Péter Földvári

The Economic Impact of the European Integration on the Netherlands

A Quantitative Analysis of Foreign Trade and Foreign Direct Investments

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Het economische effect van de Europese Integratie op Nederland:
Een Kwantitatieve Analyse van Buitenlandse Handel en Buitenlandse Directe Investeringen

(Met een samenvatting in het Nederlands)

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Foreword

PhD candidates are often asked why they choose a particular topic. In my case the reasons are twofold: partly personal and partly professional. It is convenient that I start with the professional reasons.

Even though regionalism is a popular topic, relatively few studies are concerned about the long-term analysis of economic integration. Such a project is really attractive and challenging for both an economist and an economic historian. As I happen to be both, with some interest in international economics and econometrics, it is not surprising that I ended up working on this topic. It was, however, not evident that such a study should focus on a single country. In most empirical work the impact of integration is measured and analyzed using a group of countries. Yet, a single-country analysis may answer some questions that a multi-country analysis cannot: It enables one to gain a new point of view and sometimes forces the researcher to look for country specific answers.

When I started to work on this thesis, the logical first step was to look for studies similar to mine. While there are plenty of studies applying similar econometric techniques, I have managed to find only a handful of papers that focus on a single country, and especially on the Netherlands. It seemed to me that I was fortunate enough to find a "niche".

Even though it was not my priority to draw any conclusions concerning future enlargements of the EU, being a Hungarian, it was also natural to ask myself whether a deeper understanding of what happened in the Netherlands can be useful to understand what to expect for my own country. But, as so many times in the last two decades, History was faster: Hungary joined the EU in May 2004. But even if it had not been so, I do not think that my findings for the Netherlands would have been applicable to Hungary. As I began to understand my results, I learned that the uniqueness of the Netherlands did not vanish in the 20th century at all.

In order to understand my personal motivations, let me now briefly summarize the history of this thesis:

I had studied Dutch for years at the university before I even had the idea of writing a PhD thesis. When I was accepted by the History Department of the University of Debrecen as full-time PhD student in 2000, I had already decided that whatever my PhD thesis would be about, it would be related to the Netherlands. The Huygens Scholarship provided me the opportunity in 2001/2002 to come to the Netherlands, for the first time in my life, and to spend ten very fruitful months at the International Institute of Social History (IISG) in Amsterdam. I am very grateful and indebted to Professor Dr. Jan Luiten van Zanden, who undertook the task of supervisor and was very supportive in this period. Without his trust, I would never have had the opportunity to write this dissertation nor to defend it in the Netherlands.

In retrospect, I feel that I never learned so much so fast in my whole life than during these months. For the first time, I was member of a research institute, I met very kind people, and, again for the first time in my life, my name was written on an office door. At this time, I already knew that my dissertation project would be about the measurement

of the impacts of European integration on the Netherlands but the initial plans, as usual, were far too ambitious. I wanted to analyze not only foreign trade and investments but also the labor market and the restructuring of the Dutch economy within the framework of intra-EU specialization. Later I understood that such a project would require a tremendous amount of work and time, and I had to limit the scope of my research. Finally, I decided to concentrate on foreign trade and the foreign direct investments only. Based on my first results, the Onderzoekinstituut voor Geschiedenis en Cultuur (OGC) at the Utrecht University granted me the status of international PhD student and the opportunity to defend my thesis in the Netherlands.

It was inevitable, however, that the nature of my project became more and more economic and quantitative. In 2004 I met Dr. Giovanni Russo, who at that time taught at the Utrecht University, and who was so kind as to accept the role of co-supervisor. Even though he returned to Italy after some months, he deeply influenced both this thesis and my way of thinking about economic research. He directed my attention towards the importance of theoretical modeling, and the more sophisticated econometric techniques. I am very grateful to him for his valuable advice.

In 2004 an important choice had to be made. My project was far too economic in nature to be defended in history, and also, I got more and more attracted by economics and econometric modeling. Again I must thank to Prof. Dr. Van Zanden for his understanding and assistance in this decision and the OGC for allowing me to move to the Faculty of Economics. We contacted the Utrecht School of Economics and, after Prof. Dr. Rob Alessie head of Econometrics Department agreed to be my supervisor, my research was officially transferred in March 2005.

My thesis took its final form in 2005. My models became simpler, some of my chapters got much more informative, and some were shortened and merged. But all this could not have been achieved without the assistance of my two newly joined supervisors, Professor Dr. Rob Alessie, and Dr. Richard Nahuis, Program Leader at the Central Planbureau (CPB). Rob provided me with a great assistance in econometric techniques, and Richard was always ready to help me not to loose my focus and not to overlook some important problems or pieces of literature. Therefore I would like to express my gratitude to them both.

Just a few weeks after the manuscript has been completed, a tragical event reminded me that Life is neither rational, nor just. At the age of 34, Richard passed away unexpectedly. I will miss both his kindness and his excellent and deep knowledge of economics, coupled with his precision and accuracy that helped me so much when writing this thesis. I learned a lot from him.

It is impossible to avoid building up a debt to a great number of persons while writing a thesis, including the library personnel at the IISG, and many colleagues who gave me valuable advices. I am especially grateful to the reading commission, which consisted of Prof. Steven Brakman, Prof. Bart van Ark, Prof. Harry Garretsen and Dr. Wolter Hassink, for their valuable suggestions and comments.

And finally, let me thank Bas van Leeuwen, PhD-candidate at the IISG in Amsterdam for his valuable remarks and suggestions concerning my thesis, and most importantly, for his friendship.

I.
Introduction and the focus of research

1.1 Introduction

Regional Economic Integrations (REIs) became increasingly popular after the Second World War. The memories of the war were vivid enough to inspire European nations to achieve, within a decade, what had seemed to be no more than a dream of a few idealists for centuries beforehand. Now, after five decades, we understand that idealism was just a very small part of the story. Initially, it was not quite clear whether Regional Economic Integration was a step toward the liberalized world trade strongly supported by the USA, or just another form of protectionism. This debate returns every time when the interests of the European Union seem to conflict with the non-discriminatory regulations of the WTO (previously the GATT). Nevertheless, following the example of Europe, several countries chose a similar way and the 1960s and 1970s saw an increasing number of Regional Economic Integrations through the World.

The Netherlands, by all means, can be considered as a foregoer of economic integration. In the interwar period, when European foreign trade regimes were strongly protectionist, the Netherlands had one of the most liberal foreign trade policies of the continent. In 1948, the Benelux was the first modern customs union in Europe, and was later considered as a promising precedent for the European Economic Community. Still even if the reasons for the creation of REIs are based on theories concerning the welfare effects and the hoped efficiency gains outlined by among others Jacob Viner (1950), the failure of the Benelux draws the attention to the importance of political and social factors. When the Benelux treaty came into power in 1948, all customs duties on intra-Benelux trade were abolished immediately. As a result of efficiency differences of the producers, the Dutch exports to Belgium increased sharply, and some Flemish industries suffered losses to such an extent that significant restrictions on Dutch exports were introduced in 1953 (van Zanden, 1997). Even if what happened is completely in accordance with the theoretical expectations, and probably would have led to a better allocation of resources in the long-run, the Benelux's fate is a good example for a major shortcoming of the classical Customs Union theory. Namely, it does not take account of the time-preference of the consumers[1], and completely ignores the preferences of politicians, which might be very different from a simple long-run maximization of aggregate income.

Probably this is one reason why the public opinion has turned against further extensions or deepening of the European integration recently, and Euro-skepticism seemed to have gained popularity in the last decade. Indeed, immediate negative effects paired with fears of losing national identity and political independence are always easier to perceive than long-run benefits. Furthermore, forecasting or measuring the impact of economic

[1] That is how much immediate loss they are willing to take in hope of future gains.

integration is a very challenging task, the results of which are not always easily interpretable and accessible by the public. What is more, there seems to be a methodological trade-off between simplicity and the ability to answer the "sensitive" questions regarding welfare impacts. Methods which yield simply interpretable results, such as regression analysis, are mostly not capable to estimate the welfare gains directly, while sticking to the terminology of the Vinerian Theory requires one to make strong assumptions. This trade-off is present in this thesis as well: similarly to the bulk of recent literature, I choose not to think in terms of Vinerian effects, but rather opt for easily interpretable regression methods. It is possible however to use these results to draw conclusions about some long-run welfare impacts of the European Union on the Netherlands.

It is important to bear in mind, however, that the European integration process has a very deep influence on all areas of society, and therefore a purely economic analysis cannot be an adequate tool to decide whether European integration is beneficial or not. If one takes account with the most apparent political effects only, such as political stability in previously unstable regions (Southern Europe), and the longest period of peace in European History, the balance can only be positive.

1.2. Motivation and research questions

The main objective and motivation of this thesis is to provide the reader with an analysis focusing on the impact of the European integration on the Netherlands only. Even though it is not a new idea to analyze the impacts of economic integration from the perspective of a single country, the most influential works so far have rather been interested in how integration affects a group of countries or the EU as a whole. A multi-country analysis undoubtedly has its advantages; still the single-country perspective enables me to be more direct, and probably more accurate in answering the main question of the thesis: did the European integration have a significant impact on the Dutch economy? This approach makes it possible to introduce Dutch-specific regressors into the model, which increases its accuracy.

This thesis has a minor and two major areas of research in its focus. The minor problem is addressed first, that is the old-standing debate on the possible growth effects of foreign trade or external openness. An extended empirical literature seems to indicate that countries that are more open, experience higher economic growth as well. It is debated however whether trade has just a temporary impact or can affect economic growth in the long-run as well. As the EEC is most likely to increase the openness of the Dutch economy, it is necessary to check whether this hypothesis applies for the Netherlands as well. Even if dynamic effects of integration are difficult to measure, the results about the relationship between openness and economic growth can be used to comprehend the magnitude and direction of them.

My next research focus is foreign trade. The static theory of Customs Union predicts a positive shift in trade with other members, even at the expense of outsiders. I test this hypothesis for the Netherlands in the 1961-2000 period, with special attention to the impact of European Economic Community (EEC) and the Economic and Monetary Union (EMU). The single-country perspective I apply through this thesis makes it possible to explore the

impact of integration on exports and imports separately, which seems necessary since I hypothesize that imports and exports are affected differently by trade liberalization.

The second and final major focus is on Foreign Direct Investments (FDI). The theoretical expectations about the possible reaction of FDI to economic integration are not as established as in case of foreign trade. Therefore I apply a somewhat ad-hoc empirical model to explore whether European integration had an impact on the Dutch in- and outward FDI in the 1984-2002 period. Also I address the relationship between foreign trade and FDI (substitution or complementarity), which is indicative of the motives behind investments.

1.3 The methodological aspects

This thesis, as its title suggests, is fundamentally quantitative, that is I apply econometric methods (regressions) to find answer to my research questions. In Chapter 2, which is devoted to the Vinerian Customs Union Theory and the previous works on measuring the impacts of regional economic integrations, I review some studies (Verdoorn, 1954; Balassa, 1975) that are much more analytical in nature than mine and are built on very explicit assumptions concerning the possible reactions to integration. This approach lost much of its popularity in the 1970's in favor of regression analyses utilizing some form of the gravity equations, which have become predominant by the 1990's. Following the majority of recent literature I will apply this econometric approach even though this requires leaving the traditional Vinerian categories. The estimations may be indicative of how much higher the trade or the investment activities with member countries become as a result of integration, but identifying and separating the components of this integration effects into the Vinerian categories (trade creation and trade diversion) is not possible.

Even if the application of regression techniques on large historical datasets is common in empirical literature, I am not aware of any other work in this field that used a dataset including 63 countries through 40 years to analyze the long-run impacts of economic integration on a single country.

As I pointed out in the previous sub-section, using a single-country perspective offers great possibilities but also requires some reconsideration of the traditional gravity model. Also in most of the empirical literature gravity models are estimated as static panels, even when there are strong indications that trade and foreign investments are fundamentally dynamic processes. Therefore I estimate both static and dynamic panel models, and argue that the results from the former one are biased because of misspecification. This approach has important consequences for the results as well: a lot of variables, which are traditionally found statistically significant in static panel models, do not remain significant any more. Since there is no reason to believe that this finding applies to my thesis only, it may be advisable to be more critical regarding results from static gravity models in general.

1.4 The structure of the thesis

In Chapter 2, I provide the reader with a brief introduction to the traditional Vinerian theory of Regional Economic Integrations, followed by a review of some important em-

pirical works that dealt with the measurement of the impact of economic integrations. Of course this part is far from being a comprehensive review of the literature, but it is important to collect and present some of the most typical methodological approaches and their findings about the magnitude of the impact of economic integration on trade.

Chapter 3 starts with a historical overview of the development of Dutch foreign trade in the 20th century. Here I address three aspects of foreign trade: the weight of the Netherlands in world trade, its openness and the geographical composition of the Dutch foreign trade, with a special attention to Europe. In the final section of Chapter 3, I address the first research problem of the thesis, the relationship between economic growth and external openness with the application of a Granger causality test based on a Vector Autoregression (VAR) approach.

Chapter 4 focuses on the theoretical background and the application of gravity models. I review the generalized gravity model of Jeffrey Bergstrand in detail and pay special attention to some practical problems concerning the estimation of gravity models and the consequences of the single-country perspective (an asymmetric gravity model) applied in this thesis.

Chapter 5 deals with my first major research focus: the quantitative analysis of Dutch foreign trade. Here, I apply and test two extensions to the classical gravity model. First, I estimate both a static and a dynamic panel model and argue that the results from the second one should be preferred. Secondly, I also lift the implicit restriction adopted by most empirical works that the impact of integration is constant over time.

