intensive margins of FDI activity, the extensive margin is less affected. Hence, this chapter focuses on the location choices of the MNEs' regional headquarters and refrains from making statements about the affiliates' sales or employment levels.

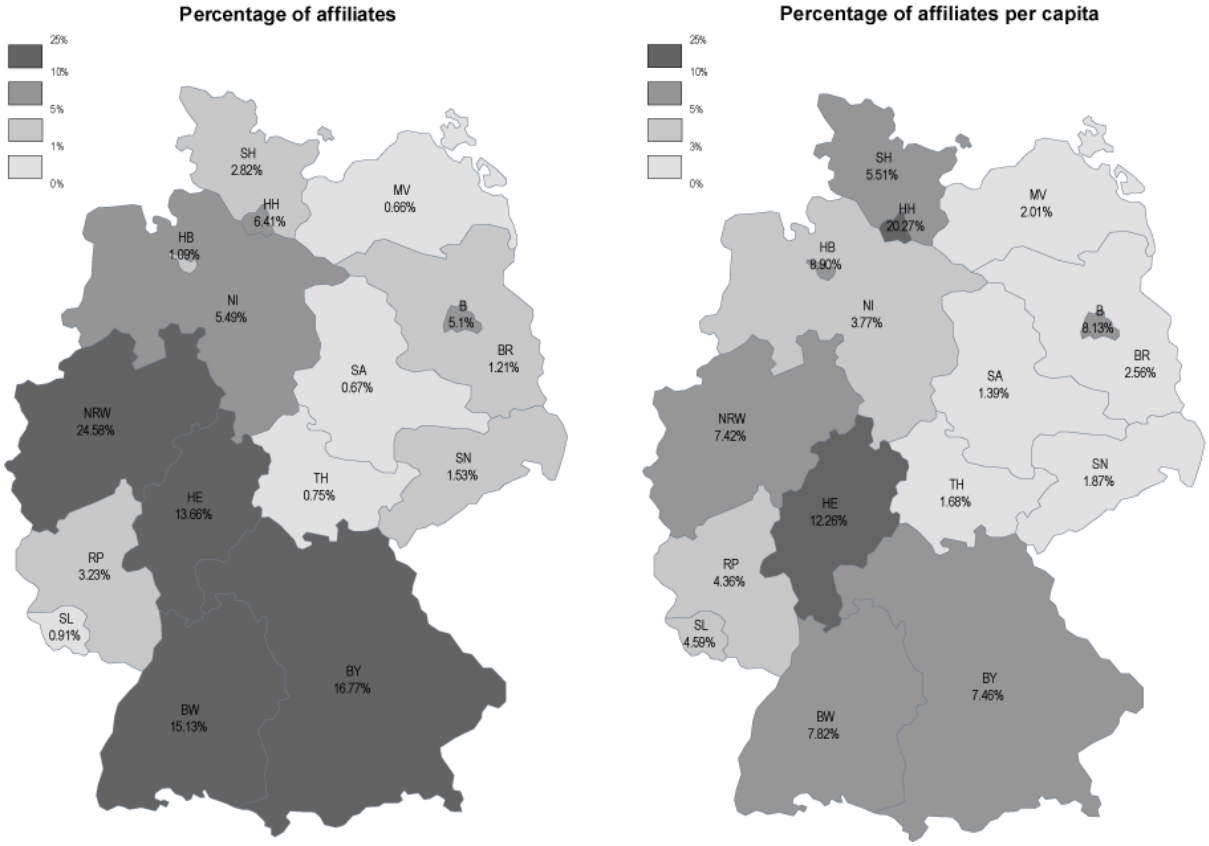
In addition to the chosen federal state, information on the sector groups of the affiliates can be retrieved from the MiDi. The over 100 NACE Rev. 1 sectors are, for the purpose of this study aggregated into 37 broader industries. In order to capture the initial location choice, each affiliate enters the estimation sample only once – in the founding year. Thus, if an affiliate has parents from several countries, it is attributed to the country of origin of the first investor. For this reason, the original worldwide country sample reported in MiDi reduces here to 79 countries that have established an affiliate in Germany within the considered time frame 1997-2005. In principle, the MiDi is a panel dataset since 1996. To

[85] For Germany as a whole (foreign and domestic firms), headquarters and affiliates are located in the same state in about 76% of the cases (Monopolkommision 2006: 119).

ensure, however, that only newly established affiliates are considered, affiliates already present in 1996 are excluded from the calculations.

Figure 4.1 gives an overview of the distribution of foreign affiliates within Germany. The left map plots the percentage of affiliates established in each federal state over the period 1997-2005.

Figure 4.1: Spatial Distribution of Affiliates (1997-2005)



Note: NRW: North Rhine Westphalia; BY: Free State of Bavaria; BW: Baden-Wurttemberg; HE: Hesse; HH: Hamburg; NI: Lower Saxony; B: Berlin; RP: Rhineland Palatine; SH: Schleswig-Holstein; SN: Free State of Saxony; BR: Brandenburg; HB: Bremen; SL: Saarland; TH: Thuringia; SA: Saxony-Anhalt; MV: Mecklenburg-Western Pomerania.

Source: Own calculations. Data from Deutsche Bundesbank.

Three regional groups can be distinguished. North Rhine-Westphalia, Bavaria, Baden-Wurttemberg and Hesse hosted between 1997 and 2005 over 70% of all foreign multinationals' affiliates. In contrast, the nine lowest ranked states together did not even attract 10% of all investment objects. Although there is some variation also within West and East Germany, the observation translates into an East-West disruption.[86] While foreign

[86] Note that Berlin is attributed to East Germany throughout the analysis.

investors established between 1997 and 2005 766 affiliates in an average Western German federal state, they founded during the same time only 141 affiliates in an average Eastern German federal state.[87] This observation holds generally true for the percentage of per capita investments, plotted in the map on the right. With the exception of Berlin, each East German federal state hosted between 1997 and 2005 less MNEs' affiliates per capita than each West German federal state.

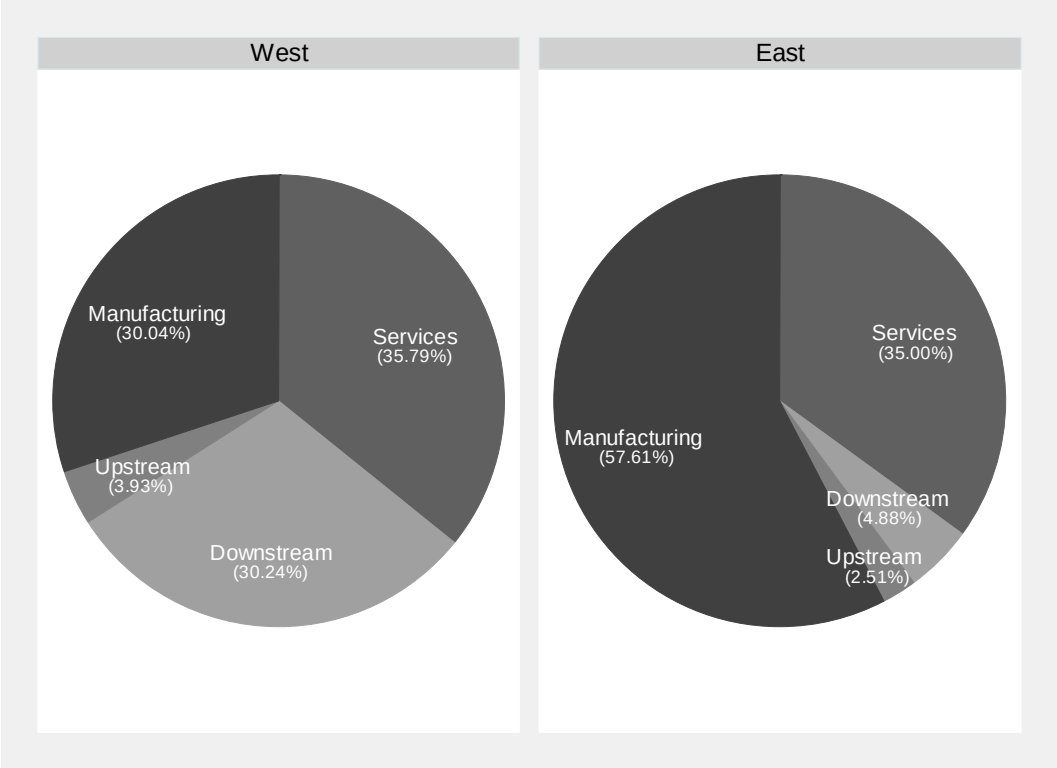
The regional distribution looks similar for the five most important countries of origin (see Figure A4.1 in Appendix A4.1), which account for 67% of all affiliate set ups in Germany over the period 1997-2005. It is striking that Switzerland and the Netherlands invest disproportionately into the adjacent federal states of Baden-Wurttemberg and North Rhine-Westphalia, respectively. In contrast, out of the six East German federal states, only Berlin and Saxony appear among the top ten locations of the biggest investors. Eastern and Western German federal states do not only differ in terms of the total number of established MNE affiliates but also in terms of the sectoral composition of inward FDI. Four sectoral groups are considered in this chapter: service affiliates, manufacturing affiliates and as complementing the latter, upstream (R&D and holdings) and downstream (wholesale and retail) activities. Figure 4.2 indicates that manufacturing activities make up for a larger part of inward FDI into East Germany, while services and especially downstream activities such as wholesale and retail affiliates are a major factor in West Germany. This seems surprising at first sight since one might expect high-tech manufacturers to be located close to high-skilled human capital in West German industry clusters and downstream activities that do not rely on a specialised labour force to be spread across the country. Becker, Ekholm and Muendler (2008) find, however, that offshoring of German MNEs has changed the task composition towards non-routine and interactive tasks more drastically in the service than in the manufacturing sector. The discussions of Chapter 4.2 also suggest that market access is of predominant importance for downstream activities, which is arguably higher in the West German federal states.