Chapter 6 is again of theoretical nature as it introduces some theoretical concepts regarding Foreign Direct Investments and reviews Markusen's Knowledge-Capital model in detail. In this chapter, I attempt to collect all theoretical considerations and indications of previous empirical works that are important to build the empirical FDI model applied in the next chapter.

Chapter 7 focuses on the second major question of this thesis, the impact of the integration on FDI activities, through the estimation of two empirical models. The first one is a panel data based Granger-test applied to decide whether foreign trade and FDI are complements or substitutes. The second model estimates the stock of the in- and outward FDI based on some exogenous variables identified in Chapter 6 and tests the hypothesis that the European economic integration significantly affected the volume of investments.

In Chapter 8, I summarize my findings and draw some final conclusions regarding the research questions.

Finally, at the end of the thesis I review the data and its sources used through the thesis in an Appendix, which hopefully may prove useful for further empirical research.

II.
Measurement of the impacts of Regional Economic Integrations

2.1 Introduction

This chapter aims to provide the reader with a brief introduction into the classical Customs Union theory, and to review some of the most influential studies that attempted to measure the economic impact of Regional Economic Integrations (REI). This chapter is however not meant to provide the reader with a comprehensive survey of integration theory and the empirical literature. What I intend to achieve in this chapter is to illustrate the variety of different methodological approaches that characterizes this field of empirical research. For detailed monographs on theory and empirical methods the reader may wish to consult, among others, Pelkmans (2001) or El-Agraa (1999). Chapter 2 follows the following structure:

Section 2.2 deals with the definition and stages of Regional Economic Integration according to the classical definitions of Balassa (1962), while Section 2.3 introduces the basic concepts of the Vinerian Customs Union theory. Section 2.4 focuses on the earliest (pre-integration) attempts to measure the future impacts of economic integration. This is followed by Section 2.5 which offers a review of the first generation of empirical assessments of the European integration in the 1970's. Section 2.6 concentrates on the results and methodology of the Common Market studies, and Section 2.7 surveys some of the numerous empirical studies on the impacts of the Economic and Monetary Union. Finally, Section 2.8 is devoted to the most recent measurement attempts that preceded the Eastern enlargement of the European Union in May 2004.

2.2 The definition and stages of economic integration

The first question to answer is what Regional Economic Integration means. Although Regional Economic Integration (REI) is usually referred to as "integration", one must be aware that integration is a very wide social, political and economic notion. Although the theoretical background of Regional Economic Integration did not appear until the late 1940's, it is a common phenomenon in Europe's history (for example the unification process of Italy and Germany in the second half of the 19th century). As a result, when defining REI, one must choose between universality and accuracy. If the definition is accurate, it will lose universality and *vica versa*.

Definition:
Regional Economic Integration occurs when at least two independent countries, on their free will, decide to cooperate in order to liberalize their economic relationship.[1]

[1] Pelkmans (2000) uses a very similar definition: *"Economic integration is defined as the elimination of economic frontiers between two or more economies."* I slightly modified this approach in order to distinguish between REI's as we know them now and the numerous other types of integration in the past.

This is a very general definition, which excludes only the coerced economic integrations. In the following, I will gradually narrow the definition, which leads to the definitions of the different stages of economic integration.

The most common form of economic integration is the liberalization of foreign trade among the participating countries.

Definition:
The stage of REI, when the participants introduce tariff reductions or completely remove tariffs on each other's goods without any further regulation is called ***FREE TRADE AREA (FTA)***.

In practice, pure FTAs are difficult to find, since these treaties always go further then pure trade liberalization. As recent example of FTAs, among others, one may mention the CEFTA, the free trade area agreement of Central-European countries established Free Trade Areas established in 1993 or the free trade treaty between the ASEAN[2] and the People's Republic of China signed in 2001. It is, however, much more typical that the member countries create and apply some regulations regarding their foreign trade policy. [3] The Customs Union steps further than the FTA by introducing Common External Tariffs (CET).

Definition:
A ***CUSTOMS UNION (C/U)*** is a Free Trade Area with an additional harmonization of external tariffs. A Common External Tariff (CET) is introduced.

It is much easier to find examples of Customs Unions. As I mentioned in Chapter 1, the Benelux Treaty is a classical example of a Customs Union, which established free trade within the Benelux immediately after its came into power in 1948. The Treaty of Rome signed in 1957, also created a Customs Union, but this time with a gradual tariff reduction policy. The liberalization process took ten years to complete. One can argue thus that the Netherlands achieved this stage of economic integration with other five other European countries by 1968. As the Common External Tariff was defined as a weighted average of the members' pre-integration tariffs, the Netherlands saw an increase in some of her import duties levied on goods from outsiders.

The major limitation of the Customs Union is that it covers only the market of goods. The stage of integration which enables a more efficient allocation of the factors of production (capital and labor) is called the Common Market.

Definition:
A ***COMMON MARKET (CM)*** is a Customs Union with a liberalization of the markets of capital and labor.

[2] Association of South East Asian Nations
[3] As Curzon Price (1974) points out, the Stockholm Treaty of 1960 that created the EFTA establishes a slight common management, and as a result the EFTA is more than a simple FTA.

The Treaty of Rome does not explicitly define a common market, even though some freedom of the movement of capital and labor was seen as a necessary condition. Still the Common Market is a purely theoretical concept. In practice the liberalizations of the movement of factors of production also involves the establishment of common institutions and some degree of harmonization. This is however, in the original 1962 version of his classification, seen by Balassa as a more evolved form, the Single Market.

Definition:
The ***SINGLE MARKET (SM)*** or "Economic Union", as originally called by Balassa, is a Common Market with a harmonization of the member's national policies in order to foster the market integration.

In 1986 the 12 members of the European Economic Community signed the Single European Act, which aimed to achieve the free movement of goods, services, labor and capital by 1 January 1993. Therefore the Netherlands achieved the Single Market stage of integration by 1993.

The creation of a Single Market means an important step from an institutional perspective as well. The SM is the first stage of regional economic integration where the establishment of common institutions becomes necessary. On this ground Tinbergen (1965) distinguishes negative integration (all stages under Single Market) from positive integration (stages when common institutions are inevitable).

The next step, and the final stage of integration in Balassa's classification is the total economic integration. This requires the harmonization of monetary, fiscal and counter-cyclical policies, and the creation of a supranational authority.

Definition:
If the members of a REI harmonize their monetary, fiscal, social and counter-cyclical policy and establish a common supranational authority, the stage of ***TOTAL ECONOMIC INTEGRATION*** is reached

The Maastricht Treaty that came into power in 1992, set the goal of establishing a monetary union for the EC members. The euro was introduced in 1999, and completely replaced the national currencies in 12 countries on 1 January 2002. Therefore one can argue that the Netherlands and the euro-zone achieved the stage of Monetary Union by 2002. Also the Europan Central Bank indeed functions as a supra-national institution. Still as the complete harmonization of national economic and social policies is not completed, the EMU is less than what the definition of total economic integration implies.

2.3 The impacts of economic integration

2.3.1 The static effects of economic integration

The classical theory of Customs Union, pioneered by Viner (1950), and refined by Meade (1955) and Lipsey (1957) focuses on the welfare effects of a Customs Union.

Their approach is mainly concerned about the changes in production and consumption as a result of trade liberalization and the introduction of common external tariffs. The Vinerian theory may be seen as an extension of the classical free trade theory, with a focus on possible welfare effects. The impacts identified by Viner are also referred to as static effects, because they are built on the assumption that the demand and supply functions do not change. I briefly review these effects in the followings.

The liberalization of intra-block trade through tariff reductions decreases the price of the imports from other C/U members. If the partner countries' producers are more effective on average than those of the home country, the new price in the domestic market will be lower than in the pre-integration period. As a result, consumption and imports rise, while the less efficient domestic producers cease production. This effect is called *internal trade creation*.

Internal Trade Creation: the substitution of cheaper imports from the partner country for expensive domestic production (trade destruction is the opposite).

The introduction of the common external tariffs may affect the imports from outsiders. If the new tariffs are higher than in the pre-integration period, the price of imports from outsiders may rise to such an extent that they are replaced by imports from other C/U members. In other words, the discriminatory common external tariffs may foster relatively inefficient production within the C/U at the expense of outsiders. This effect is known as *trade diversion*.

Trade Diversion: the replacement of originally cheaper initial imports from outsiders by less cheap (i.e. less effectively produced) imports from partners.

Another option is also possible. If the pre-integration tariffs are higher than the common tariffs, some non-C/U producers' goods can find their way to the domestic market even at the expense of domestic production. This effect is called *external trade creation*. If the new common tariffs are higher than the pre-integration tariffs, however, and the imports from outsiders are replaced by domestic production, which is an *external trade destruction*.

External Trade Creation: the replacement of expensive domestic production by cheaper imports from outsiders due to reductions in the Common External Tariff rates. (External Trade Destruction is the opposite.)

The last static trade effect is a clear consequence of the trade creation and trade diversion taking place in the Customs Union. Namely, since the demand for intra-C/U imports increases, the share of C/U members may increase at the expense of outsiders in the exports. This effect is known as *supply-side diversion*.

Supply-Side Diversion: the replacement of exports to outsiders by exports to partners.

2.3.2 The dynamic effects of economic integration

The dynamic effects are the consequences of the adaptation of the economy to the new situation. Balassa (1961) identifies several dynamic effects, such as economies of scale, faster innovation process, increased competition (also known as the *"cold shower"* effect). All these effects may contribute to an increase in the economic growth.

One may argue that the dynamic effects restructure the economy and thereby indirectly affect economic growth. Even though the possibility of growth effects were known in the 1960's, the first empirical works in this field appeared in the 1990's inspired by the New Growth Theory. The literature on endogenous growth like Romer (1986, 1992) and Rebelo (1991) emphasizes the importance of technology in the production process, and consequently makes trade liberalization and openness a very promising candidate for explaining the differences in growth rates.

As Badinger (2001) notes, a distinction must be made between permanent growth effects that affects the long-run growth rate of the economy, and the temporary growth effects or level effects, which cause an increase in aggregate output but leaves the growth path unaffected.

In this dissertation, I pay relatively little attention to the growth effects of economic integration and address the relation between economic growth and trade openness only briefly in Chapter 3. The main reason for my choice is that the growth effects are very difficult to measure and the different available methodological approaches are all strongly debated, similarly to the whole empirical literature on economic growth. As such, the empirical results on the possible growth effects of integration are controversial: Landau (1995) finds no growth effect at all, while Henrekson et al. (1997) argue that economic integration increases the rate of growth. Most empirical results, however, seem to confirm the existence of level (temporary) effects, but reject permanent growth effects (Jones 1995, Vanhoudt 1999, Badinger 2001).

2.4 Ex-ante analyses of the impacts of economic integration

Verdoorn's study (1954) is the earliest assessment of the future effects of European economic integration. Verdoorn departs from the assumption that consumers choose from a range of similar, imported products on the basis of the prices of these competing goods. More precisely, he assumes a relationship between the demand for a good and the deviation of its price from the average. As for the choice between domestic and imported goods, he argues that it is also governed by the price-ratio of domestically produced and imported goods. Verdoorn does not try to estimate this function but rather accepts the findings of previous works on the price elasticities of finished and semi-finished commodities. He applies these elasticities to calculate what would have happened if liberalization had taken place in 10 countries of Europe and a Common External Tariff (CET) had been applied (a Customs Union).

As for intra-block trade, he calculates a total of 993 million USD increase, in 1952 prices (see Table in Verdoorn, 1954: 491), 60% of which is caused by trade diversion from outside trade partners. As for the Netherlands, he estimates a 141 million USD

increase in intra-block exports and a 47 million USD growth of the intra-block imports. Since he finds that trade diversion is larger than trade creation, he forecasts a general improvement of the balance of payments within the block at the expense of the outsiders. He also calculates the impact under exchange rate corrections: in this case the total volume of intra-block trade increases by 750 million USD, in 1952 prices. It is important to remark that according to Verdoorn's calculations, the net changes in the Dutch current account are negative, since the increase in imports (56 millions USD) exceeds the exports (15 millions USD). Verdoorn's study implicitly shows that large countries might react differently to liberalization than smaller ones: exchange rate corrections cause the positive initial current account balance of smaller members to become negative, while strongly improve the position of the larger economies. In short, Verdoorn states that the short-term effects of the creation of a Customs Union in Western Europe can be advantageous for all participants but does not exclude the possibility of long-term disadvantages for some participants.

Unlike Verdoorn, the Economist Intelligence Unit (1957), further EIU, concentrates on the UK alone and assesses the impacts of a Regional Economic Integration in Western Europe on this single country. They analyze two alternatives: the first scenario assumes that the participating countries achieve a C/U by 1970, while the second one assumes the creation of an FTA. The EIU's work surpasses Verdoorn's study inasmuch as they estimate the some economic and social indicators, such as GNP and population, of the participant countries instead of accepting previously determined values. As a result of their single-country approach, the EIU focuses on determining the industries that are expected to gain from European economic integration. The EIU's approach was later refined by Johnson (1958 and 1962).

Among the shortcomings of these early studies, I point now only at the most important one, the modeling of the *anti-monde* by extrapolating the trends of the pre-integration period. Even if there had been a "representative period" in Europe's history, which could have been taken as a control period, it seems certain that it was not the 1950s. Still, these studies are very important from a methodological perspective since they set a standard for the empirical work on this field in the next two decades.

2.5 Ex-post analyses of the 1970s and 1980s

Balassa's (1967 and 1975) analyses on the economic impacts of integration is considered methodologically superior to the ex-ante studies in the previous section, but show strong resemblance with them. Balassa proposes a comparison of the ex-post income elasticities of import demand in the pre-integration period (1953-59) and the post-integration period (1959-65), which is extended to 1970 in his later work (Balassa, 1975).

Balassa defines ex-post income elasticities of import demand as the annual rate of change of imports divided by the annual rate of change of GNP. Balassa assumes that the increase in the income elasticity of intra-block trade indicates a gross trade creation, while the decrease of the income elasticity of extra-block trade (i.e. trade between the EEC and the outsiders) implies trade diversion. Balassa argues that in the first decade of integration only trade creation took place, which was the most significant in manufac-

tured products. He also finds an external trade creation that is an increase in imports of machinery from outsiders, which he explains by an investment boom. Balassa's approach is criticized by Winters (1984, 1987) who doubts whether economic integration should necessary increase the sensitivity of imports to changes in GNP (as Balassa assumes). He argues that a simple shift in the level of imports is also possible in which case Balassa's method does not work.

Kreinin (1972) remains very close to the classical Vinerian theory in his analysis of the effects of integration on the imports of manufactures. He identifies trade creation as an increase in the share of imported goods in the total consumption, and trade diversion as a decrease in the share of imports form outsiders to the total consumption. The most important problem with this approach is that there is no reason to believe that these shares would not have changed in the absence of integration. Kreinin seeks to eliminate this problem by modeling the *anti-monde* based on industrial countries outside the EEC. He assumes that the share of imported goods in total consumption would have followed the same trend in Europe as in the USA if no integration had taken place. In fact thus Kreinin extrapolates the trends observed for the USA to the *anti-monde* Western Europe and attributes all observed deviations from this trend to the trade impacts of the EEC. Kreinin's approach can be looked upon as an attempt to find a better solution to model the *anti-monde* than a simple extrapolation of trends in the past. Yet, the shortcomings of his method are obvious: there is no theoretical explanation why the trends of consumption and imports in the USA should follow a "general pattern" applicable to Europe independently of whether there is an integration or not. What is more, one has good reason to argue that in the absence of integration Europe would be more different from the USA as it actually is, since small economies are likely to develop and behave very differently than a country with a large internal market. In short, one may argue that the economic trends of the USA are much more similar to the trends of the integrated Europe than the *anti-monde*. Another important argument is that even if the impact of the EEC is very likely to be marginal on the USA in this period (the 1960's), there is no reason to treat this effect as completely negligible. The USA was probably affected by the EEC and therefore there is another reason to challenge its use as an *anti-monde* model. Kreinin's findings are very similar to those of the other studies: he finds trade creation being much larger than trade diversion, i.e. the welfare balance of integration for Europe seems to be positive.

Tinbergen (1962), Pöyhönen (1963), Pulliainen (1963) and Linnemann (1966) are often referred to as the pioneers of applying gravity-equitation to analyze international trade patterns. Aitken (1973) uses a cross-section gravity model to estimate the value of bilateral trade in Europe between 1951 and 1967 that is he estimates his model for each year. He then compares the coefficients in order to find out if the effect of integration changes over time. Aitken applies a binary variable (dummy) to capture the effect of membership in the EEC. He finds that 1960 is the last year when the EEC coefficient is insignificant at level 10% but it is 1958 when the integration effects are completely insignificant. In order to simulate the trade flows in absence of integration, Aitken uses the parameters of the equation for 1958 to estimate the trade for the *anti-monde* for the whole period. The difference between the actual and the projected values, he argues, indicates a gross trade creation. For the Netherlands, Aitken calculates the gross trade creation resulting from

the EEC at 979 million USD in 1967 and the trade diversion due to EFTA at 412 million USD. Aitken's approach means a departure from the Vinerian categories, as it does not enable the researcher to identify all the classical trade effects, only just a gross trade creation and trade diversion, but even these are based on very strong, sometimes ad-hoc assumptions.[4]

Winters (1984) applies Deaton and Muellbauer's (1980) "Almost Ideal Demand System (AIDS)" to model the import demand of Britain. In the followings, I reproduce El-Agraa's (1999) explanation of Winter's methodology.

The AIDS assumes tha the demand for imports follows the relationship:

$$w_{it} = \alpha_i + \sum_j \gamma_{ij} \log p_{jt} - \beta_i \log(E_t / P_t^*) + u_{it} \qquad (2.1)$$
$$i = 1, ..., N$$

where w_i is country i's share of the total domestic expenditure (E_t), t is a time index, p_{jt} is the price of manufactures from country j, P_t^* is the average price of the alternative suppliers, and u_{it} denotes the error-term. The AIDS, when used to measure REI effects, shows a very strong resemblance to the basic idea behind Verdoorn (1954), inasmuch as the basis of the model is the relative change of prices. Equation 2.1 suggests that the share of a supplier in domestic consumption depends on the ratio between the price of his/her product and the average price of all suppliers.

Winters estimates equation (2.1) for the UK imports from 1952 to 1979, and uses dummy variables to capture the EC effect. Winter's analysis is a successful attempt to step forward inasmuch as it approaches the problem from the side of domestic sales and incorporates the effects of production in his empirical framework (El-Agraa, 1999: 264). On the other hand, the supply-side effects are absent from his method, which can be seen as a drawback.

2.6 Ex-ante studies on the Single Market

After the White Paper on the Single Market had been completed in June 1985[5], the studies on estimating the impacts of the economic integration seemed to have been given a new impetus. The Cecchini Report (Cecchini, 1988) applies a new approach compared to the previous works. Instead of modeling a counterfactual situation, the Cecchini Report estimates what would have happened if the Single Market had existed, and compares these projections with the observed data. In other words, what the Cecchini Report explicitly

[4] Bikker (1987) remarks that the gravity models are not capable of measuring the decline in trade with outsiders resulting from trade diversion. He proposes, therefore an extended gravity model, estimated with an iterative process which is capable of capturing the substitution between different flows.

[5] Comission of the European Communities: Completing the Internal Market. White Paper from the Comission to the European Council (Milan, 28 and 29 June 1985). Office for Official Publications of the European Communities, Luxembourg 1985.

estimates is not the gains from creating the Single Market, but rather the welfare losses resulting from not creating it. The Report estimates the medium term effect of completing the internal market being between 3.2 and 5.7 % of the real GDP of the EC.

Baldwin (1989) criticizes Cecchini on his handling of economic growth. Namely, the Cecchini Report assumes no significant change in the long-run growth rate, even though (as I illustrated in Section 2.3.2), New Growth Theory enables the possibility of permanent growth effects. Let us follow Baldwin's reasoning in detail:

First, Baldwin argues that increasing output is likely to result in higher savings. Higher savings lead to an increase of investments which induces a further growth of output. What Baldwin finds missing from Cecchini's work is the endogeneity of the process: an initial upward shift of output may affect growth rate. Even if this increase is not permanent, as neoclassical growth theory suggests, the Cecchini Report does not take it into account.

Secondly, Baldwin also calculates with the possibility of endogenous growth (Romer, 1986), and estimates the impact of a permanent positive impact on the growth rates. Baldwin finds that in the first case the estimations of Checcini should be raised to 3.5-9% of the real GDP, while in the second case, with a permanent increase in growth rates, this number can be as high as 9-29 % of the real GDP. The empirical observations do not confirm Baldwin's expectations, and there is still no decisive evidence on a permanent effect on the rate of growth resulting form economic integration. As such, Baldwin's critique was just partly justified.

2.7 Studies on the impact of Economic and Monetary Union (EMU) on foreign trade

The bulk of empirical literature agrees on the importance of exchange rate regimes in explaining international trade. First, relative real exchange rates have a direct impact on the competitive position of countries. Secondly, the volatility of exchange rates means an important risk factor that is taken account with in the decisions of firms (see for example Clark, 1973; Baron, 1976; Hooper and Kohlhagen, 1978; or Cote, 1994 for theoretical explanations). It is not obvious however how important the exchange rate is in comparison with other determinants of foreign trade: namely, there are effective techniques to minimize exchange rate risks.

Brada and Méndez (1988) find that exchange rate volatility has a significant impact on trade, but the coefficient has a "wrong" sign, that is positive.[6] Bélanger et al. (1992) analyse the sectoral imports of the US from Canada, and find the impact of exchange rate volatility statistically insignificant. Frankel and Wei (1993), on the other hand, come to the conclusion that the impact is negative and statistically significant but quite low.

Yet, one should not draw conclusions from these findings regarding the possible impact of currency unions. As de Nardis and Vicarelli (2003) note, the problem of currency unions cannot be handled by the same approach as exchange rate volatility. They argue that the elimination of the uncertainty is just a small part of the total impact of currency

[6] Kumar (1992) argues that exchange rate volatility may decrease the volume of foreign trade, but may at the same time increase intra-industry trade. This may be an explanation for the result of Brada and Méndez.

union, which could be achieved by a fixed exchange regime as well. It is much more important that currency unions make prices directly comparable, and thereby boost the transparency of the common market.

Rose's (2000) frequently cited empirical study is extraordinary in two aspects. First, it uses a cross-section sample of 186 countries, secondly, his estimates seem to indicate that countries sharing the same currency tend to trade three times more than the others. The finding of such a tremendously large coefficient set off a debate.

The first source of criticism, partly from the author himself, arises from the fact that the sample of Rose contains a lot of developing countries that are very different from the EU members. As a result, these findings are hardly applicable to the trade flows between developed countries (Lockwood, 2000). Another important problem of Rose's approach is that he uses a cross-section of countries, which is applicable only to measure the spatial aspect of currency unions' impact on trade, that is the differences among countries, but tells nothing about the more important part of the story: the change in the volume of foreign trade before and after the creation of a common currency area. Further, one may note that a cross-section analysis is unable to capture the impact of the omitted country specific effects and leads to biased parameter estimates.

In reply to the critics, Glick and Rose (2002) apply a fixed-effect panel analysis on a database with a large time dimension (dating back to 1948). This approach reduces the original estimate by about one-third, but even this coefficient is quite high. It must be noted however that their within-group estimates are much lower than the coefficients obtained from a between-group estimation. The former estimation method focuses on the time-series aspect of panel data, and therefore it is a clear indication that the high original coefficient is caused mostly by the cross-country differences.

Bun and Klaassen (2002b) apply a fixed-effect dynamic panel specification in order to look for the possible impact of the EMU on exports. Their dataset consists of 17 countries and 37 years (1965-2001). They find that the exchange rate volatility is in most cases insignificant, but the *EMU* dummy yields significant coefficients. The authors estimate the impact of the Monetary Union on intra-EU exports at 3.9% in 1999, 6.9% in 2000 and 9.6% in 2001. They also argues that the long-run impact is expected to be 37.8%, which is quite high.

In their recent study, de Nardis and Vicarelli (2003) also apply a dynamic panel analysis in order to estimate the impact of the EMU on the EU countries. Their data consists of observations for 30 countries (11 euro zone countries, and 19 important trade partners) in the period 1980-2000. While the euro was introduced from 1 January 1999 only, they assume that the monetary effects are already present from 1998. Their estimation suggests that the adoption of a common currency leads to a slight, 6.3 percent increase of the foreign trade in the short-run, which is similar to the estimates of Bun and Klaassen (2002b).

2.8 Ex-ante studies on the effects of Eastern enlargement in 2004

The Eastern Enlargement of the European Union differed in several respects from the previous enlargements. First, the number of candidates was very high, secondly their

average level of development expressed in term of GDP per capita was well below the EU average. As a result, concerns grew rapidly regarding the effects of the Eastern enlargement on EU members and the public opinion proved to be especially sensitive toward the expected impacts on the labor market and the redirection of EU funds toward the new members. As a result, the majority of the analyses about the effects of the enlargement focused on the immediate and mid-term costs and less attention was devoted on the estimation of benefits.

From methodological perspective, the development that has taken place since the Single Market studies is apparent. The first important change is that the effects of the enlargement were analyzed not exclusively from the perspective of the EU as a block, but several assessments chose a single-country perspective, especially for Germany (Keuschnigg et al, 2001) and Austria (Breuss and Schebek, 1996, 1999; Keuschnigg and Kohler 2002).

There is a development in the theoretical and empirical approach as well. The most influential works on this field apply either a Computable General Equilibrium (CGE) or a macroeconomic model in order to simulate the impacts of enlargement. The CGE modeling is adopted by Brown et al (1997), Baldwin et al. (1997), and the above-mentioned studies of Breuss and Schebek (1999), and Keuschnigg and Kohler (2001, 2002). Breuss (1999, 2001) applies a macro model, while Lejour et al. (2004) combine a CGE model with a gravity equation. The common characteristic of these models is their high degree of complexity. In the followings I will rely on Breuss (1999) who surveys some of these CGE models and the results of their simulations. He identifies three shortcomings of the CGE models: they rely on the observations for a single year as benchmark, they assume full employment and he also mentions the weak dynamic specification of the models. On the other hand, CGE models are capable to capture more aspects of modern trade theory: monopolistic competition, product variety, economies of scale and the accumulation of capital. Furthermore, it is also possible to analyze the interaction between different sectors. The macro-models offer opportunity to look at the development of GDP, employment and trade simultaneously.

The problem of the *anti-monde* is solved by an indirect way: the CGE models are first calibrated on the observations of the benchmark year (pre-enlargement situation). In order to estimate the impact of trade liberalization, for example, the *ad-valorem* tariff equivalent of tariff and non-tariff trade barriers in the original model are reduced and the calculated counterfactual equilibrium (after enlargement situation) is compared with the benchmark equilibrium.

Brown et al. (1997) apply the University of Michigan CGE Model with the reference year 1992. They assume full employment at the aggregate level, and concentrates on the allocation of employment across sectors. The authors identify two integration effects: the trade cost reduction resulting from the elimination of tariffs and the non-tariff barriers, and the increasing product variety, which is closely related to the economies of scale. Their simulation indicates that the enlargement would cause a relatively high welfare improvement in the Central European countries (Hungary, Poland and the ex-Czechoslovakia) ranging from 5.6% to 7.3%, while the EU members would gain little (0.1-0.2%). They also argue that the returns to capital would decrease and the returns to labor would increase in the new members.