The descriptive analyses support the theoretically derived location choice determinants. Investors prefer large markets in the West, where a common border and existing firm networks also facilitate their entry. The tendency towards investing where the sales potential is high gets support from the sector composition of investments. Downstream

[87] Buch and Toubal (2008) report similar gaps for the degree of trade openness and immigration.

activities make up for a large part of total foreign investment in the West, while the East hosts mainly manufacturing affiliates.

Figure 4.2: Sectoral Composition of the Total Number of Affiliates in East and West Germany (1997-2005)



Note: The service sector is defined as excluding wholesale, retail and R&D affiliates as well as holdings.
Source: Own calculations. Data from Deutsche Bundesbank.

4.4.2 The Explanatory Variables

Information on German federal states is extracted from the Federal Statistical Office.[88] In a first set of regressions, the variables derived from equation (4.5) are considered. The taxes t_{it} are expected to lower a firm's profit in a location. For the present analysis, only those tax rates that vary at the federal state level are included – namely the real estate and the business tax. Wages and land rents are the prices of the two input factors. Following the critique by Bellak, Leibrecht and Riedl (2008), gross wages are not an adequate measure for labour costs, so that unit labour cost are defined instead as

[88] For a complete list of explanatory variables, see Table A4.1 in Appendix A4.2.

$$ulc_{it} = \left(\frac{w_{it} / emp_{it}}{gva_{it} / emp_{it}} \right), \tag{4.9}$$

with emp_{it} as the total employment and gva_{it} as the gross value added in region *i* at time *t*. The unit labour cost measure bears the advantage of being more directly linked to the profitability of FDI.[89] Regions lose competitiveness (and are therefore expected to attract less FDI) if wages are high and/or if productivity is low. Market access in the chosen location *i*, a pull factor for foreign investors, is represented by the GDP of market *i*. Low internal transport costs guarantee a good attainability of potential customers. ϕ_{iit} is therefore approximated by a local infrastructure index, constructed out of the relative length of motorways, roads, rivers and the number of airway passengers. Not only the local sales potential, but also the access to other markets influences the location choice of a foreign investor. The external market potential is calculated in accordance with Harris (1954), as the inverse distance-weighted sum of incomes,

$$MP_{lt} = \sum_{l} \frac{MA_{lt}}{\phi_{il}} = \sum_{l} \frac{GDP_{lt}}{dist_{il}}.^{90} \tag{4.10}$$

With respect to the fixed cost specification, two variables are employed. As it is assumed that investing in an adjacent region entails informational advantages, a border dummy serves as a proxy for the regional-level part of fixed costs. The number of plants with the same country of origin within an industry approximates the plant-level part of fixed costs.[91] In order to test whether network externalities are still present among competitors from different countries of origin, a non-nation specific agglomeration variable will additionally be

[89] In the absence of a regional price deflator, the unit labour costs are measured in nominal terms. Profitability therefore depends also on a firm's ability to pass on increasing labour costs to the consumer.

[90] Harris (1954) assumes the price indices to equal zero. Redding and Venables (2004) propose a market potential measure that is more rigorously derived from theory. Their approach requires the estimation of a trade equation to obtain the trade cost parameters. Since data on bilateral trade flows among German federal states is not available, market potential is, in this chapter, calculated according to Harris (1954). Head and Mayer (2004) stress that Harris' measure outperforms the approach by Redding and Venables (2004), particularly if national borders do not matter.

[91] To avoid an endogeneity bias in the empirical estimations, variables measuring the costs of the production factors, the market potential and the clustering of firms are lagged by one period. The count of affiliates is then increased by one unit in order to avoid loosing many observations by taking the log of zero.

included. Both cluster variables are expected to facilitate the market entry and attract new investors, but to different extents as information fluctuates better within nation-specific networks.

In a second set of regressions, a number of control variables are added to the baseline specification. With these policy variables, the possibilities of federal state governments to actively undertake measures in order to attract foreign multinationals can be assessed. One important policy field, which remains conducted under the governance of the federal states in Germany, is education policy. Regions compete for the best educational system and substantial differences in the performances are regularly confirmed by the OECD's Programme for International Student Assessment (PISA) study (compare e.g. Heller and Ziegler 2007). Specifically, I include public R&D expenditures, the share of university graduates and the share of school leavers without a degree to evaluate the importance of research and education for the attractiveness of a region. It has to be noted that the ongoing emigration of young skilled East Germans to the West (see e.g. Buch and Toubal 2008) might considerably weaken the tool of education policy to attract investors. Since the causality between migration, education and employment opportunities is, however, not clear ex-ante, it seems worthwhile to assess these additional controls. Finally, a variable measuring the population density of a federal state will be included. Even more than for the whole sample, this variable is, in the light of the discussions of Chapters 4.2 and 4.4.1, expected to provide new insights at the sector level. Investors seeking for new sales opportunities may prefer to locate their wholesale and retail affiliates in highly populated areas. Manufacturers, in contrast, could even be deterred by a high degree of urbanisation.

4.5 Results

This chapter presents the results of the conditional and nested logit estimations of the location choices of MNEs in Germany. First, the estimations on the whole sample will be discussed (4.5.1). Second, this exercise will be repeated for the most important sectors in order to account for potential differences among them (4.5.2). Third, the five most important countries of origin will be assessed individually (4.5.3). In all regressions, the continuous variables are taken in logs, which permits an interpretation of the estimated coefficients as the

approximate elasticities of the probability of an average investor choosing region *i* (Train 2003).[92]

4.5.1 Estimations on the Whole Sample

The results from the nested logit estimation are displayed in Table 4.1. For the regressions in columns (1)-(4), the IV parameters are significantly estimated to lie in the range of [0;1]. The Likelihood Ratio (LR) test rejects the null hypothesis of the IIA, hence, the conditional and the nested logit model cannot be perceived as equivalent. One possibility to mitigate the IIA problem characteristic to the conditional logit model is to include federal state dummies as is done in column (6) of Table A4.2 in Appendix A4.3. This strategy is valid as long as investors have uniform perceptions about the attractiveness of regions. Table A4.2, column (6) reveals that the inclusion of federal state dummies leads to substantial changes in the estimated coefficients. While the signs and magnitudes of the agglomeration variables and the border dummy remain stable, taxes, factor prices, and the infrastructure variable become insignificant. By contrast, the coefficients on the local and the external market potential increase dramatically. This result is not entirely surprising and in line with the findings of Crozet, Mayer and Mucchielli (2004) for inward FDI into French departments. As in their study, differences in market potential may be more important over time than across federal states. For the other explanatory variables, in contrast, the time-invariant cross-sectional component explains location choices better than the time series variation, an effect, which is in the specification of column (6) already absorbed by the fixed effects. Since the adopted nesting structure is valid, I refrain from further commenting the conditional logit results (see Table A4.2 in Appendix A4.3).[93]

[92] In fact, the presented coefficients are slight overestimates of the elasticities of location choice probabilities. It can be shown that $\frac{\partial P_i}{\partial x_i}\frac{x_i}{P_i} = \gamma(1-P_i)$ for the conditional logit model and $\frac{\partial P_{in}}{\partial x_i}\frac{x_i}{P_{in}} = \gamma\left[(1-P_{i|n}) + \lambda_n(1-P_n)P_{i|n}\right]$ for the nested logit model. Hence, the higher the number of alternatives (and nests), the closer is the estimated coefficient to the actual elasticity.

[93] Note, however, that overall the nested logit coefficients seem to be equal in sign, but smaller in magnitude and less statistically significant than their conditional logit counterparts in Table A4.2 in Appendix A4.3. This finding suggests that inside East and West Germany the push and pull forces of the explanatory variables are weak compared to the situation where the federal states are chosen independently of the nests.

Table 4.1: Nested Logit Estimations

Dependent variable: choice between federal states				
	(1)	(2)	(3)	(4)
$\ln t_{it}^{bus}$	-1.03***	-0.60	-0.53	-1.27**
	(0.31)	(0.37)	(0.39)	(0.60)
$\ln t_{it}^{est}$	0.70***	0.30	0.28	0.61
	(0.17)	(0.20)	(0.21)	(0.51)
$\ln ulc_{it}$	-2.26***	-1.51***	-1.55***	-0.91*
	(0.25)	(0.33)	(0.34)	(0.48)
$\ln r_{it}$		0.12***	0.12***	0.14**
		(0.03)	(0.03)	(0.06)
$\ln MA_{it}$	0.47***	0.46***	0.42***	0.51***
	(0.03)	(0.03)	(0.03)	(0.08)
$\ln \phi_{iit}$	0.35***	0.23*	0.21	0.36
	(0.12)	(0.14)	(0.14)	(0.25)
$\ln MP_{lt}$	0.07*	0.06*	0.06	-0.02
	(0.04)	(0.04)	(0.04)	(0.06)
$\ln N_{ikt}^{c}$	0.50***	0.51***	0.37***	0.37***
	(0.02)	(0.03)	(0.03)	(0.03)
$\ln N_{ikt}^{f}$			0.12***	0.13***
			(0.02)	(0.02)
Z_{i}^{c}	0.16***	0.17***	0.24***	0.26***
	(0.03)	(0.03)	(0.03)	(0.04)
$\ln RD_{it}$				-0.08
				(0.07)
$\ln unigrads_{it}$				0.11*
				(0.06)
$\ln nongrads_{it}$				0.18
				(0.14)
$\ln popdensity_{it}$				-0.03
				(0.08)
IV parameters				
East	0.40***	0.44***	0.48***	0.48***
	(0.03)	(0.04)	(0.05)	(0.06)
West	0.76***	0.77***	0.78***	0.80***
	(0.02)	(0.03)	(0.03)	(0.04)
LR test (IIA)	95.94***	63.87***	51.53***	45.02***
Observations	102256	91204	91204	83700
Investments	6391	6049	6049	5580

Note: This table presents the estimation results of equation (4.6). The regressions are based on the nested logit estimator. The IV parameters in the [0;1] interval and the significant LR test statistic confirm the nesting structure with East and West Germany as two nests. The dependent variable is the discrete choice of multinational firms to locate in one of 16 German federal states. The independent variables are as described in Chapter 4.4.2 and based on the variables listed in Table A4.1 in Appendix A4.2. Based on the specification of column (1), columns (2), (3) and (4) successively introduce land rents, non-nation-specific industry clusters and R&D expenditure, university graduates, school leavers without a degree and population density as additional control variables. Standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

Column (1) contains the results for the basic equation without land prices due to the fact that these were not available for the entire sample. Business taxes have the expected

negative sign, while the real estate tax somehow surprisingly shows a significant positive impact. High unit labour costs decrease the probability for a state being chosen as an FDI location. Internal market access as well as – although to a lesser extent – Harris' external market potential, help attracting foreign investors. A good local infrastructure allows for a better attainability of potential consumers in the periphery. Finally, the fixed cost specification of equation (4.2) seems valid. Both a higher number of existing affiliates with the same source country and within the same industry and the existence of a common border reduce the costs of entering a foreign market and induce investors to decide for that particular federal state.