Baldwin et al. (1997) apply the GATT/WTO CGE Model, which covers nine world regions. This model allows for scale economies and imperfect competition. Again, 1992 is chosen as benchmark year. Their results are similar to that of Brown et al. (1997) in that respect that small countries and the Central European members benefit more from the enlargement than the EU. Also they attempt to distribute the gains among the member states. They estimate the average impact on the welfare at 0.2% in the EU15, and 1.5% for the new members.

Keuschnigg and Kohler (2002) use a dynamic general equilibrium model to estimate the impacts for Austria. They identify by far the most possible impacts of the enlargement: the terms of trade changes, lower resource use for international trade, intersectoral reallocation of resources through trade creation and trade diversion, pro-competitive effects, scale and variety effects, and finally the accumulation or growth effects. They estimate that the opening-up of Central Europe that is a reduction of the trade real trade costs from 10% to 5% would contribute to the Austrian GDP 0.5% in the long-run, while the ascension of Central-Europe to the EU would result in a 1.5% growth effect. Also they forecast an improvement of terms of trade for Austria. The balance is thus positive.

The macro-models appear to be more adequate tools to distribute the benefits among countries. Breusch and Schebek (1996, 1999) apply the WIFO macro model in order to analyze the impacts of the enlargement for Austria. The opening-up of Central Europe in their simulation would increase the Austrian GDP by 0.4% annually, while the enlargement causes an 0.1% increase in the GDP annually in the 2002-2010 period. Besides, their model predicts an increase in the Austrian employment.

Bruess (2001) applies the Oxford Economic Forecasting Model to assess the expected benefits from the enlargement for 13 EU members, 3 Central European countries and the rest of Eastern Europe. His estimates of the growth effects are close to those of the previous studies. For the EU members finds the cumulative per capita GDP growth effect around 0.5%, while for the three Central European countries he predicts a much higher improvement in welfare, between 4.18 and 8.18%. Interestingly, he expects a marginal increase of unemployment in the EU, while the employment grows in the new members.

Lejour at al. (2004) combines the Central Planning Bureau's WorldScan CGE model with gravity equations. These latter are used to calculate a tariff equivalent of the trade barriers in 16 sectors. These results suggest that the trade would increase by 34-249% as a result of the enlargement, but there are a number sectors that seems to be unaffected by the ascension to the EU, such as energy-intensive products, raw materials, metals, transport and communication and financial services. Their estimates indicate that the change in trade would be the highest for Hungary, followed by Poland. The estimated trade tariff equivalents of the non tariff barriers are used to abolish these from the CGE Model. The growth effects by 2020 are insignificant in the EU, but positive in the new members (4.3% in Poland and 1.9 in Hungary). The average growth effect for seven Central and Eastern European countries is estimated at 2.5%.

One may conclude that the results of the ex-ante studies on the Eastern Enlargement yield quite similar results: the impacts are little for the EU15, and significant for the new members, but the final balance is positive. It is remarkable that the differences in the results of different studies are much less than they were in the previous decades, which one may attribute to the similarity of the methods applied.

2.9 Conclusions

In this chapter I tried to illustrate the high variety of methodological approaches to the measurement of the impacts of European integration. From a methodological perspective, the empirical research in this field can be divided into three generations.

From the 1950s until the 1970s there is intent in the empirical studies to remain close to the concepts of the classical Vinerian theory of Customs Union. This first generation of empirical assessments applied very strong, sometimes ad-hoc assumptions about the *anti-monde* and the possible reactions of the member countries to the integration.

The second generation seems to turn away from the Vinerian concepts, not because of theoretical considerations, but rather because of the difficulty of identifying these effects. These studies are characterized by the application of regression techniques. A great disadvantage is that the impacts of integration manifest themselves in these studies as shifts in the volume of foreign trade (gross effects), but offers no detailed information about the composition of the gross effects. An important advantage is however that one needs relatively few *ex-ante* assumptions. My dissertation follows the methodological approach of the second generation.

Finally, the third generation utilizes the most sophisticated techniques of modelling and simulates the impacts. These studies are the results of team work rather than individual achievements, which is at least partly a consequence of their complexity. Also, the CGE approach has its own limitations: since one should choose a benchmark year for the calibration, this should not be very far from the year when the assumed policy changes take place, which narrows the possible time-scope of this method. The CGE modelling is a very sophisticated tool for predicting the effect of changes in policy, but for the needs of a long-run ex-post analysis, it does not suffice. This drawback of CGE modelling is the main reason for my preference for the regression analysis.

III.
An overview of the Dutch foreign trade after 1945 and the impact of openness on economic growth

3.1 Introduction

This chapter can be divided into two parts. The first one offers the reader a general and historical overview of the position of the Netherlands in the world economy (Section 3.2) and the geographical composition of the Dutch international trade (Section 3.3). The motivation behind this part of this chapter is to turn the attention toward the importance of the starting position of an economy when entering a Customs Union. If one seeks to formulate some ex-ante hypotheses about the impacts of integration on trade, observing the historical trends seems necessary.

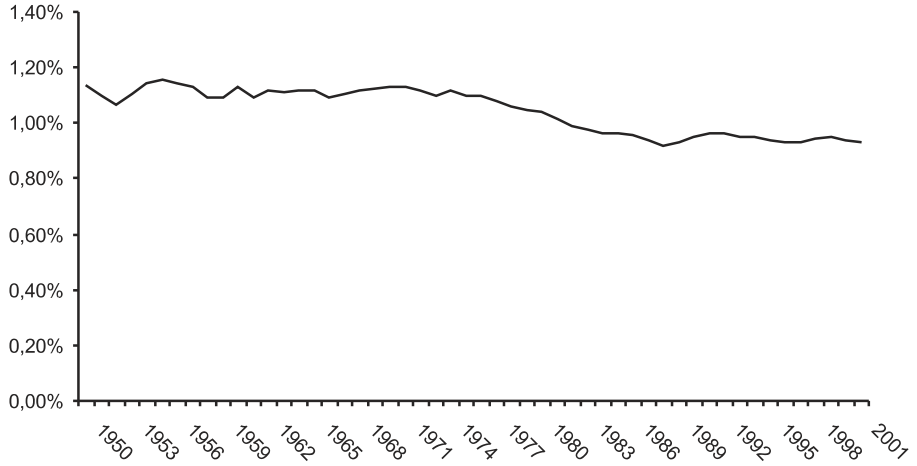
The second part is of different style, however related to the long-run structural changes of the Dutch economy. In Chapter 2 I addressed the difficulties of measuring the growth effects of integration and noted that this dissertation does not wish to estimate the growth effect of integration on the Netherlands. It is unavoidable, however, to at least offer some indications about the possibility and magnitude of these impacts. For this purpose I will apply a VAR based Granger test in Section 3.4. The results will be shortly summarized in Section 3.5.

3.2 The Dutch economy in the World

The Netherlands is traditionally seen as a small open economy, which, however, reminded of a large economy for a long time: a quite diversified economy and relatively large regional differences. This special feature of the Dutch economy is generally attributed to the fact that the Netherlands had colonies that were much larger in area and in population than the mother country and so the Dutch economy had to meet the demands from these colonies as well. The situation gradually changed on the course of the 20th century: the Netherlands turned from a "small large economy" to a "large small economy" (Van Zanden [1997]: 46-47), that is several traditional branches of the economy experienced a decay and the regional differences between the Randstad (the agglomeration of the four largest cities) and the surrounding provinces also started to vanish.

There are several ways to capture this process through macroeconomic data. If "economic weight" of the Netherlands, measured as its share in the World's total Gross Domestic Product, one finds that it marginally decreased in the last five decades, as shown in Figure 3.1.

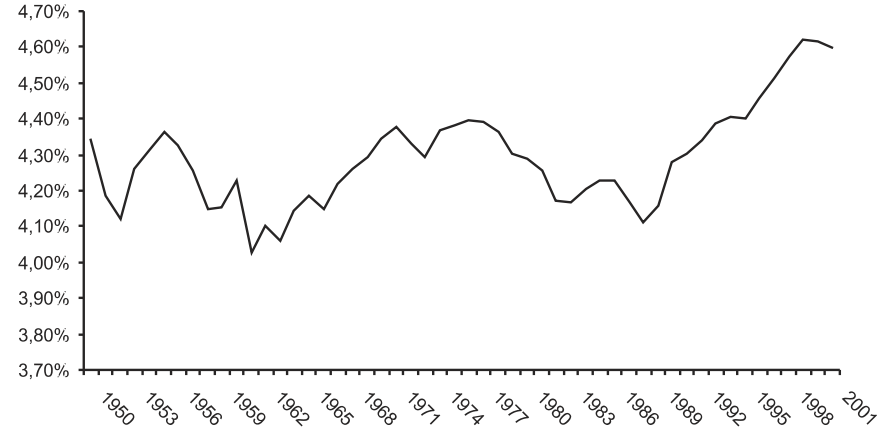
Figure 3.1
The Netherlands share in the World's GDP



Source: Maddison, Angus: The World Economy: Historical Statistics, 2003

This is not surprising at all, though, as the last five decades saw a very quick development of East-Asia, and the share of Europe in the World's GDP decreased as a whole as well. This requires reformulating our question: did the economic weight of the Netherlands decrease relatively to other European countries? If the Dutch GDP is compared to the total GDP of 29 European countries, one can observe a different trend:

Figure 3.2
The share of Dutch GDP in the total GDP of 29 European countries
(measured in constant prices, PPP)

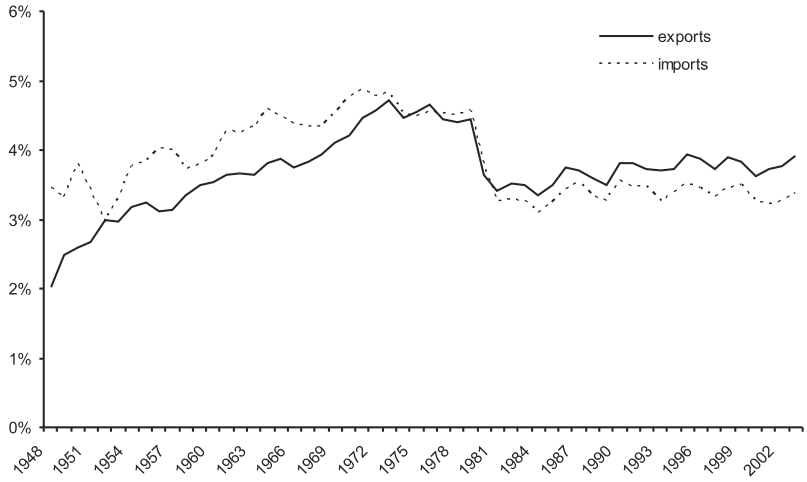


Source: Maddison, Angus: The World Economy: Historical Statistics, 2003

Figure 3.2 helps one to sketch a different picture of the development of the Dutch economy in the second half of the 20th century: not only was the Netherlands' economic importance preserved, it increased quite significantly, especially during the 1990s (which is generally attributed to the moderate wage policy[1]). The pattern on Figure 3.2 tells that the Dutch GDP grew at a higher pace in the 1960s (the Golden Age of post-war economic growth) and the 1990s than the European average.

Another way to draw conclusions about the Netherlands' position is to observe how the Netherlands' share in World's total merchandises trade changed in the last fifty years.

Figure 3.3
The Netherlands share in World's trade, 1948-2003 (in current prices)



Source: World Trade Organization on-line database

Figure 3.3 reveals that until the turn of the 1970s and the 1980s the share of the Netherlands in total world trade gradually increased, than abruptly decreased and remained stable around 3.5-3.8% in the last twenty years. This decrease in the share of the Netherlands in total World trade can be attributed to at least two factors. Firstly, the whole period is characterized by the growing importance of Asia, especially Japan, Taiwan and South Korea. These countries became important exporters of industrial products and electronic components and commanded an increasing share of World trade. Secondly, the years 1979-1985 was a time of depression for the Netherlands (van Zanden [1997]: 227-231.), when the economic growth fell behind the European average and this is observable on the trade performance of the Netherlands as well.

[1] On 24 November 1982 the central organizations of the employers and employees met in Wassenaar and condescended a moderation of wages paired with a reduction of labour-time (the Wassenaar Arrangement).

3.3 Main directions of the Dutch foreign trade

In this section I focus on the question whether the geographical distribution of Dutch foreign trade changed in course of the 20th century, and if it actually did, how the main direction changed. Figure 3.6a and b show the share of different continents in the total Dutch exports and imports respectively.

In Figure 3.4a two major processes can be observed: a strong Europanization of exports, and the gradual loss of Asia's share. This latter is clearly a result of decolonization, while in case of the former, one cannot be certain whether European integration was mainly responsible. If one were observing the export share of Europe only after 1945, it would be straightforward to argue that the obvious increase in the 1950s until the first half of the 1970s was attributable to the integration process. Still, such a conclusion sounds premature, when pre-war trend are also taken into account: Europe had already had quite high shares in Dutch exports in the inter-war period, much higher than in the turn of the 1950s and 1960s. The 1930s cannot be seen of course as a perfect reference period, as it saw a significant strengthening of protectionist tendencies, but the lack of data on the pre-1914 period strongly limits the possibilities.

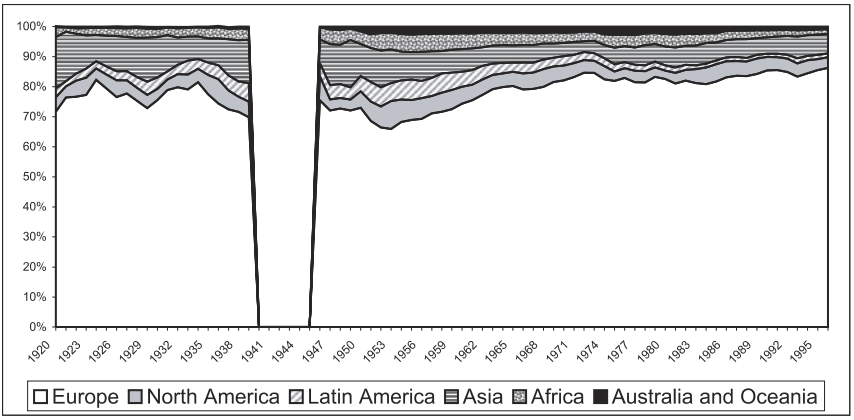
What makes the whole problem a bit more delicate is that there were at least two processes that increased the share of Europe in total exports after World War 2:

A re-Europanization of exports, that had most certainly taken place in the absence of integration as well, and the integration (EEC and EFTA) itself.

By observing shares in trade only, it is not possible say anything certain about the magnitude of integration effect, because these are affected by several unidentified factors. Still one may create a few hypotheses. The share of Europe in total exports reached a peak twice in the inter-war period: in 1924 (82.3%) and in 1934 (81.5%), which were not surpassed by 1969. Even if one assumes that these two years were exceptional, and the "normal" share of Europe was the average of the 1920-1939, which is 76.3%, this level was surpassed only in 1962 (except a short period directly after the war, when Europe's share significantly decreased). These all suggests that if European integration did have an impact on the geographical composition of Dutch exports, then it had not taken place before 1962, and its magnitude was 7-8 percentage points at most.

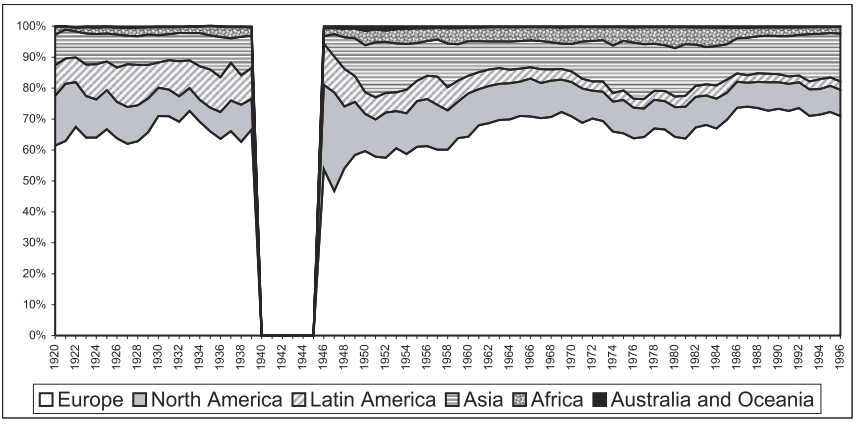
As for other continents, the shares of Africa and Latin America show some similarities: Both became larger in the 1960s and gradually decreased from the 1970s on.

Figure 3.4a
The geographical composition of Dutch exports, 1920-1996 (in current prices)



Source: CBS Statline on-line database

Figure 3.4b
The geographical composition of Dutch imports, 1920-1996 (in current prices)



Source: CBS Statline on-line database

As for the imports, Figure 3.4b suggests that the importance of European suppliers marginally increased and especially in the 1960s and 1990s. This growth seems to have happened mostly at the expense of the North American imports, the share of which reached a bottom twice: once in 1934 (7.1%) and in 1987 (7.8%). The peak was, not surprisingly at all, in 1947 (31.9%) at the height of post-war reconstruction.

One can also observe that it took some time for the share of European imports to reach the inter-war level (a re-Europanization observed again). Now the same problem rises as before: there are two processes, both increasing the share of Europe in imports, and one can again do not more than form some hypotheses: using the same assumption that the "normal" share of Europe in the total imports equaled the average of the years 1920-1939

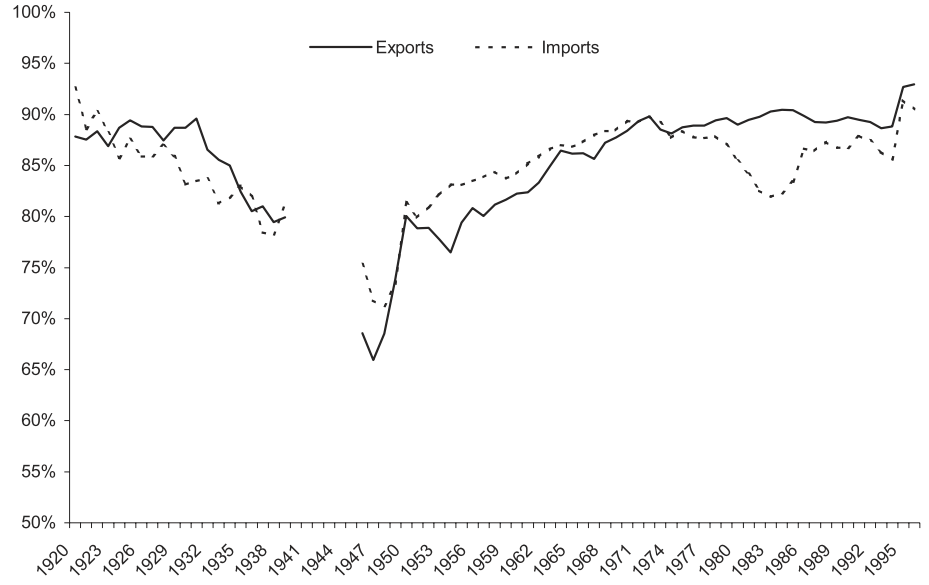
(65.9%), we can draw the conclusion that it was surpassed between 1961-1973 and after 1978. If European integration indeed had an impact, this took place in this period, but about the magnitude it is not possible to say anything.

At this point the question arises whether the Marshall Plan played an important role in determining the main directions of Dutch foreign trade. There is a debate about the economic impact of the Marshall Plan, and several authors argue that its magnitude was too small to stimulate a replacement and expansion of the physical capital stock (see Milward 1984). De Long and Eichengreen (1991) argue that the reconstruction had already been mostly complete by 1948, and consequently the Marshall Plan could not have an important role in it. On the other hand, they find that the Marshall Plan was an important factor in alleviating resource shortages. In case of the Netherlands, however, it is important to note that it received relatively larger share of the aid than most European countries. According to Van der Eng (1987), the aid had a significant impact on the reconstruction and the physical capital stock as well: a lot of the newly purchased machinery was financed by the Marshall Aid. Also in this period the guilder was devaluated against the dollar, which contributed to an increase in the exports toward the dollar zone (Van Zanden and Griffith 1989). Altogether one may argue that the Marshall Aid must have an impact on the Dutch foreign trade in this period, and contributed to both the expansion of exports and to preservation of the high share of North America in the imports in the 1950s.

Another region besides North America, which lost some of its importance, was Latin America. While about 8-12 percent of the Dutch imports in the inter-war period came from Latin America, after 1964 it never surpassed 5 %, and mostly stayed under 4 percent. On the other hand, Asia and Africa became more important sources of imports, however this latter could not hold its position very long. In the post-war period and directly after World War II, Indonesia was a main source of Asian imports, which changed later: the economic boom in Japan and later in the Asian "tigers", assured the position of Asia as the second most important source of imports, with a 12-20% share in the last three decades. It is important to mention that the most important OPEC members (Saudi Arabia and Kuwait) are also in Asia, which contributes to the relatively large share of this region.

Finally, there remains one question to address: Did European integration lead to a redirection of Dutch foreign trade in Europe? In order to obtain some ideas, I plot the share of EU member countries in total European exports and imports against time.

Figure 3.5
The share of EU countries in the total Dutch exports to and imports from Europe, 1920-1996 (in current prices)



Source: CBS Statline on-line database, the data on the war years is missing.

Figure 3.5 indicates that even if the share of EU countries (1995 membership with 15 countries) within the total European imports and exports marginally grew in the period 1946-1972, this is not unprecedented. The same countries had already had an even higher share in the Dutch trade with Europe in the interwar period, reaching 92.61% in 1920 for imports, 87.84% for exports. What one can draw as a conclusion is that the basic statistics provides no clear and incontestable evidence for any redirection of the Dutch foreign trade within Europe toward the EU countries that could be attributed to integration. This is not surprising though: the Netherlands had a liberal foreign trade regime in the 20th century, and as a result, her foreign trade relationships reflected much less distorting effects that later liberalization could have corrected for. It is important to bear in mind that when a country establishes a regional economic integration with her traditional trade partners, as happened in case of the Netherlands, there is no reason to expect any dramatic changes to take place. Whether European integration indeed affected Dutch foreign trade I am going to test in Chapter 5 with econometric methods, which make possible to identify and separate the effect of different factors.

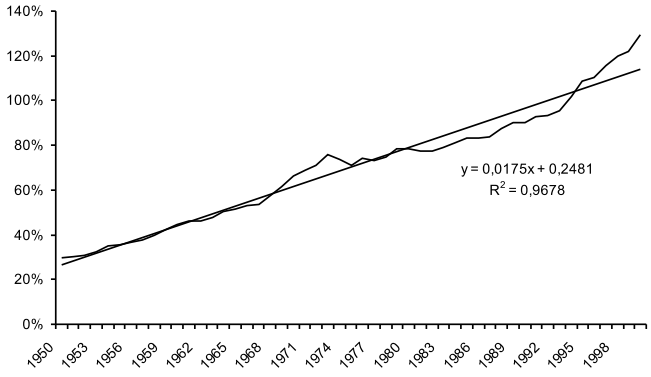
3.4 Openness and growth in the Netherlands

In this section I will focus on the openness of the Dutch economy and its relationship with economic growth. Empirical observations confirm that smaller economies tend to

trade relatively more than large ones. This can be attributed to two main factors. First, smaller countries usually have a less diversified economic structure and therefore depend more on imported goods and resources. Secondly, the internal market is too small to utilize economies of scales, and the domestic production needs external markets to be able to decrease average costs sufficiently.

This leads to concentration and that is why we see that a lot of large multinational firms based in small countries (Philips, Shell, Nokia, Ericsson etc.). These enterprises can only prevail in the competition with companies of large countries (USA or the British Commonwealth) if they seek transnationalization.

Figure 3.6
The openness of the Dutch economy (in constant prices)



Note: Openness is measured as the share of the sum of total exports and imports in the GDP.
Source: Penn World Table 6.1

It is quite clear from Figure 3.6 that the openness (calculated as the share of total trade in the GDP) of the Dutch economy increased significantly during the period analyzed by this thesis. A linear trend fits the observed openness quite good, and on basis of the trend regression one can argue that the openness grew stable by about 1.75 percentage point annually.[2] This is also typical for a small open economy in the second half of the 20th century. One can observe a small positive deviation from the trend in the beginning of the 1970s, possibly because of rising oil prices and a negative deviation in the 1980s.

It has become a focal point of a lot of studies whether trade, through improved allocation of resources, actually fosters economic growth. Theoretically, this question is related to the rise of new growth theories like Romer (1986) and Lucas (1988). Grossman and Helpman (1991), Romer (1992) and Barro and Sala-i-Martin (1995) argue that countries that are more open have also more ability to absorb new technologies.

Severals attempts have been made to confirm these expectations empirically, yet, the results are frequently debated (for more detailed discussion the reader may wish to con-

[2] A semi-logarithmic equation (log of openness against time) yields a coefficient of 0.027 significant at 1% level of significance. That is the openness grew 2.7% annually on average.

sult the comprehensive studies of Harrison [1996], and Rodrik and Rodriguez [1999]). Empirical work faces two main problems regarding the measurement of the impact of openness on economic growth.

The first problem is that the traditional measurement method equaling openness with the share of the sum of exports and imports in GDP may be misleading. The purely quantitative indicators do not take the qualitative differences among countries into account. For example, while the share of foreign trade may be remarkably high in South-East Asian countries, only few would argue that they can indeed be considered as traditional examples of open economies.

Several authors attempt to replace this purely quantitative measure by a qualitative one. Leamer (1988), for example, estimates the volume of trade under fully liberalized trade regime, and uses the difference between the actual and this theoretically predicted trade to construct an openness indicator. His openness indicator is used by Edwards (1992) who finds a positive relationship between openness and economic growth. Probably the best known critics and solution comes from Sachs and Warner (1995). Sachs and Warner's critique is concerned about the proxy used for openness. They argue that instead of the share of foreign trade in total GDP, it would be more convenient to create a dichotomous variable that indicates if a country has liberalized foreign trade policy or not. To create their composite index, they used trade-related indicators such as tariffs, quotas, the existence of export-marketing boards, etc. Their approach is criticized by Rodrik and Rodriguez (1999) who argue that the specifications applied by studies adopting purely qualitative openness measures and cross-section analysis are statistically sensitive, and the results are not as robust as claimed.

Another problem is the endogeneity of the variables in growth regressions. Frankel and Romer (1997) and Dollar and Kraay (2003) apply instrumental variable regressions to cope with this problem. Frankel and Romer use geographical characteristics to create instruments, while Dollar and Kraay opt for the lagged value of the openness instead. This latter instrumentation is criticized by Lee, Ricci, and Rigobon (2004) on the ground that if openness affects growth through more than one period, the first-lag of openness is not a reliable instrument.