In general, the results remain stable with the inclusion of the prices for building land in column (2). However, the tax rates can no longer be estimated as being significantly different from zero. The positive coefficient of land prices is striking in this context. Together with the positive coefficient of the real estate tax rate in column (1), the result suggests a density effect in metropolitan areas, which attracts investors despite of the relatively high prices. Finally, the inclusion of a variable measuring the costs of the second production factor, land, reduces the negative impact of unit labour costs. The other coefficients remain stable in terms of sign, magnitude, and significance level.

In column (3), in addition to the number of affiliates in the same sector and with the same country of origin (N_{ikt}^{c}), the total number of affiliates in the same sector aggregated over all foreign countries of origin (N_{ikt}^{f}) is included. As expected, the positive influence of the aggregate cluster variable is smaller than the impact of the country-specific cluster variable. The finding corroborates that firms particularly benefit from national networks, where no language or cultural barrier impedes informational interchanges. Interestingly, the coefficient of N_{ikt}^{c} has decreased as compared to columns (1) and (2). This result corresponds well to the theoretical prediction of intense competition lowering positive network externalities.

From the additional control variables in column (4), only the share of university graduates has a statistically important impact. While the availability of a highly qualified workforce matters for the location decision of MNEs, non-skilled workers, public R&D expenditures and population density do not seem to play a role. The theoretical discussion of Chapter 4.2 and the descriptive statistics presented in Chapter 4.4.1 suggest, however, to look at sectors and activities individually. Especially, distribution-related functions of trade

affiliates might react to regional conditions differently than production-related activities of manufacturing affiliates.

4.5.2 Sector-Specific Estimations

Table 4.2 reports the estimates for the manufacturing and the service sector as well as for pre- and post-production activities. The first columns contain the results for the baseline specification; the second columns introduce the policy control variables.

Columns (1) and (2) report the location choice determinants of service affiliates, excluding wholesale, retail and R&D affiliates as well as holdings. In contrast to the estimates for the whole sample (Table 4.1), column (1) indicates that taxes and the local infrastructure are relevant for service affiliates. Furthermore, the coefficient of the common border dummy is slightly higher. This last finding may be due to the complexity of some services that necessitate the adjacency to the parent company. In general, the results are robust to the inclusion of the additional control variables in column (2), although the evidence for land rents and tax rates is somewhat ambiguous.

The heterogeneity of the service sector requires, however, a differentiated analysis. To this end, columns (3) and (4) contain the results for downstream activities, like wholesale and retail trade and columns (5) and (6) report the estimates for upstream activities, like R&D and holdings. Taxes and local infrastructure do not seem to matter for wholesale and retail affiliates. This result is plausible against the finding of a large, positive coefficient of population density in column (4).[94] Direct customer proximity rather than the accessibility of potential consumers is crucial for the location of downstream activities at the regional level. The large positive effect of local market access (and also the positive coefficient of land prices in column (3)) supports this interpretation and is also in line with Hanson, Mataloni and Slaughter (2001). The authors find that US wholesale affiliates have higher sales in high-income countries.

[94] Note that in column (4), the LR test cannot reject the IIA property. As a robustness check, the regression has been repeated using the conditional logit model. The results confirm the relevance of urbanisation for downstream activities as indicated through a positive significant coefficient of population density and market access. The results of this exercise are not presented here, but can be made available upon request.

Table 4.2: Nested Logit Estimations for Different Sectors and Activities

Dependent variable: choice between federal states								
	(1) Other services	(2) Other services	(3) Services: Down-stream activities	(4) Services: Down-stream activities	(5) Services: Upstream activities	(6) Services: Upstream activities	(7) Manu-facturing	(8) Manu-facturing
$\ln t_{it}^{bus}$	-1.02	-2.10*	-0.70	-0.96	-1.36	-3.31	-0.65	-1.39
	(0.79)	(1.11)	(1.10)	(1.85)	(1.47)	(2.16)	(0.57)	(1.01)
$\ln t_{it}^{est}$	0.95**	1.08	0.29	-2.07	1.05	1.98	-0.06	0.77
	(0.44)	(0.92)	(0.60)	(1.38)	(0.84)	(1.72)	(0.31)	(0.88)
$\ln ulc_{it}$	-3.52***	-3.12***	-1.92**	-1.54	-1.82	0.87	0.44	1.49
	(0.66)	(0.80)	(0.92)	(1.25)	(1.18)	(1.67)	(0.57)	(0.91)
$\ln r_{it}$	0.20***	0.15	0.34***	0.07	0.09	0.30	0.02	0.12
	(0.07)	(0.10)	(0.11)	(0.17)	(0.11)	(0.18)	(0.05)	(0.09)
$\ln MA_{it}$	0.45***	0.56***	0.43***	1.05***	0.62***	0.98***	0.48***	0.58***
	(0.06)	(0.16)	(0.08)	(0.38)	(0.11)	(0.27)	(0.05)	(0.11)
$\ln \phi_{iit}$	0.61**	0.79*	0.59	-0.55	0.75	0.96	-0.02	0.24
	(0.29)	(0.47)	(0.41)	(0.71)	(0.53)	(0.86)	(0.21)	(0.42)
$\ln MP_{lt}$	0.09	-0.04	-0.02	0.02	0.08	-0.17	-0.01	-0.11
	(0.08)	(0.11)	(0.11)	(0.16)	(0.14)	(0.20)	(0.06)	(0.11)
$\ln N_{ikt}^{c}$	0.33***	0.29***	0.42***	0.43***	0.33***	0.22**	0.30***	0.34***
	(0.05)	(0.05)	(0.06)	(0.07)	(0.10)	(0.11)	(0.05)	(0.07)
$\ln N_{ikt}^{f}$	0.12***	0.11***	0.07**	0.07**	0.06	0.09*	0.11***	0.12***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.03)	(0.03)
Z_i^c	0.33***	0.32***	0.40***	0.36***	0.23**	0.30**	0.13**	0.17***
	(0.06)	(0.07)	(0.09)	(0.10)	(0.11)	(0.12)	(0.06)	(0.07)
$\ln RD_{it}$		-0.14		-0.43		-0.46*		-0.10
		(0.14)		(0.28)		(0.23)		(0.11)
$\ln unigrads_{it}$		0.11		-0.04		0.04		0.08
		(0.14)		(0.21)		(0.22)		(0.08)
$\ln nongrads_{it}$		0.09		0.12		0.11		0.26
		(0.25)		(0.41)		(0.44)		(0.23)
$\ln popdensity_{it}$		0.05		0.73**		-0.11		-0.13
		(0.15)		(0.32)		(0.25)		(0.13)
IV parameters								
East	0.56***	0.49***	0.54***	0.65***	0.46***	0.35**	0.40***	0.44***
	(0.09)	(0.10)	(0.11)	(0.19)	(0.13)	(0.14)	(0.07)	(0.10)
West	0.81***	0.75***	0.94***	0.92***	0.82***	0.78***	0.74***	0.81***
	(0.06)	(0.08)	(0.07)	(0.11)	(0.10)	(0.13)	(0.05)	(0.09)
LR test (IIA)	14.18***	10.75***	20.75***	4.53	8.96**	6.57**	15.95***	18.13***
Observations	29738	26970	22135	20535	8772	7620	27188	25380
Investments	1971	1798	1469	1369	580	508	1805	1692

Note: This table presents sector-specific estimation results based on the nested logit estimator. Columns (1) and (2) report results for other services, excluding wholesale, retail and R&D affiliates as well as holdings. Columns (3) and (4) report results for downstream activities of wholesale and retail affiliates and Columns (5) and (6) for upstream activities of holdings and R&D affiliates. Columns (7) and (8) report results for manufacturing affiliates. The independent variables of the respective first columns are as in Table 4.1, column (3) and of the respective second columns as in Table 4.1, column (4). Standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

Turning to the upstream activities (columns (5) and (6)), we find that only few of the standard location choice determinants exhibit importance. It is noteworthy, however, that the agglomeration variables have a lower impact on upstream activities. If holdings provide headquarter services it is reasonable to believe that they act independently from potential competitors. Interestingly, a high level of public R&D expenditure detracts MNEs from locating their R&D and holding activities in a certain federal state. One possible explanation for this might stem from the actual low number of R&D affiliates within this category. They make up for only around 5% of all affiliates conducting upstream activities. Since holdings are, except for serving as a local headquarter, also established for tax reasons (see Weichenrieder and Mintz 2007), they might have claims at odds with usual pre-production activities.