As for the results, several empirical studies confirmed a positive relationship between openness and welfare see for example Michaely (1977), Dollar (1992), Edwards (1992), Rodrik (1994) and Frankel-Romer (1997)[3]. There are examples for much more critical approaches though, like Sachs and Warner (1995), Rodrik and Rodriguez (1999). Vamvakidis (2002) significantly extends the time-scope of the empirical research by applying a more historical approach. He finds that the relationship between openness and growth was negative in the 1920-1940 period, while the positive relationship is a quite new phenomenon appearing after 1970 only.

It is obvious that the solution of Sachs and Warner is not applicable to a single-country analysis, since it replaces a continuous variable (external openness) by a dichotomous

[3] Frankel and Romer (1997) find the elasticity between GDP per capita and openness being 0.85 in 1985 with an OLS regression. My results from a GLS Dummy Variable panel estimation are lower (0.345) for the OECD countries between 1951-from a GLS Dummy Variable panel estimation (Földvári, 2004). Letting the openness coefficient change over time reveals a positive but decreasing trend.

(quantitative) variable based on country-specific policy/institutional factors. Thereby not only loses a lot of information, but also restricts possible analyses to cross-country differences. As a result, I must retain the original, openness measure for this analysis.

In the following I apply a Granger test (Granger, 1969) to explore the causal relationship between economic growth and openness in the period 1950-1995. A similar analysis has recently been carried out for Greece by Dritsakis and Adamopoulos (2004) who apply a Vector Error Correction (VEC) model and find causal relationship between openness and economic growth. Furthermore, Kónya (2004) also applies a Granger causality test based on a VAR model to explore the possible causal relationships between real exports and real GDP. He finds no evidence for a causal relationship between exports and GDP in the Netherlands and Luxembourg while in case of several other OECD countries (Canada, Japan, Korea, Sweden, the UK) the causality relationship exists in at least one direction.

Theoretically, a two-way relationship – even endogeneity – between economic growth and openness seems possible. While trade liberalization leads to more efficient allocation of resources, and thereby increases GDP per capita it may also increase demand for imports. Still, a simple Granger test on per capita GDP and openness only would be likely to suffer from an omitted variable bias. In order to avoid this problem, one needs some solid theoretical foundations behind the causality regression.

One can, for example, specify the following production function:

$$y_t = A_t K_t^{\alpha} L_t^{\beta-1} \varphi_t^{\gamma} \qquad (3.1)$$

where the y is per capita GDP, K is the stock of physical capital, L is the labor, approximated by population, and φ denotes openness. In the followings, I modify (3.1) for a Granger causality test which is carried out for the period 1950-1995.

The main idea behind the Granger causality test is that only past may influence future. In terms of regression, one can argue that if the dependent variable (Y) is regressed on its own lagged value(s) and the lagged values of one or more regressors (X), X Granger-causes Y only if the lagged X can explain Y statistically significantly. It is crucial however that the Granger test is carried out on stationary and not cointegrated variables, or else the test results will be biased. Even though in most cases Granger causality tests are specified as single-equation dynamic models, now I opt for a Vector Autoregressive (VAR) model instead, since there is reason to assume that the regressors in (3.1) are strongly interrelated. Further, in order to capture a possible effect of the economic integration I introduce a dummy variable (*EEC*) in the system of equations, which takes the value of one after 1957.

The data on GDP per capita are taken from the GGDC dataset (http://www.ggdc.nl/dseries/totecon.html), the openness is available from the Penn World Table 5.1 (http://pwt.econ.upenn.edu/), while the data on physical capital stock is available from the dataset of Groote et al. (1996) for the period 1900-1995 expressed in 1990 Geary-Khamis international USD. Another dataset on gross fixed capital stock is available from Timmer et al. (2003) for the 1980-2004 period (the dataset has been updated in 2005), but the two time series are so different, I cannot use the one to complete the other.

The unit-root tests suggest that all of our variables are non-stationary and integrated of order one, indicating that we need to difference our variables. The Johansen-test cannot reject the null-hypothesis of no cointegration, which contradicts the finding of Dritsakis

and Adamopoulos (2004), and Kónya (2004) who find a long-run equilibrium relationship between openness and per capita GDP.

The Schwarz's Bayesian information criterion (SBIC) suggests that one only needs to use the first lags of the endogenous variables in the VAR specification. One can thus use (3.1) to write the following VAR(1) model:

$$\Delta\vec{Y}_t = \delta + \Gamma_1\Delta\vec{Y}_{t\text{-}1} + c\cdot\Delta EEC_t + d\cdot\Delta\ln pop_t + \vec{\varepsilon}_t$$
$$\vec{Y}_t = (\ln y_t, \ln K_t, \ln\varphi_t)' \qquad (3.2)$$

where the notation is the same as in (3.1). The integration dummy and the population are treated as exogenous variables. The constant term in (3.2) can be interpreted as a differenced linear time trend to capture the unobserved effect of technology.

The estimated coefficients of the equation system are not reported, since they cannot be interpreted by the usual way as *ceteris paribus* elasticities. Instead, I report the results from the Granger causality test, which is carried out on equation (3.2) by F-tests. If the exclusion of a variable from an equation significantly decreases the fit of our model, one can infer that the omitted variable Granger causes the dependent variable of the equation. The sign of the coefficient in the equation is indicative of the direction of the relationship.

Table 3.1
Results of the Granger causality test

	Equation (a)	Variable removed (b)	F-statistic *(p-values)*	Sign of relationship	Decision
1.	GDP per capita	Capital stock	0.337 *(0.565)*	0	b Granger does not cause a
2.	GDP per capita	Openness	11.124 *(0.002)*	+	b Granger causes a
3.	Capital stock	GDP per capita	10.338 *(0.003)*	+	b Granger causes a
4.	Capital stock	Openness	0.969 *(0.331)*	0	b Granger does not cause a
5.	Openness	GDP per capita	0.389 (0.536)	0	b Granger does not cause a
6.	Openness	Capital stock	0.038 (0.846)	0	b Granger does not cause a

Note: the F-test is used to decide whether excluding b from the regression significantly reduces our model's explanatory power. If the exclusion test is significant, one may infer that the "b" variable Granger causes the "a" variable.

It is a surprising result that a short-run increase in the per capita physical capital does not result in an increase of per capita GDP as suggested by the test result in the first row of Table 3.1. The results in the second row confirm that the past values of openness do really have significant impact on the present level of GDP per capita. As the coefficient is positive and significant at 1%, one can conclude that the causality works in a positive direction: increasing openness causes GDP per capita growth in the short-run.

The third row indicates that the increase of the per capita GDP increases capital stock, which is an expected result. On the other hand the fourth row suggests that openness does not affect the capital stock.

The last two rows indicate no causal relationships from GDP per capita and capital stock toward openness.

In the following, I plot the results from the simulation from the VAR system of the impact of openness on per capita GDP.

Figure 3.7a
The response of the log of per capita GDP to a unit change in the log of openness

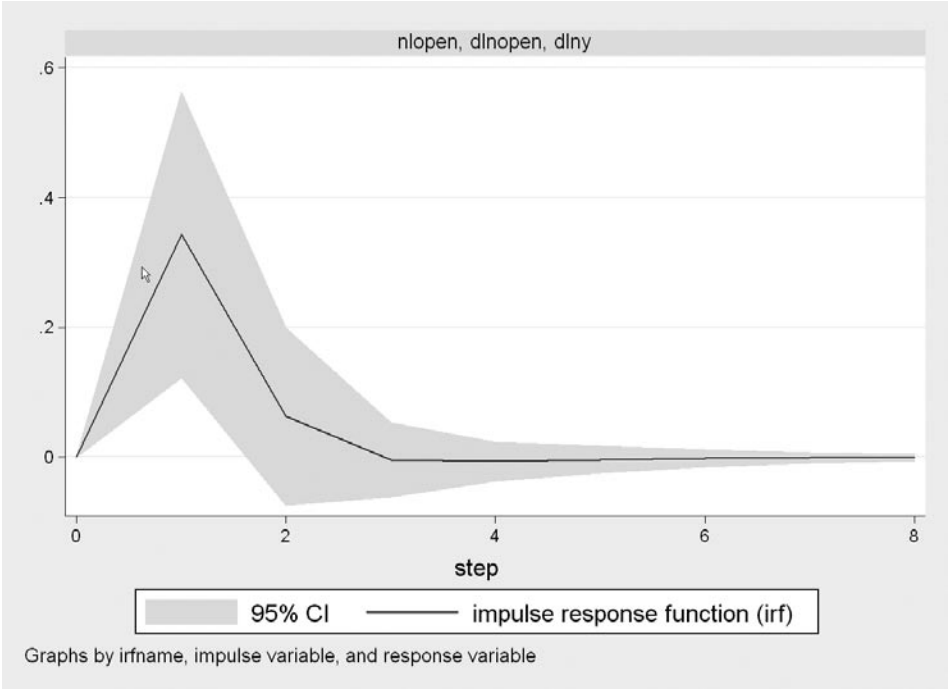


Figure 3.7b
The cumulative response of the log of per capita GDP to a unit change in the log of openness

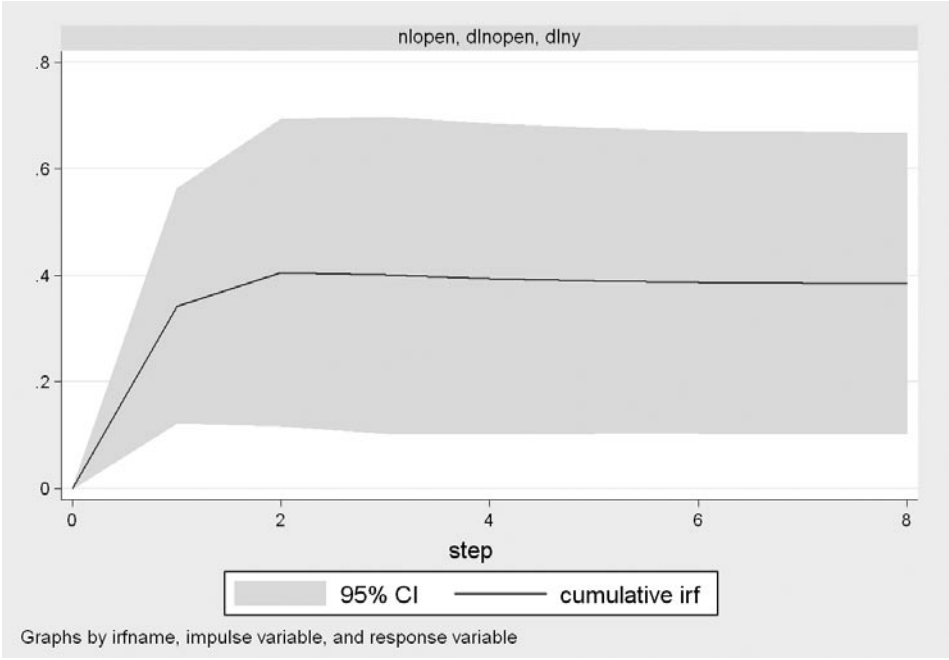


Figure 3.7a and b visualize the result from the simulation of the response of the log of the per capita GDP to a unit change in the log of the openness from the VAR model (3.2). The impulse-response function (Figure 3.7a) suggests that there is a short-run positive relationship between openness and economic growth. The positive impact does not last long, however, and after about 3 years it completely vanishes. The cumulated impulse-response function helps to estimate the total impact, which is about 0.38. In words, one percent change in the openness results in a 0.38% increase of the per capita GDP after three years. This result might suggest that the impact of openness was not a very important source of economic growth in the last five decades, but if one takes it into account that the openness grew at an about constant 2.7% rate annually, the effect is not negligible any more. This result leads to the conclusion that the growth of openness added annually about one percent to the Dutch GDP.

The *EEC* dummy is significant in the equation for per capita GDP, and is negative, which implies that the creation of the EEC had some negative immediate impact. The EEC membership does not seem to have affected the openness immediately, but since the gradual liberalization process was not completed until 1968, this is not surprising at all.

3.5 Conclusions

In this chapter I presented a brief historical overview of the Dutch foreign trade from two perspectives: the position of the Netherlands in the world economy, and the redirec-

tion that took place in exports and imports that partly might have been caused by integration. I summarize the observations on the general trends:

- While her economic weight, measured in terms of GDP did marginally decreased in the World, the Netherlands improved her position in Western Europe quite significantly in the second half of the 20th century, making her the most important small economy in Europe.

- The high shares of Europe in the total Dutch foreign trade observed from the 1950s on, are not unprecedented if a historical perspective is applied. Therefore conclusions about the magnitude of the impact of integration that are based on such statistics are deceiving.

- Both in exports and imports show the sign of re-Europanization, that is a return to the interwar trend that is likely to would have taken place in absence of the integration as well. The deviation from the interwar trends is the most apparent in the exports, where therefore the most likely that a gross trade creation took place as a result of integration.

The above-mentioned hypothesis should be tested for, which will happen in Chapter 5. In the second part of this chapter I addressed the problem how trade, measured in terms of openness, contributes to economic growth. The conclusions are the following:

- The Netherlands became more and more open in the last five decades. The pace of this increasing openness was quite stable, about 1.75 percentage points annually.

- The VAR based Granger test suggests that openness has a short-run positive impact on the growth of per capita GDP, but the effect vanishes in three years. The growth rate is not affected permanently, which is in accordance with the findings of most empirical studies. There are no indications of a long-run relationship though.

- Since openness grew at a constant rate, openness, through its efficiency improving and restructuring effects, seems to have contributed to the economic growth by one percent annually.

IV.
On the theory and application of Gravity Models

4.1 Introduction

Gravity models have become predominant in the last four decades in empirical analysis of bilateral trade and foreign investments. The first applications (Tinbergen, 1962; Pölyhönnen, 1963; Pulliainnen, 1963; Linnemann, 1966), however, preceded the theoretical explanation for the empirical success.

It is obvious that the pure formal resemblance between the Newtonian gravity equation and the one used in empirical economic studies is not an adequate explanation of why gravity models have become such popular tools for trade modeling. That is why before the estimation of such a model it is important that I shortly review the most important theoretical explanations behind gravity models and establish a link between empirics and theory.

Chapter 4 is structured as follows: First, in section 4.2, I briefly refer to the most important studies that so far have attempted to provide a theoretical basis for gravity models. Section 4.3 reviews the 1985 article of Bergstrand in detail, in which he derives a generalized form of the gravity equation. In Section 4.4 I summarize the crucial problems associated with the estimation of gravity models. Finally, in section 4.5, the gravity model is adapted to a single-country perspective, and I briefly discuss the consequences of such an approach.

4.2 Theoretical explanations of the gravity models

The application of gravity equations to empirical analysis of international trade was pioneered by Tinbergen (1962), Pölyhonnen (1963), Pullianinen (1963), and Linneman (1966).

These early gravity equations generally took the following (log-linearized) form:

$$\ln IM_{ij} = \alpha_0 + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln P_i + \alpha_4 \ln P_j + \alpha_5 \ln Dist_{ij} + u_{ij} \qquad (4.1)$$

where IM_{ij} is the imports from country i to j, Y_x, P_x denote the aggregate income and the population of country x, and $Dist_{ij}$ is the geographical distance between i and j. The coefficients α_1 and α_2 are expected to be positive, while α_3, α_4, α_5 are expected to be negative in empirical studies. In other words, the volume of foreign trade between two countries is directly proportional with their incomes, but inversely proportional with the geographical distance. Also, one may expect that larger countries trade less in relative terms and consequently the ceteris paribus impact of population should also be negative.

As equation (4.1) suggests, the gravity equation was developed for cross-sectional analysis. Gravity equations applied to panel data analysis appeared in the 1980s only, but made the traditional cross-section approach obsolete in a few years. The main reason for

preferring panel data analysis is that the cross-section specification (4.1) is very likely to suffer from omitted variable bias because of the unobserved country specific effects and since it completely neglects the temporal aspects (and dynamics) of foreign trade. Still, even early empirical works have applied gravity equations with an apparent success, and the goodness-of-fit the cross-section gravity models were quite high (the R^2 often surpassed 0.8).

Empirical applications preceded a solid theoretical explanation of why gravity equations seem to fit the data so well. It is remarkable that a lot of studies have managed to derive gravity models from very different theories of international trade. For more detailed surveys on these theoretical works and recent contributions the reader may wish to consult the studies of Deardorff (1998), Evenett and Keller (1998), Harrigan (2001), and Anderson and van Wincoop (2004).

One of the earliest attempts to derive a gravity equation (Leamer and Stern, 1970) is based on a probability model. They assume that the success of gravity equations is mainly due to the fact that they capture the most important determinants of aggregate demand and supply, though those functions are not specified at all by the authors.

Anderson (1979) was the first to apply utility functions (both Cobb-Douglas and CES) to derive a more sophisticated model. He assumes that consumers differentiate according to the origin of goods (following Armington, 1969).[1] A similar approach is taken by Deardorff (1998). Bergstrand (1985, 1989, and 1990) also applies CES preferences, and generalizes the gravity model by introducing prices. In his 1989 paper, Bergstrand applies Dixit and Stiglitz's (1977) monopolistic competition model, and assumes that goods are differentiated among firms rather than countries. Finally, Bergstrand (1990) incorporates the Linder hypothesis in his trade model.[2] Another important contribution is made by Helpman and Krugman (1985) who derive the gravity model under the assumption of increasing returns to scale in production. Following this path, Evenett and Keller (1998) derive the gravity model from both the Hecksher-Ohlin model and increasing returns to scale hypothesis, under perfect and imperfect product specialization.

As I noted above in this section, the same basic gravity equations apparently can be derived from several trade theories.[3] This is the reason why Deardorff (1998) is quite critical about the application of gravity equation for the justification of any of the trade theories: an empirical model that can be derived from any of the conflicting theories is not the right tool of the selection among them. Still, it remains an important tool for international trade modeling because of its convenience, empirical success, and high degree of flexibility.

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[1] Anderson remarks that the disequilibrium of balance-of-payments may appear in the residual of the regression. If this is correlated with any of the regressors, it may lead to biased estimates.

[2] The Linder hypothesis (Linder, 1961) was born as an early answer to the shortcomings of the Hecksher-Ohlin Model. It argues that consumers in countries with similar endowments and similar level of development are likely to share similar preferences, which increases the volume of international trade among these countries.

[3] Anderson and van Wincoop (2003) argue the theoretical foundations of gravity equations are still unsatisfactory.

4.3 A microeconomic founded theoretical gravity model

In this section, I review Bergstrand's first model (1985), which has become a cornerstone of theoretical reasoning of the success of gravity equations. The model is based on a general equilibrium model of world trade, and this makes it one of the soundest theoretical explanations for the gravity equation.

First, let us assume that the consumers in country j have the following CES utility function:

$$U_j(X_{ij},...,X_{Nj}) = \left\{ \left[\left(\sum_{\substack{k=1 \\ k \neq j}}^{N} X_{kj}^{\theta_j} \right)^{\frac{1}{\theta_j}} \right]^{\psi_j} + X_{jj}^{\psi_j} \right\}^{\frac{1}{\psi_j}} \quad (j = 1,...,N) \qquad (4.2)$$

$$\psi_j = (\mu_j - 1)/\mu_j, 0 \leq \mu_j \leq \infty$$
$$\theta_j = (\sigma_j - 1)/\sigma_j, 0 \leq \sigma_j \leq \infty$$

Where X_{kj} is the amount of goods produced in country k demanded by the consumers in country j (X_{jj} is the amount of domestically produced goods demanded). μ_j is the constant elasticity of substitution (CES) between domestic and importable goods, σ_j is the CES among importables. One can look upon (4.1) as a two-level choice, where the CES function between importables and domestic goods has a further inner CES function, which describes the consumer's preferences for the importables. The technique that μ_j and σ_j are chosen to be different is often referred to as the Armington approach (Armington, 1969). This has proved to be a useful tool of modeling home-bias.[4] Clearly, if μ_j and σ_j are equal, (4.1) reduces to a simple CES.

Consumers face the following budget constraint:

$$Y_j = \sum_{k=1}^{N} \bar{P}r_{kj} X_{kj}, \; j = 1,...,N \qquad (4.2)$$

and

$$\bar{P}r_{kj} = Pr_{kj} T_{kj} C_{kj} / E_{kj} \qquad (4.3)$$

where Pr_{kj} is the k-currency price of k's product, sold in market j,[5] T is one plus the tariff rate on k's product (T_{jj}=1), and C_{kj} is the transport costs of shipping k's product to j, in terms of k's currency (again C_{jj}=1). Finally, E_{kj} is the price of j's currency in terms of k's currency (exchange rate).

[4] For an elaborated home-bias model also utilizing the Armington-approach, see for example Obstfeld and Rogoff (2000).

[5] Unlike Bergstrand, I denote price by *Pr*, in order to avoid confusion with population I will denote by *P* through the dissertation.

The maximization of (4.1) subject to (4.2) yields N(N+1) first-order-conditions, and N(N-1) bilateral demand functions (X_{ij}^{D}) and N domestic demand functions (X_{jj}^{D}). These latter are:

$$X_{ij}^{D} = Y_j \bar{P}r_{ij}^{-\sigma_j} \left[\left(\sum_{\substack{k=1 \\ k \neq j}}^{N} \bar{P}r_{kj}^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} \right]^{\sigma_j - \mu_j} \times \left\{ \left[\left(\sum_{\substack{k=1 \\ k \neq j}}^{N} \bar{P}r_{kj}^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} \right]^{1-\mu_j} + Pr_{jj}^{1-\mu_j} \right\}^{-1} \qquad (4.4)$$

$$(i, j = 1, ..., N),\ i \neq j$$

and

$$X_{jj}^{D} = Y_j Pr_{jj}^{-\mu_j} \left\{ \left[\left(\sum_{\substack{k=1 \\ k \neq j}}^{N} \bar{P}r_{kj}^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} \right]^{1-\mu_j} + Pr_{jj}^{1-\mu_j} \right\}^{-1} \qquad (4.5)$$

$$(j = 1, ..., N)$$

As the next step, the respective supply functions are derived.

First let us specify the following profit function for the producers in country *i*:

$$\Pi_i = \sum_{k=1}^{N} Pr_{ik} X_{ik} - W_i R_i \qquad (4.6)$$

where R_i denotes the amount of an internationally immobile resource available in country *i*, and W_i is the value of a unit of *R* in *i*'s currency.

The factors of production are allocated by the following Constant Elasticity of Transformation (CET) production function, which is the supply-side counterpart of (4.1).

$$R_i = \left\{ \left[\left(\sum_{\substack{k=1 \\ k \neq i}}^{N} X_{ik}^{\phi_i} \right)^{\frac{1}{\phi_i}} \right]^{\delta_j} + X_{ii}^{\delta_j} \right\}^{\frac{1}{\delta_j}} \qquad (4.7)$$

$$\delta_j = (1 + \eta_j)/\eta_j, 0 \leq \eta_j \leq \infty$$

$$\phi_j = (\gamma_j - 1)/\gamma_j, 0 \leq \gamma_j \leq \infty$$

where η_i and γ_i are the CET of between production for domestic and foreign markets and the CET among export markets respectively. Equation (4.7) reflects again a two-level choice in form of a composite function: if η_i and γ_i are equal, (4.7) will reduce to a basic CET.

Maximizing (4.6) subject to (4.7) results in N^2 first-order-conditions, N(N-1) bilateral export supply equations (X_{ij}^S), and N domestic supply functions (X_{ii}^S):

$$X_{ij}^S = Y_i \bar{P} r_{ij}^{\gamma_i} \left[\left(\sum_{\substack{k=1 \\ k \neq i}}^{N} \bar{P} r_{ik}^{1+\gamma_j} \right)^{\frac{1}{1+\gamma_j}} \right]^{-(\gamma_j - \eta_j)} \times \left\{ \left[\left(\sum_{\substack{k=1 \\ k \neq j}}^{N} \bar{P} r_{ik}^{1+\gamma_i} \right)^{\frac{1}{1+\gamma_i}} \right]^{1+\eta_i} + Pr_{ii}^{1+\eta_j} \right\}^{-1} \quad (4.8)$$

$$(i, j = 1, ..., N) \text{ i} \neq j$$

and

$$X_{ii}^S = Y_i \bar{P} r_{ii}^{\eta_i} \left\{ \left[\left(\sum_{\substack{k=1 \\ k \neq j}}^{N} \bar{P} r_{ik}^{1+\gamma_i} \right)^{\frac{1}{1+\gamma_i}} \right]^{1+\eta_i} + Pr_{ii}^{1+\eta_j} \right\}^{-1} \quad (4.9)$$

$$(i = 1, ..., N)$$

General equilibrium requires supply and demand to equal:

$X_{ij}=X_{ij}^S=X_{ij}^D$ $(i,j=1,...,N)$ (4.10)

This leads to a general equilibrium model of $4N^2+3N$ equations, where the incomes of exporters and importers are excluded. Therefore it is not a gravity equation yet.

Bergstrand argues that a gravity equation can be derived from this system only if certain assumptions are made and so a partial equilibrium is determined[6].

These assumptions are the following:

1. Small economy assumption, which means that the aggregate trade flow from i to j is small relatively to the other N^2-1 markets. This causes that the changes in X_{ij} and Pr_{ij} will have only negligible impact on the incomes of i and j, and will also not affect the prices in any countries of the world.

2. Identical utility and production functions across countries, which is a common assumption of international trade theory. In other words, the representative consumer and producer are alike in all countries.

If the first two assumptions are met, it is possible to derive a "generalized" gravity equation:

[6] Partial equilibrium analysis means that one focuses on the countries which are directly affected and ignores the effects on other markets.

$$PrX_{ij} = Y_i^{\frac{\sigma-1}{\gamma+\sigma}} Y_j^{\frac{\gamma+1}{\gamma+\sigma}} C_{ij}^{-\frac{\sigma(\gamma+1)}{\gamma+\sigma}} \times T_{ij}^{-\frac{\sigma(\gamma+1)}{\gamma+\sigma}} E_{ij}^{\frac{\sigma(\gamma+1)}{\gamma+\sigma}} \times \left(\sum_{\substack{k=1 \\ k\neq j}}^{N} Pr_{ik}^{1+\gamma} \right)^{-\frac{(\sigma-1)(\gamma-\eta)}{(\gamma+1)(\gamma+\sigma)}} \times$$

$$\times \left[\left(\sum_{\substack{k=1 \\ k\neq j}}^{N} \bar{P}r_{kj}^{1-\sigma} \right)^{\frac{(\gamma+1)(\gamma+\sigma)}{(\gamma+\sigma)(1-\sigma)}} \times \left(\sum_{\substack{k=1 \\ k\neq j}}^{N} Pr_{ik}^{\gamma+1} \right)^{\frac{(1+\eta)}{(1+\gamma)}} + Pr_{ii}^{1+\eta} \right]^{-\frac{\sigma-1}{\gamma+\sigma}} \times \left[\left(\sum_{\substack{k=1 \\ k\neq j}}^{N} \bar{P}r_{kj}^{1-\sigma} \right)^{\frac{1-\mu}{1-\sigma}} + Pr_{jj}^{1-\mu} \right]^{-\frac{\gamma+1}{\gamma+\sigma}} \quad (4.11)$$

where $PrX_{ij}=Pr_{ij}X_{ij}$ is the value of the trade flow from i to j, Y_x, is the income of country x, and C_{ij}, T_{ij} and E_{ij} denote the transport costs, the tariffs and the exchange rate between i and j. In (4.11) the income elasticities are identical across all country-pairings. In other words, all gravity equations are based on assumption 2 either implicitly or explicitly. Also the incomes of exporters and importers are exogenous in this model. Equation (4.11) can be expressed in words as follows: the value of bilateral trade between i and j is proportional with the incomes in i and j, and inversely proportional with transport-costs and tariffs indicated by the negative sign of the C_{ij} and T_{ij} coefficients, which is a common and logical assumption in gravity equations. The sign of the exchange rate coefficient (E_{ij}) is positive, that is, the appreciation of the j's currency should *ceteris paribus* lead to an increase of the exports from i to j.