The results for the manufacturing sector are reported in columns (7) and (8). Two main differences with respect to the service sector in general and with respect to downstream activities in particular are striking: First, having a common border with the chosen location is less relevant for manufacturers. Second, the relatively low IV parameter (East) suggests that Eastern German federal states are viewed as especially close substitutes by these investors. Thus, since the main investing countries are Western economies (compare Figure A4.1) and since manufacturers make up for a large share of investments in East Germany (compare Figure 4.2), the result seems to describe the particular situation of Germany well. Education policy does, like for the other sectors and activities, not matter for manufacturers. As already noted, the possibilities of local policy makers to gain regional competitiveness might be considerably weakened by a highly mobile East German labour force.

4.5.3 Source Country-Specific Estimations

Chapters 4.5.1 and 4.5.2 have indicated that a common border is relevant for the probability to decide for a certain location but plays less of a role for manufacturers. This finding may already partly explain the specific situation of the East German federal states. Existing nation-specific firm networks also appeared as a robust location choice determinant, suggesting that it might be crucial to attract a number of affiliates from one country which spurs then – ideally via a self-reinforcing process – additional investments from the same country.

Table 4.3: Conditional and Nested Logit Estimations for the Most Important Countries of Origin

Dependent variable: choice between federal states					
	(1) NL	(2) USA	(3) CH	(4) GB	(5) F
$\ln t_{it}^{bus}$	-1.00	1.27	-4.12**	-0.63	0.18
	(0.93)	(1.10)	(1.82)	(2.08)	(1.68)
$\ln t_{it}^{est}$	0.31	-1.11*	1.85**	1.05	0.48
	(0.51)	(0.58)	(0.88)	(1.15)	(0.85)
$\ln ulc_{it}$	-2.76***	-0.05	-3.83**	-3.80**	-2.90
	(0.83)	(0.93)	(1.75)	(1.69)	(1.96)
$\ln r_{it}$	0.13	0.26**	0.24	0.27*	0.13
	(0.09)	(0.10)	(0.18)	(0.15)	(0.17)
$\ln MA_{it}$	0.24***	0.40***	0.22*	0.65***	0.19*
	(0.07)	(0.08)	(0.13)	(0.15)	(0.11)
$\ln \phi_{iit}$	0.60*	-0.30	1.31**	0.34	0.61
	(0.32)	(0.40)	(0.62)	(0.71)	(0.62)
$\ln MP_{lt}$	-0.05	0.16	-0.30*	0.30	0.00
	(0.08)	(0.11)	(0.18)	(0.19)	(0.16)
$\ln N_{ikt}^{c}$	0.26***	0.19**	0.28***	0.26**	0.49***
	(0.07)	(0.08)	(0.11)	(0.12)	(0.12)
$\ln N_{ikt}^{f}$	0.20***	0.27***	0.31***	0.36***	0.21**
	(0.06)	(0.07)	(0.09)	(0.09)	(0.08)
Z_{i}^{c}	0.37***		0.48**		0.37**
	(0.11)		(0.21)		(0.18)
IV parameters					
East	0.50***	0.39***			
	(0.11)	(0.11)			
West	0.75***	0.67***			
	(0.07)	(0.07)			
LR test (IIA)	8.75**	9.46***			
East-West dummy			Yes	Yes	Yes
Federal states dummies	No	No	No	No	No
Pseudo R^2			0.25	0.29	0.18
Observations	20246	12906	9996	9099	8593
Investments	1343	857	663	604	571

Note: This table presents country-specific estimation results based on the nested and the conditional logit estimator. The IV parameters in the [0;1] interval and the significant LR test statistic confirm the nesting structure for the Netherlands (column (1)) and the US (column (2)); for Switzerland (column (3)), Great Britain (column (4)) and France (column (5)) the conditional logit results are reported instead. The independent variables are as in Table 4.1, column (3). (Robust) standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

To see which regional factors actually pull or push the most important source countries, Table 4.3 displays the individual regression results for the five most important countries of origin. The LR test and the IV parameters support the nesting structure for Dutch, US and British investors. The LR test could not reject the IIA assumption for Swiss, British

and French investors. For this reason, only the conditional logit results are reported for these source countries of inward FDI in Germany.

At the individual country level, it is remarkable that taxes matter only for Swiss and US investors, while the latter do not respond to unit labour costs. In contrast, US MNEs seem to be located in metropolitan areas where land prices are also high. Using wages instead of unit labour costs and omitting land prices, Crozet, Mayer and Mucchielli (2004) find that US investments even react positively to high wages in French regions. Like in this chapter, the authors further estimate a relatively low impact of market access on Dutch investors (column (1)).

When looking at the most important source countries individually, assessing the fixed cost specification is of particular interest. The descriptive analysis of Figure A4.1 indicates that affiliates of Swiss and Dutch multinationals are predominantly located in the adjacent federal states of Baden-Wurttemberg and North Rhine-Westphalia. In the empirical results of Table 4.3, a common border is, accordingly, estimated to exhibit a significant influence on investments from these countries as well as from France. Furthermore, the agglomeration variables indicate that country networks are most important for French investors with a coefficient of 0.49 and least important for US investors (with a coefficient of 0.19). It is remarkable that MNEs from the US, Great Britain and Switzerland, who are assumed to be less affected by language barriers when investing in Germany, are even to a larger extent attracted by industry clusters in general than by industry clusters consisting of firms from the same country. Dutch and French investors, on the contrary, benefit more from nation-specific agglomeration. Hence, the empirical evidence not only for the whole sample and for the sectoral regressions, but also for individual countries of origin validates the adopted fixed cost specification in equation (4.2).

The importance of network and border effects has implications especially for East Germany. While the lacking adjacency to strong investing countries is an insuperable problem for East German policy makers, they might consider the promotion of industry clusters. This could be an especially promising strategy with regards to investors that do not heavily rely on nation-specific networks.

4.6 Conclusions to Chapter 4

This chapter examined and identified the main determinants of inward FDI into German federal states during the time span 1997-2005. Three questions were highlighted: First, in the theoretical part, a profit function was derived according to which foreign multinationals choose their locations. Common borders and nation-specific industry clusters were thought of as facilitating market entry. Possible particularities with regard to the distribution-related activities of trade affiliates were mentioned. Second, the specific situation of East Germany in terms of attracting less MNEs' affiliates and depending largely on the manufacturing sector was accounted for by adopting a nesting structure. The IV parameters of the baseline regressions all point at a higher degree of substitutability among Eastern as compared to Western federal states. Third, the empirical estimations confirm the theoretical presumptions: the theory-consistent specification of fixed costs shows a significant influence in the conditional and the nested logit estimations with the common border and existing firm clusters turning out as very robust determinants of inward FDI. The individual country regressions showed that network effects arise from aggregate industry clusters as well, but are less important for French investors. Finally, the sector estimates confirm that downstream industries prefer to locate in highly populated, wealthy (West German) federal states.

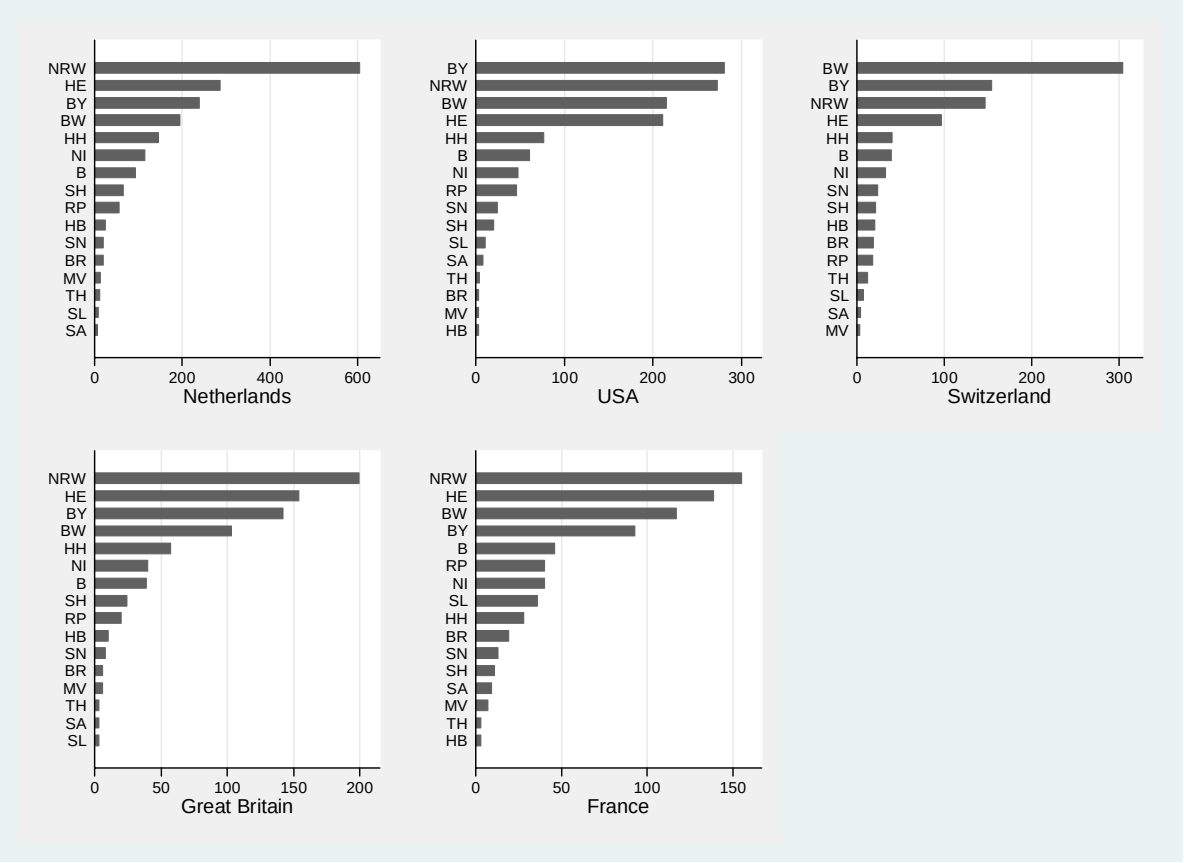
The findings are of high interest not only for the scientific community but also for policy makers. The insight that local demand and unit labour costs significantly influence foreign investors in their location choices represents indispensable information for regional policy makers when reflecting about ways to enhance the location attractiveness in general or to investors from certain sectors or countries. This latter strategy might be particularly sound, since a critical mass of affiliates from one industry and one country proves to be a reliable pull factor for other investors that operate in the same sector and have the same country of origin.

Although insightful, this chapter is limited by the availability of data. Due to lacking information about the characteristics of foreign multinational firms, a possible heterogeneous behaviour of firms investing at home or abroad cannot be accounted for. This task has therefore to be left for future research.

A4 Appendix

A4.1 Number of Affiliates by Country of Origin

Figure A4.1: Total Number of Affiliates by Country of Origin (1997-2005)



Note: In order to retain the confidential nature of the data, country of origin-federal state combinations with less than three observations have been made anonymous and defined to count at least three observations.

Source: Own calculations. Data from Deutsche Bundesbank.

A4.2 Variable List and Definitions

Table A4.1: List of Variables – Chapter 4

Variable	Definition	Source
t_i^{bus}	Business tax in percent	Federal Statistical Office
t_i^{est}	Real estate tax in percent	Federal Statistical Office
ulc_i	Unit labour costs measured as the ratio of labour compensation per labour input and labour productivity	Federal Statistical Office
r_{ik}	Prices of building land per qm²	Federal Statistical Office
MA_i	GDP in federal state *i* at current market prices	Federal Statistical Office
ϕ_{ii}	Infrastructure index calculated from the length of motorways, other streets, rivers and the number of airway passengers	Federal Statistical Office
MA_l	GDP in federal states *l* at current market prices	Federal Statistical Office
ϕ_{il}	Great circle distance between federal state *i* and federal states *l* as measured by the haversine formula	Latitudes and Longitudes from GPS Visualizer
Z_i^c	Dummy = 1 if region *i* and the source country share a common border	Federal Agency for Carthography and Geodesy
N_{ik}^f	Number of MNE affiliates in the same industry	MiDi
N_{ik}^c	Number of MNE affiliates in the same industry and with the same country of origin	MiDi
RD_i	Public R&D expenditures	Federal Statistical Office
$unigrads_{it}$	Share of university graduates in the total number of graduates	Federal Statistical Office
$nongrads_{it}$	Share of school leavers without a degree in the total number of graduates	Federal Statistical Office
$popdensity_{it}$	Number of inhabitants per qm²	Federal Statistical Office

A4.3 Conditional Logit Results

Table A4.2: Conditional Logit Estimations

Dependent variable: choice between federal states						
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln t_{it}^{bus}$	-2.68***	-2.84***	-1.05*	-0.86	-2.30***	-1.61
	(0.46)	(0.47)	(0.56)	(0.56)	(0.83)	(1.62)
$\ln t_{it}^{est}$	1.96***	2.05***	0.86***	0.72**	0.49	-0.09
	(0.23)	(0.24)	(0.30)	(0.30)	(0.72)	(1.36)
$\ln ulc_{it}$	-3.63***	-3.47***	-1.95***	-1.96***	-1.04*	1.46
	(0.34)	(0.37)	(0.46)	(0.46)	(0.61)	(2.75)
$\ln r_{it}$			0.29***	0.27***	0.14*	0.05
			(0.04)	(0.04)	(0.08)	(0.12)
$\ln MA_{it}$	0.69***	0.67***	0.61***	0.54***	0.86***	5.30**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.12)	(2.41)
$\ln \phi_{iit}$	0.79***	0.81***	0.37*	0.29	0.25	-0.67
	(0.17)	(0.17)	(0.20)	(0.20)	(0.36)	(1.90)
$\ln MP_{lt}$	0.13**	0.13**	0.13**	0.12**	-0.01	9.04*
	(0.05)	(0.05)	(0.06)	(0.06)	(0.08)	(5.34)
$\ln N_{ikt}^{c}$	0.65***	0.66***	0.64***	0.45***	0.44***	0.44***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
$\ln N_{ikt}^{f}$				0.17***	0.17***	0.17***
				(0.02)	(0.02)	(0.02)
Z_{i}^{c}	0.20***	0.19***	0.21***	0.31***	0.33***	0.35***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
$\ln RD_{it}$					-0.22**	-1.07**
					(0.11)	(0.45)
$\ln unigrads_{it}$					0.20**	0.10
					(0.09)	(0.12)
$\ln nongrads_{it}$					0.51***	-0.28
					(0.18)	(0.27)
$\ln popdensity_{it}$					0.23*	-7.22
					(0.13)	(5.17)
East-West dummy	No	Yes	Yes	Yes	Yes	No
Federal state dummies	No	No	No	No	No	Yes
Pseudo R^2	0.23	0.23	0.24	0.25	0.25	0.25
Observations	102256	102256	91204	91204	83700	83700
Investments	6391	6391	6049	6049	5580	5580

Note: This table presents the estimation results based on the conditional logit estimator. The dependent variable is the discrete choice of multinational firms to locate in one of 16 German federal states. The independent variables are as described in Chapter 4.4.2 and based on the variables listed in Table A4.1 in Appendix A4.2. Based on the specification of column (1), columns (2), (3), (4), (5) and (6) successively introduce an East-West (0/1) dummy, land rents, non-nation-specific industry clusters, R&D expenditure, university graduates, school leavers without a degree and population density as additional control variables and federal state dummies. Robust standard errors are in parentheses with significance at the *** p<0.01, ** p<0.05, * p<0.1 level.

Source: Own calculations.

CHAPTER 5 CONCLUSIONS

5.1 Summary

This thesis has not intended to give a complete picture of the complex interactions of integration on the one hand and trade and FDI flows within and from outside Europe on the other hand. Instead, it highlighted selected questions that arise in the context and provided pieces that contribute to the puzzle. These pieces are interrelated through various features. By content, since all of them work on internationalisation patterns within Europe, with either focusing on trade or on FDI flows. By methodology, since pooled or panel data estimation techniques are largely applied. And by modelling, since all estimations rely on equations that build upon a monopolistic competition framework with product differentiation and increasing returns.

Chapter 2 analysed the trade impact of the FTAs signed and implemented between the EU and each CEEC in the 1990s. According to Viner (1950), preferential liberalisation involves two opposing effects – trade creation and trade diversion. The gravity model has become a popular instrument to study the ex-post consequences of trade policies. Its empirical success was followed up by endowing the equation with theoretical underpinnings. A cornerstone has in this context been the contribution of Anderson and van Wincoop (2003) who showed that trade between two countries does not solely depend on bilateral trade resistances but on the resistance of these two countries to trade with any other country in the world (as described through price indices). Not accounting for these multilateral resistances leads to an omitted variable bias in empirical estimations that also concerns the FTA coefficient as one part of the bilateral trade costs. The methods so far employed in the literature reduce the problem either to the time-invariant part of the price indices by using country or country pair-specific dummy variables or they entail a computational complexity, which makes the estimation of big panel data sets unfeasible.

Chapter 2 introduced a new procedure that describes multilateral trade resistance through all observable bilateral trade barriers. A decreasing multilateral trade resistance over time, e.g. through the conclusion of an additional FTA reduces – under constant bilateral trade costs – a country's imports from a specific trade partner. At the same time, a global trend towards greater regional integration increases the worldwide trade flows. This last phenomenon is accounted for by a term measuring the world's resistance to (or – in the described case – the world's facilitation of) trade.

The empirical estimation results confirm the relevance of the additional multilateral measures. First, a Wald test approves the joint significance of these terms in all specifications. Second, the results indicate a downward bias of the FTA coefficient in studies, which do not properly account for Anderson and van Wincoop's price indices. In total, the trade stimulating effect of the EU-CEEC FTAs is estimated to add up to 72% in the static and 49% in the dynamic estimation. This equals an increase of 20 and 18 percentage points as compared to the specifications without the MWR terms, respectively. Individually, the FTAs with Romania and Bulgaria and with the Baltic States show the highest trade boosts both among the contracting parties and with the ROW. The losses that arose from the FTAs with the Czech and the Slovak Republic and Slovenia are of no consequence for the overall positive effects of the FTAs also for third countries.

Chapter 3 was built upon the presumption that positive and negative trade consequences do not only arise as a result of real but also in the wake of monetary integration. The chapter is tied in with the preceding analysis in multiple respects.

First, the ongoing integration of the CEECs has currently come to the challenge of the admission of the new EU member states to the Euro Area. Two views are controversially discussed in the literature. On the one hand, the classic OCA theory acts on the assumption that a minimum level of integration must be achieved such that the stability losses from giving up monetary independence will be outweighed by efficiency gains. On the other hand, Frankel and Rose (1998) and Rose (2000) document that the classical OCA criteria can be fulfilled ex-post since the common currency reduces trade costs and stimulates competition through enhanced price transparency. The descriptive statistics show that in 2004, Slovakia, the Czech Republic and Hungary possessed the highest degrees of openness towards the EMU-12, which makes them promising candidates for an early Euro adoption under the terms of the OCA textbook view. In accordance with the endogeneity assumption of currency areas,

however, the countries with the lowest degree of openness in 2004, Poland, Lithuania and Latvia, should bear the biggest potential of trade intensification with the EMU-12.

Second, the chapter continues methodologically the analysis of Chapter 2 by again adopting a specification with multilateral trade terms. With respect to the possibility of reverse causality of currency unions and trade flows, a HT instrumental variables estimator is applied.

The results of the baseline regression support a trade increasing effect of the Euro introduction for the entire time frame 1998-2004 as well as in detail for the years until 2002 (until 2003 in the out-of-sample estimation). Assuming that the same relationship between country characteristics and imports continues to hold for future EMU member states, the obtained parameters can be applied to the CEEC data set. The potential import increases are then calculated by comparing the results from the baseline scenario without the Euro to the counterfactual scenario with the Euro. The results of this exercise show that except for the least integrated countries – Poland, Lithuania and Latvia – all CEECs can expect trade gains from their EMU accession. This empirical evidence in favour of the classical OCA theory gains additional support as the Spearman rank correlation coefficient between the degree of openness and the potential import increases turns out to be significantly positive. The finding entails important policy implications: while the open economies should opt for an early introduction of the single currency, Poland, Lithuania and Latvia may prefer to concentrate on stronger real integration.

Chapter 4 shifted the focus to a different international activity of firms, namely FDI. In light of recent findings of positive effects of inward FDI on the local economy and on domestic firms, not only nations but also regions compete for foreign capital. Ongoing disparities between the East and the West of Germany indicate varying degrees of attractiveness for foreign investors. The chapter adopts a theoretical framework in which a firm decides for a location if the profits outweigh the attainable profits in all other locations. In accordance with Helpman, Melitz and Yeaple (2004), the fixed costs of establishing a new affiliate abroad are subdivided into a region- and a plant-level part. The plant-level part is described by the number of firms from the same sector and the same country as the investing firm. Whereas higher agglomeration in a certain location is to begin with positive as firms can interchange information, they become more reluctant to do so once the market becomes more crowded and competition intensifies. The region-level part is described through a common border between the chosen location and the home country of the investor. Hence, market entry

is facilitated when more information is available – due to existing firm networks or due to adjacency.

The estimations are based on a conditional and a nested logit model that define the choice of a certain federal state as a profit maximising decision of a firm. Due to the IIA, the conditional logit model presumes a constant degree of substitutability between the 16 federal states. Since the motivation to invest in Eastern or Western German regions can substantially differ, the nested logit model is preferred for the problem at hand. The descriptive and the econometric evidence support the subdivision of the alternatives into the two nests. Furthermore, the IV parameters suggest that foreign investors perceive East German federal states as closer substitutes than West German federal states. The theoretically derived location choice determinants, like taxes, labour costs, market potential and infrastructure underline their economic relevance in the estimations. Adjacency and existing sector and country clusters appear as especially robust drivers of inward FDI. This result supports the adopted fixed cost specification also against the finding of decreasing network externalities among firms from different countries. The individual country regressions further show that Dutch and French investors highly benefit from nation-specific networks, whereas US, British and Swiss investors – possibly confronted with lower language barriers – are equally attracted by cross-country industry clusters.

Although the estimated equation describes the profits of a single representative firm, in fact, the relevance of the determinants may differ across different sectors. Following recent theoretical and empirical studies, Chapter 4 distinguishes four sectoral headings, services and manufacturing and as surrounding the latter, pre-production upstream and post-production downstream activities. The estimation outcome supports the hypothesis that downstream activities of wholesale and retail affiliates are highly attracted by a large sales potential of a region. At the same time, a common border matters least for manufacturing affiliates. These empirical results support the descriptive statistics, which identified wholesaling and retailing as a very important activity in West Germany, and manufacturing as the main activity in East Germany.

In general, the results obtained in the three chapters broadly confirm earlier studies in the field, but still extend the literature into various directions. While there are only a few other studies measuring the impact of real and monetary integration on the CEECs, the thesis contains, to the best of my knowledge, the first analysis of MNEs' location choice determinants in Germany. The econometric analysis abuses recent estimation techniques that

invoke important improvements as compared to more traditional methods. E.g. the FEVD and the HT estimator report estimates for important explanatory time-invariant variables as the distance variable in gravity equations. The HT estimator additionally takes into account reverse causality issues that are important in the context of monetary integration.

All estimations are based upon structural trade and FDI models. In Chapters 2 and 3, Anderson and van Wincoop's (2003) proposal of introducing multilateral trade resistance is accounted for in an innovative way. The estimation results confirm their importance and suggest that earlier studies omitting these terms may have provided biased estimates. The estimated equation of Chapter 4 also considers the feature of multilateral resistance in parts as the choice of location depends not only on the local market access but also on the market potentials of all other regions. Its influence, in turn, varies with the remoteness of the chosen location. Eventually, the specification of fixed costs exhibits importance since the results suggest that the positive effects of agglomeration are stronger if nation-specific and weaker with fiercer competition.

5.2 Outlook

It has already been mentioned that the determinants and effects of the ongoing internationalisation of economic activities are multifaceted and cannot be treated exhaustively within one thesis. Despite of the various research strands that had to be left aside in this context, some very specific questions that are closely tied in with the treated problems could not be analysed due to time and/or data constraints. These restrictions were mentioned in the respective chapters.

There are several interesting directions for future research that pick up aspects studied in Chapters 1 to 3. While the trade effects of the Euro have by now been extensively studied (at least at the aggregate country level), the transmission channel of monetary integration to FDI is hardly explored. If the exchange rate was seen as a trade cost variable, a cost reduction (by fixing the exchange rate) would boost trade at the expense of horizontal FDI. The option value approach by Pindyck and Dixit (1994) delivers an argument why an investment decision may be delayed in the presence of uncertainty. Volatile exchange rates increase the uncertainty about the rates of return of an investment project that are necessary to cover the fixed sunk costs. The combination of the irreversible nature and the multi-period framework of investment projects create a positive value of waiting in a risky environment. In

heterogeneous firm models, where revenues are driven by firm-specific productivity levels, the cut-off productivity level at which investments just break even is higher in risky environments than in stable economies. By allowing less productive firms to bear the sunk fixed costs more easily, monetary integration may hence, permanently lower the probability that investment opportunities are deferred. Since such an effect rather increases the number of investment projects than the FDI volume, it is essential to use firm-level data that allows distinguishing the extensive from the intensive margin.

Another related topic arises from the ongoing internationalisation of the production chain which often spans over a number of countries and changes the nature of world trade. In a world where not only products, but also capital can move freely across borders, intra-industry- and also intra-firm trade makes up for a large part of total world trade. The fact that intra-industry trade is particularly high in countries that are also increasingly involved in FDI activity suggests that both phenomena should be studied jointly. While intra-industry trade occurs in similar but differentiated products, intra-firm trade is likely to take place in finished products where the foreign affiliate conducts distributional, marketing or service activities (OECD 2002: 163). This observation fits well into a very recently rising scientific interest in distinguishing the international activities of firms and specifically, in investigating more closely the particularities of the service sector (see Krautheim 2007 and Felbermayr and Jung 2008 for theoretical contributions). The expansion of intra-firm transactions gives rise to at least two questions: first, what are the circumstances under which firms decide to export or to establish a service affiliate abroad? And second, when will the service activity be conducted within the borders of a firm and when will external contracting be profit-maximising?

These are just a few possibilities in which direction research activities on trade and FDI could go from here. The raised questions are expected to give new insights into the determinants of FDI flows and the prerequisites and impacts of RTAs and currency unions that may complement, weaken or strengthen the points made in the present thesis.

References

Adam, A., Kosma, D. and McHugh, J. (2003) Trade-Liberalization Strategies: What Could Southeastern Europe Learn from CEFTA and BFTA?, *IMF Working Paper,* 239.

Aitken, N. (1973) The Effect of EEC and EFTA on European Trade: A Temporal Cross-Section Analysis, *American Economic Review,* 63(5): 881-92.

Alesina, A. and Barro, R. (2002) Currency Unions, *Quarterly Journal of Economics,* 117(2): 409-36.

Amiti, M. and Javorcik, B. (2008) Trade Costs and Location of Foreign Firms in China, *Journal of Development Economics,* 85(1-2): 129-49.

Anderson, J. (1979) A Theoretical Foundation for the Gravity Equation, *American Economic Review,* 69(1): 106-16.

Anderson, J. and van Wincoop, E. (2003) Gravity with Gravitas: A Solution to the Border Puzzle, *American Economic Review,* 93(1): 170-92.

Arellano, M. and Bond, S. (1991) Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, *Review of Economic Studies,* 58(2): 277-97.

Arndt, C. and Mattes, A. (2008) Country Evidence on the Impact of Foreign Ownership on the Performance of German Multinational Firms, *MicroDyn Working Paper,* forthcoming.

Baier, S. and Bergstrand, J. (2001) The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity, *Journal of International Economics,* 53(1): 1-27.

Baier, S. and Bergstrand, J. (2007a) Do Free Trade Agreements Actually Increase Members' International Trade?, *Journal of International Economics,* 71(1): 72-95.

Baier, S. and Bergstrand, J. (2007b) Bonus Vetus OLS: A Simple Method for Approximating International Trade-Cost Effects Using the Gravity Equation, http://www.eco.rug.nl/~brakman/GravityConference/BergstrandOct2007.pdf.

Baldwin, R. (1994) *Towards an Integrated Europe,* CEPR, London.

Baldwin, R. (2006a) The Euro's Trade Effects, *ECB Working Paper,* 594.

Baldwin, R. (2006b) *In or Out: Does It Matter? An Evidence-Based Analysis of the Euro's Trade Effects*, CEPR, London.

Baldwin, R. and Di Nino, V. (2006) Euros and Zeros: The Common Currency Effect on Trade in New Goods, *NBER Working Paper,* 12673.

Baldwin, R., Skudelny, F. and Taglioni, D. (2005) Trade Effects of the Euro – Evidence from Sectoral Data, *ECB Working Paper,* 446.

Baldwin, R. and Taglioni, D. (2006) Gravity for Dummies and Dummies for Gravity Equations, *NBER Working Paper,* 12516.

Baldwin, R. and Wyplosz, C. (2004) *The Economics of European Integration,* McGraw-Hill, Geneva.

Baltagi, B., Egger, P. and Pfaffermayr, M. (2003) A Generalized Design for Bilateral Trade Flow Models, *Economic Letters*, 80(3): 391-7.

Barrios, S., Görg, H. and Strobl, E. (2006) Multinationals' Location Choice, Agglomeration Economies and Public Incentives, *International Regional Science Review*, 29(1): 81-107.

Basile, R. (2004) Acquisition versus Greenfield Investment: the Location of Foreign Manufacturers in Italy, *Regional Science and Urban Economics,* 34(1): 3-25.

Basile, R., Castellani, D. and Zanfei, A. (2008) Location Choices of Multinational Firms in Europe: The Role of EU Cohesion Policy, *Journal of International Economics,* 74(2): 328-40.

Bayoumi, T. and Eichengreen, B. (1992) Shocking Aspects of European Monetary Unification, *NBER Working Paper,* 3949.

Bayoumi, T. and Eichengreen, B. (1995) Is Regionalism Simply a Diversion? Evidence from the Evolution of the EC and EFTA, *NBER Working Paper*, 5283.

Bayoumi, T. and Eichengreen, B. (1998) Exchange Rate Volatility and Intervention: Implications of the Theory of Optimum Currency Areas, *Journal of International Economics,* 45(2): 191-209.

Becker, S., Ekholm, K. and Muendler, M. (2008) Offshoring and the Onshore Composition of Occupations, Tasks and Skills, http://www.eea-esem.com/files/papers/EEA-ESEM/2008/2631/fditasks-v12.pdf.

Belke, A. and Gros, D. (2002) Designing EU-US Monetary Relations: The Impact of Exchange Rate Variability on Labour Markets on both Sides of the Atlantic, *The World Economy*, 25(6): 789-813.

Belke, A. and Setzer, R. (2003) Costs of Exchange Rate Volatility for Labour Markets: Empirical Evidence from the CEE Economies, *Economic and Social Review*, 34(3): 267-92.

Belke, A. and Spies, J. (2008) Enlarging the EMU to the East: What Effects on Trade?, *Empirica*, 35(4): 369-89.

Bellak, C., Leibrecht, M. and Riedl, A. (2008) Labour Costs and FDI Flows into Central and Eastern European Countries: A Survey of the Literature and Empirical Evidence, *Structural Change and Economic Dynamics*, 19(1): 17-37.

Berger, H. and Nitsch, V. (2005) Zooming Out: The Trade Effect of the Euro in Historical Perspective, *CESifo Working Paper*, 1435.

Bergstrand, J. (1985) The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence, *Review of Economics & Statistics*, 67(3): 474-81.

Bergstrand, J. (1989) The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade, *The Review of Economics and Statistics*, 71(1): 143-53.

Bergstrand, J. (1990) The Heckscher-Ohlin-Samuelson Model, the Linder Hypothesis and the Determinants of Bilateral Intra-Industry Trade, *Economic Journal*, 100(403): 1216-29.

Berthou, A. and Fonatgné, L. (2008) The Euro and the Intensive and Extensive Margins of Trade: Evidence from French Firm Level Data, *CEPII Working Paper*, 08/06.

Bitzer, J. and Görg, H. (2008) Foreign Direct Investment, Competition and Industry Performance, *Kiel Working Paper*, 1416.

Blundell, R. and Bond, S. (1998) Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, *Journal of Econometrics*, 87(1): 115-43.

Bond, S., Nauges, C. and Windmeijer, F. (2005) Unit Roots: Identification and Testing in Micro Panels, *cemmap Working Paper*, 07/05.

Breuss, F., Fink, G. and Haiss, P. (2004) How Well Prepared Are the New Member States for the European Monetary Union?, *Journal of Policy Modeling*, 26(7): 769-91.

Broto, C., Ruiz, J. and Vilarrubia, J. (2006) Firm Heterogeneity and Selection Bias: Estimating Trade Potentials in the Euromed Region, http://www.eco.uc3m.es/jruiz/MENA_Trade_Potentials.pdf.

Brouwer, J., Paap, R. and Viaene, J. (2008) The Trade and FDI Effects of EMU Enlargement, *Journal of International Money and Finance*, 27(2): 188-208.

Buch, C. and Toubal, F. (2008) Openness and Growth: The Long Shadow of the Berlin Wall, *Journal of Macroeconomics*, forthcoming.

Bun, M. and Klaassen, F. (2007) The Euro Effect on Trade is not as Large as Commonly Thought, *Oxford Bulletin of Economics and Statistics*, 69(4): 473-96.

Bussière, M., Fidrmuc, J. and Schnatz, B. (2005): Trade Integration of Central and Eastern European Countries: Lessons from a Gravity Model, *OENB Working Paper*, 105.

Byé, M. (1950) Unions Douanières et Données Nationales, *Economie appliqué*, 3: 121-57.

Caporale, M., Rault, C., Sova, R. and Sova, A. (2008) On the Bilateral Trade Effects of Free Trade Agreements between the EU-15 and the CEEC-4 Countries, *IZA Discussion Paper*, 3782.

Carrère, C. (2006) Revisiting the Effects of Regional Trade Agreements on Trade Flows with Proper Specification of the Gravity Model, *European Economic Review*, 50(2): 223-47.

Caves, R. (1981) Intra-Industry Trade and Market Structure in the Industrial Countries, *Oxford Economic Papers*, 33(2): 203-23.

Chaney, T. (2008) Distorted Gravity: The Intensive and Extensive Margins of International Trade, *American Economic Review*, 98(4): .1707-21.

Cheng, I. and Wall, H. (2004) Controlling for Heterogeneity in Gravity Models of Trade and Integration, *Federal Reserve Bank of St. Louis Working Paper,* 1999-010E.

Cieslik, A. (2005) Regional Characteristics and the Location of Foreign Firms within Poland, *Applied Economics,* 37(8): 863-74.

Clark, P., Tamirisa, N. and Wei, S. (2004) Exchange Rate Volatility and Trade Flows – Some New Evidence, http://www.imf.org/external/np/res/exrate/2004/eng/051904.pdf.

Crozet, M., Mayer, T. and Mucchielli, J. (2004) How Do Firms Agglomerate? A Study of FDI in France, *Regional Science and Urban Economics,* 34(1): 27-54.

De Benedictis, L., De Santis, R. and Vicarelli, C. (2005) Hub-and-Spoke or Else? Free Trade Agreements in the Enlarged EU, *European Journal of Comparative Economics,* 2(2): 245-60.

De Nardis, S., De Santis, R. and Vicarelli, C. (2007) The Single Currency's Effects on Eurozone Sectoral Trade: Winners and Losers?, *ISAE Working Paper,* 88.

Deardorff, A. (1998) Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World, In: Frankel, J. (ed.) *The Regionalization of the World Economy,* NBER University of Chicago Press, Chicago, 7-28.

Defever, F. (2006) Functional Fragmentation and the Location of Multinational Firms in the Enlarged Europe, *Regional Science and Urban Economics,* 36(5): 658-77.

Dixit, A. and Pindyck, R. (1994) *Investment under Uncertainty,* Princeton University Press, Princeton.

Egger, P. (2002) An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials, *The World Economy,* 25(2): 297-312.

Egger, P., Pfaffermayr, M. and Schmidt, R. (2007) What Happened to Trade in Western and Eastern Europe in the Aftermath of COMECON?, *Oxford Economic Papers,* 59(1): 102-26.

European Commission (2006) EU Competitiveness and Industrial Location, Bureau of European Policy Advisers, http://ec.europa.eu/dgs/policy_advisers/publications/eu_comp_en.htm.

European Commission (2007) The Impact of the Euro Appreciation on Domestic Prices and the Trade Performance, *Quarterly Report on the Euro Area*, 6(2): 14-22.

Evenett, S. and Keller, W. (2002) On the Theories Explaining the Success of the Gravity Equation, *Journal of Political Economy,* 110(2): 281-316.

Faruqee, H. (2004) Measuring the Trade Effects of EMU, *IMF Working Paper,* 154.

Feenstra, R. (2002) Border Effects and the Gravity Equation: Consistent Methods for Estimation, *Scottish Journal of Political Economy,* 49(5): 491-506.

Felbermayr, G. and Jung, B. (2008) Endogenous Export Modes. Trade Intermediation Versus Wholesale FDI in General Equilibrium, In: Mooslechner, P. and Gnan, E. (eds.) *International Trade & Domestic Growth: Determinants, Linkages and Challenges,* forthcoming.

Felbermayr, G. and Kohler, W. (2007) Does WTO Membership Make Difference at the Extensive Margin of World Trade?, *CESifo Working Paper*, 1898.

Fidrmuc, J. (2006) Gravity Models and Cross-Sectional Correlation in Integrated Panels, http://www.eea-esem.com/files/papers/EEA-ESEM/2006/845/GRcoint.pdf.

Fidrmuc, J. and Fidrmuc, J. (2003) Disintegration and Trade, *Review of International Economics,* 11(5): 811-29.

Fiorentino, R., Verdeja, L. and Toquebeouf, C. (2007) The Changing Landscape of Regional Trade Agreements: 2006 Update, *WTO Discussion Paper,* 12.

Flam, H. and Nordstrom, H. (2006a) Trade Volume Effects of the Euro: Aggregate and Sector Estimates, *Institute for International Economic Studies Stockholm Working Paper,* 746.

Flam, H. And Nordstrom, H. (2006b) Euro Effects on the Intensive and Extensive Margins of Trade, *CESifo Working Paper,* 1881.

Frankel, J. and Rose, A. (1998) The Endogeneity of the Optimum Currency Area Criteria, *Economic Journal,* 108(449): 1009-25.

Fujita, M. and Thisse, J. (1996) Economics of Agglomeration, *Journal of the Japanese and the International Economies,* 10(4): 339-78.

Ghosh, A., Gulde, A. and Wolf, H. (2002) *Exchange Rate Regimes: Choices and Consequences,* MIT Press, Cambridge.

Gros, D. and Thygesen, N. (1998) *European Monetary Integration – From the European Monetary System to Economic and Monetary Union,* 2nd ed., Addison Wesley Longman, New York.

Guimarães, P., Figueiredo, O. and Woodward, D. (2000) Agglomeration and the Location of Foreign Direct Investment in Portugal, *Journal of Urban Economics,* 47(1): 115-35.

Hafner, K. (2008) Agglomeration Economies and Clustering – Evidence from German Firms, *CeGe Working Paper,* 72.

Hamilton, C. and Winters, A. (1992) Opening Up for International Trade with Eastern Europe, *Economic Policy,* 7(14): 78-115.

Hanson, G., Mataloni, R. and Slaughter, M. (2001) Expansion Strategies of U.S. Multinational Firms, *NBER Working Paper,* 8433.

Harris, C. (1954) The Market as a Factor in the Localization of Industry in the United States, *Annals of the Association of American Geographers,* 44(4): 315-48.

Hausman, J. and Taylor, W. (1981) Panel Data and Unobservable Individual Effects, *Econometrica,* 49(6): 1377-98.

Hawtrey, R. (1944) *Economic Destiny,* Longman, Green & Co., London.

Head, K. and Mayer, T. (2004) Market Potential and the Location of Japanese Investment in the European Union, *The Review of Economics and Statistics,* 86(4): 959-72.

Head, K., Ries, J. and Swenson, D. (1995) Agglomeration Benefits and Location Choice: Evidence from Japanese Manufacturing Investments in the United States, *Journal of International Economics,* 38(3-4): 223-47.

Heller, K. and Ziegler, A. (2007) *Begabt Sein in Deutschland,* Lit Verlag, Münster.

Helpman, E. (1987) Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries, *Journal of the Japanese and the International Economies,* 1(1): 62-89.

Helpman, E. and Krugman, P. (1985) *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy,* MIT Press, Cambridge MA.

Helpman, E., Melitz, M. and Rubinstein, Y. (2007) Trading Partners and Trading Volumes, *NBER Working Paper,* 12927.

Helpman, E., Melitz, M. and Yeaple, S. (2004) Export Versus FDI with Heterogeneous Firms, *American Economic Review,* 94(1): 300-16.

Herderschee, J. and Qiao, Z. (2007) Impact of Intra-European Trade Agreements, 1990-2005: Policy Implications for the Western Balkans and Ukraine, *IMF Working Paper,* 126.

Hilber, C. and Voicu, I. (2007) Agglomeration Economies and the Location of Foreign Direct Investment: Empirical Evidence from Romania, *MPRA Working Paper,* 5137.

Inui, T., Matsuura, T. and Poncet, S. (2008) The Location of Japanese MNCs Affiliates: Agglomeration Spillovers and Firm Heterogeneity, *Institute of Economic Research, Hitotsubashi University Working Paper,* 506.

Kandogan, Y. (2003) Intra-Industry Trade of Transition Countries: Trends and Determinants, *Emerging Markets Review,* 4(3): 273-86.

Krautheim, S. (2007) Export-Supporting FDI, *EUI Working Paper,* 2007/24.

Krugman, P. (1991) Increasing Returns and Economic Geography, *The Journal of Political Economy,* 99(3): 483-99.

Krugman, P. (1996) Urban Concentration: The Role of Increasing Returns and Transport Costs, *International Regional Science Review,* 19(1-2): 5-30.

Laaser, C. and Schrader, K. (2002) European Integration and Changing Trade Patterns: The Case of the Baltic States, *Kiel Working Paper,* 1088.

Limão, N. and Venables, A. (2001) Infrastructure, Geographical Disadvantage and Transport Costs, *World Bank Working Paper,* 2257.

Linnemann, H. (1966) *An Econometric Study of International Trade Flows,* North-Holland, Amsterdam.

Lipponer, A. (2008) Microdatabase Direct Investment – MiDi A Brief Guide, http://www.bundesbank.de/download/vfz/fdi/vfz_mikrodaten_guide.pdf.

Lipsey, R. (1957) The Theory of Customs Unions, Trade Diversion and Welfare, *Economica,* 24(93): 40-6.

Lucas, R. (1976) Econometric Policy Evaluation: A Critique, *Carnegie-Rochester Conference Series on Public Policy,* 1: 19-46.

Maddala, G. and Wu, S. (1999) A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test, Oxford *Bulletin of Economics & Statistics*, 61(0): 631-52.

Maliszewska, M. (2004) New Member States' Trading Potential Following EMU Accession: A Gravity Approach, *CASE Working Paper,* 286.

Marques, H. (2008): Trade and Factor Flows in a Diverse EU: What Lessons for the Eastern Enlargement(s)?, *Journal of Economic Surveys,* 22(2): 364-408.

Martín, C. and Turrión, J. (2001) The Trade Impact of the Integration of the Central and Eastern European Countries on the European Union, *European Economy Group Working Paper,* 11.

Mayer, T., Méjean, I. and Nefussi, B. (2007) The Location of Domestic and Foreign Production Affiliates by French Multinational Firms, *CEPR Discussion Paper,* 6308.

McCallum, J. (1995) National Borders Matter: Canada-U.S. Regional Trade Patterns, *American Economic Review,* 85(3): 615-23.

McFadden, D. (1978) Modelling the Choice of Residential Location, In: Karquist, A. (ed.) *Spatial Interaction Theory and Planning Models,* North-Holland, Amsterdam, 75-96.

McKinnon, R. (1963) Optimum Currency Areas, *American Economic Review,* 53(4): 717-24.

Melitz, M. (2003) The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity, *Econometrica,* 71(7): 1695-725.

Melitz, J. (2007) North, South and Distance in the Gravity Model, *European Economic Review,* 51(4): 971-91.

Micco, A., Stein, E. and Ordoñez, G. (2002) The Currency Union Effect on Trade: Early Evidence from EMU, *Economic Policy,* 18(37): 315-56.

Monopolkommission (2006) Sechzehntes Hauptgutachten der Monopolkommission 2004/2005, Bundestagsdrucksache 16/2460.

Mundell, R. (1961) A Theory of Optimum Currency Areas, *American Economic Review,* 51(4): 657-65.

Mundell, R. (1973) Uncommon Arguments for Common Currencies, In: Johnson, H. and Swoboda, A. (eds.) *The Economics of Common Currencies,* Allen and Unwin, London, 114-32.

Neven, D. (1994) Trade Liberalization with Eastern Nations. How Sensitive?, *CEPR Discussion Paper,* 1000.

OECD (2002) *Economic Outlook No. 71,* OECD publishing, Paris.

Paas, T. (2003) Regional Integration and International Trade in the Context of EU Eastward Enlargement, *HWWA Discussion Paper,* 218.

Panagariya, A. and Duttagupta, R. (2001) The "Gains" from Preferential Trade Liberalization in the CGEs: Where Do They Come from?, In: Lahiri, S. (ed.) *Regionalism and Globalization, Theory and Practice,* Routledge, London, 39-60.

Pesaran, M. (2004) General Diagnostic Tests for Cross Section Dependence in Panels, *Cambridge Working Papers in Economics,* 0435.

Piermartini, R. and Teh, R. (2005) Demystifying Modelling Methods for Trade Policy, *WTO Discussion Paper,* 10.

Plümper, T. and Troeger, V. (2007) Efficient Estimation of Time-Invariant and Rarely Changing Variables in Finite Sample Panel Analyses with Unit Fixed Effects, *Political Analysis,* 15(2): 124-39.

Pöyhönen, P. (1963) A Tentative Model for the Volume in Trade Between Countries, *Weltwirtschaftliches Archiv,* 90(1): 93-100.

Redding, S. and Venables, A. (2004) Economic Geography and International Inequality, *Journal of International Economics,* 62(1): 53-82.

Robbins, L. (1937) *Economic Planning and International Order,* Arno Press, New York.

Robson, P. (1998) *The Economics of International Integration,* Routledge, London.

Roodman, D. (2006) How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata, *Center for Global Development Working Paper,* 103.

Rose, A. (2000) One Money, One Market: Estimating the Effect of Common Currencies on Trade, *Economic Policy,* 15(30): 7-46.

Rose, A. (2004) Do We Really Know That the WTO Increases Trade?, *American Economic Review,* 94(1): 98-114.

Schiff, M. and Winters, A. (2003) *Regional Integration and Development,* World Bank and Oxford University Press, Washington DC.

Spies, J. and Marques, H. (2008) Trade Effects of the Europe Agreements: A Theory-Based Gravity Approach, *Journal of International Trade and Economic Development,* 18(1): 11-35.

Tenreyro, S. (2004) On the Trade Impact of Nominal Exchange Rate Volatility, *Federal Reserve Bank of Boston Working Paper,* 03-2.

Tinbergen, J. (1962) *Shaping the World Economy,* Twentieth Century Fund, New York.

Train, K. (2003) *Discrete Choice Methods with Simulation,* Cambridge University Press, Cambridge.

UNCTAD (2007) *World Investment Report 2007 – Transnational Corporation, Extractive Industries and Development,* United Nations, New York.

Van der Klugt, A. (1993) Association, Partnership and Cooperation Agreements with East European Countries, http://www.eipa.eu/files/repository/eipascope/Scop93_1_3(2).pdf.

Viner, J. (1950) *The Customs Unions Issue,* Carnegie Endowment for International Peace, New York.

Weichenrieder, A. and Mintz, J. (2007) What Determines the Use of Holding Companies and Ownership Chains?, Oxford University Centre for Business Taxation Working Paper, 08/03.