In order to omit the price terms in (4.11), one needs four further assumptions, which are the following:

3. Perfect substitutability of goods internationally both in production and consumption ($\sigma=\mu=\gamma=\eta=\infty$), that is consumers and producers are completely indifferent to the source of goods and resources (no home-bias).
4. Perfect commodity arbitrage ($\bar{P}r_{ij} = Pr$ for all i and j), which means that price differences are immediately eliminated and a unique price prevails in all countries.
5. Zero tariffs ($T_{ij}=1$)
6. Zero transport costs ($C_{ij}=1$)

Accepting all six assumptions, (4.11) can be simplified into a very rudimental gravity equation:

$$PrX_{ij} = \frac{1}{2} Y_i^{0.5} Y_j^{0.5} \quad (4.12)$$

It is quite obvious that (4.12) is oversimplified and too unrealistic, not to mention that it contains no estimable parameters. Also, it is straightforward that while some of the assumptions (especially assumption 1 and 2) are acceptable, some of the assumptions are unrealistic. On the other hand, an equation like (4.11) is also not feasible, simply because

one does not have enough information about prices, and the number of regressors would be far too high.

Bergstrand argues that, as usual in empirical studies, one may include exchange rates in the model, tariffs can be proxied by dummy variables denoting if a country is member of a preferential trade area, and finally transport costs can be proxied by distance. The price-terms in (4.11) are, however, normally not included at all, because of the lack of reliable data. Bergstrand proposes the application of GDP deflator of both partners as proxies for the omitted price-terms. Nevertheless, the explicit use of a GDP deflator became not general for two reasons: On the one hand, even GDP deflators are possibly difficult to find for some less developed countries, and on the other hand, most studies use constant price data.

Anderson and van Wincoop (2003) show that all prices appearing in Bergstrand's derivations can be summarized by just two price indices: one for the exporter and one for the importer. Furthermore, they argue that the (implicit) inclusion of these composite price indices in gravity equations is not optional, but a necessary condition of consistent estimation. The authors find that bilateral trade indeed depends on the bilateral trade barrier between countries *i* and *j*, but not in absolute terms as traditionally assumed. The price index of country *i* reflects the impact of all bilateral trade resistances and called therefore "multilateral resistance". If this multilateral resistance in country *i* increases relatively to the trade resistance with country *j*, it means that the relative price of imports from *j* will decrease. As a consequence, the increase of multilateral resistance may increase bilateral trade. The most important problem is that the multilateral resistance is unobservable. The authors do not advise the use of a CPI as a proxy of multilateral resistance, since this would require the assumption that all trade costs are pecuniary, and could also not capture the impact of non-traded goods on price differences. They instead use market-equilibrium conditions to eliminate the unobservable terms from their regression, which they estimate with non-linear least squares. As a simpler alternative, they also suggest the application of country-specific dummies in panel data analysis (a fixed-effect specification). This latter argument of the authors in favor of fixed-effect panel data specification significantly reduces the actuality of their critic, since most contemporary studies already apply fixed-effect panel analysis for other reasons than the omitted "multilateral resistance term".[7] Therefore, one can also interpret the results of Anderson and van Wincoop as another serious reason for preferring panel-data analysis.[8]

4.4 Some problems of the application of gravity equations

This sub-section reviews some basic questions and problems concerning the application of gravity equations. Even if these are normally given relatively little attention they should not be disregarded.

[7] Note, however, that the authors react to the study of McCallum (1995), who applies a cross-section analysis.
[8] Using fixed-effect panel specification to capture the "multilateral resistance term" has become frequent in the recent literature, see for example, Redding and Venables (2004).

4.4.1. The functional form

All empirical studies assume a log-linear functional form for gravity equations. The application of log-linear function may be justified by theory, but the main reason is beyond doubt the convenience of this form:

$$\ln EX_{ij} = \alpha_0 + \alpha_1 \ln GDP_i + \alpha_2 \ln GDP_j + \alpha_3 \ln Dist_{ij} + ... + \varepsilon_{ij}$$
$$\varepsilon_{ij} \sim N(0, \sigma_\varepsilon^2) \qquad (4.13)$$

This automatic acceptation of such a functional form is criticized by Sanso, Cuairan and Sanz (1993), who instead apply a Box-Cox transformation in order to test whether such a log-linear form applicable at all.

As it is well-known, the Box-Cox transformation (Box-Cox, 1964) assumes that for any variable X it is true that:

$$X^\lambda = \begin{cases} (X^\lambda - 1)/\lambda & \text{for } \lambda \neq 0 \\ \ln X & \text{for } \lambda = 0 \end{cases} \qquad (4.14)$$

So, it is possible to rewrite (4.13) in a more general form:

$$EX_{ij}^{\lambda_0} = \alpha_0 + \alpha_1 GDP_i^{\lambda_1} + \alpha_2 GDP_j^{\lambda_2} + \alpha_3 Dist_{ij}^{\lambda_3} + ... + \varepsilon_{ij} \qquad (4.15)$$

The log-linear form is a special case of (4.15), namely when all λ=0. If it is not the case, one has to correct the data first with the help of the lambdas, and only afterwards it is possible to estimate the original form.

Using Maximum Likelihood estimation, Sanso et al. reject the hypothesis of all lambdas being equal to zero, that is, the original log-linear form is not valid. Still, the Box-Cox transformation, just like using GDP deflators proposed by Bergstrand, became not popular, and even the authors note that the log-linear form is a very good approximation of the real functional form, and a Box-Cox transformation would be very inconvenient and time consuming to carry out.

4.4.2 The interpretation of distance coefficients

Even though geographical distance is generally used as a proxy for transport costs, interpreting the distance coefficient proved to be another problematic issue. Theoretically, most researchers expect that transaction costs have decreased in the recent decades (for a popular example see Cairncross, 1997 on the "Death of distance"). Still, in empirical attempts to justify this hypothesis, the impact of distance rather appears to increase. Frankel (1997), for example, who devotes a section to this problem in his monograph on trade blocks, estimates bilateral trade among 63 countries for seven years (1965, 1970, 1975, 1980, 1985, 1990, 1992), with a gravity equation and also finds that the distance coefficient does not follow a diminishing trend at all.

This contradictory behavior of the distance coefficient has become a focal point of several studies. There are basically three explanations for this unexpected tendency of distance coefficients.

The first one argues that important variables are absent from empirical gravity models, which causes a biased estimation of the parameters. Brun, Carrere, and de Melo (2002) set out to correct this problem and include proxies for the state of infrastructure (per capita phone lines, length of paved roads and railroads) in order to take care of the omitted-variable bias. They show that the inclusion of the new variable causes the distance coefficient to remain about stationary in case of trade among developed countries. In other cases, however, the negative trend prevails. This result suggests omitted variable bias be not to the sole source of the problem, but also draws the attention to the fact that further improvements of the gravity model are still possible and necessary.

The second explanation seems to be a much more likely candidate. Frankel (1997) notes that the log-linear functional form does not make it possible to directly interpret the distance coefficient as the impact of transport costs on trade. In a log-linear model the coefficients of continuous variables can be treated as *ceteris paribus* constant elasticities. Using the notation of (4.13), if α_3 is found to be significant and negative, it does only mean that if the distance is one percent larger between two countries, bilateral trade is reduced by α_3 percent, provided all other regressors are fixed. If this elasticity decreases (that is increases in absolute terms), it is not necessarily tantamount with the increment of average costs of shipping goods between trade partners. If one accepts Frankel's reasoning, which is quite convincing, one should not use the distance coefficients from a log-linear model at all for drawing conclusions about average transport costs. What is more, it is possible to hypothesize situations when average costs decrease, while marginal costs (and the coefficient of the distance) increase.

Exactly this is what Buch, Kleiner and Toubart (2004) do. They investigate three cases concerning the evolution of the average transport costs and analyze the behavior of the distance coefficient under these scenarios:

- The first scenario assumes that the transport costs decrease proportionally, that is the change of the transport costs is independent of the distance. They find that in this case the distance coefficient does not exhibit any changes at all, and the impact of lower average transport costs is captured by an increasing intercept.
- The second scenario assumes that the decrease of the transport costs is disproportional and greater for smaller distances than for large distances. Now they find that the distance coefficient increases over time.
- In the third scenario the reduction of the transport costs is greater for larger distances. Under this hypothesis the distance coefficient decreases.

The findings of Buch *et al.* are indicative that the increase of the distance coefficient in absolute terms is possibly resulting from a disproportional reduction of the transport costs: the average costs of shipping decreased more significantly in short distances than in long distances.

As a third possible explanation, one may argue that in the new economic geography models, the relationship between economic integration and the resulting trade pattern

in non-linear. That is, when economic integration reaches a highly developed state, the distance coefficient may increase.[9]

Yet, one should not exaggerate the possible magnitude of the "death of distance" as Anderson and van Wincoop (2004) warn. They estimate the average tax-equivalent of the trade costs for industrialized countries being about 170 percent. Of this only 21 percent is attributable to transportation costs, while 44 percent is due to border-related trade-barriers and further 55 percent is resulting from retail and distribution costs. Their results suggest distance be a less important determinant of transaction costs.

4.4.3 Static or dynamic estimation?

Until the 1990s, gravity equations had predominantly been estimated in cross-section regressions. Such regressions are capable of capturing the determinants of cross-country differences, but the possible dynamic aspects of international trade are absent. Still, such an approach undoubtedly has advantages: It requires simple estimation methods, the parameters are easily interpreted, and the only concerns are heteroscedasticity, and spatial autocorrelation (which has been neglected until recently[10]). Aitken (1973) is the first to introduce some kind of inter-temporal analysis in gravity modeling (he called it 'temporal cross-section' analysis), when he estimated cross-section gravity models for several consecutive years, and compared the coefficients for the EEC and EFTA membership dummies. He observed that in the first years of the integration the EEC dummy remained insignificant, and this changed only after 1960. The same approach is taken by Frankel (1997), who estimated a gravity model for 63 countries in seven benchmark years (see previous sub-section).[11]

The real solution is provided by panel analysis. Static panel data analysis has been applied by countless studies (see for example Mátyás, 1997; Wall, 2000; Glick and Rose, 2002; Brun, Carrere, and de Melo, 2002). Generally, a fixed-effects estimation is applied, that is, the existence of non-random individual (country specific) effects is assumed, and these individual effects are got rid of by either Least Squares Dummy Variable (and Within Group) estimation or by first-differencing and under the assumption of strict exogeneity of the regressors. As mentioned in Section 4.3, the critique of Anderson and van Wincoop (2003) also encourages the use of panel analysis in fixed-effects specification.

This approach has been criticized by Eichengreen and Irwin (1997)[12], and recently by Bun and Klaassen (2002a). Their main argument is that the impacts of several explanatory variables are likely to exert themselves with delay, and one also has all reason to believe that business connections and distribution networks are not likely to change or vanish immediately. Besides, consumers may also get accustomed to a supplier's goods, and preferences are slow to change. The existence of such rigidities leads to a partial adjustment interpretation of the dynamic specification.

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[9] I thank Prof. Harry Garretsen for suggesting this possible explanation.

[10] This new direction in empirical trade and FDI analysis is becoming more and more popular though, see Blonigen *et al*. (2004) for an application on the U.S. FDI activities.

[11] Frankel estimates a static panel as well.

[12] They apply cross-section estimation but with lagged values of exports.

One may find an alternative theoretical explanation, as well. Since agents are supposed to be imperfectly informed, they must rely on their expectations concerning prices, exchange rates etc. when making decisions. Now, one can interpret the dynamic model within the framework of adaptive expectations (or error-learning process), in the spirit of Cagan (1956) and Friedman (1957). This leads to an autoregressive specification. If one uses static model instead, it is tantamount with assuming that the coefficient of expectations equals one that is the expectations are realized (adjusted) immediately. In other words, past experience is not present in today's expectations.

If any of the above mentioned assumptions hold (this can be tested for), static panel models are likely to be misspecified. In other words: it should be hypothesized that trade is a dynamic process.[13]

Dynamic panel analysis, however, leads to further estimation problems. Nickell (1981) shows that the fixed effect estimators (both with within-group estimation and first-differencing) of dynamic panels are biased and this bias diminishes only if T goes to infinity. As most gravity models are estimated in panels with relatively large N (individuals) and a not too long T (time) dimension, this bias may actually become a problem. For this purpose, several authors propose instrumental variable estimations, where lagged values of the dependent variable are used as instruments (Anderson and Hsiao, 1981), and additional moment restrictions are applied (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). Judson and Owen (1999) carry out several simulations to analyze the behavior of several alternative estimators in panels most commons in macroeconomics (relatively high N, and small or limited T).

In their study, Bun and Klaassen (2002a) estimate a dynamic gravity panel model on the Glick and Rose (2001) dataset, including OECD trade flows for 48 years (very similar to my dataset in this respect). The authors find that the application of lagged dependent variable as regressor not only does significantly increase the fit of the model, but also completely takes care of the serial correlation. The authors also carry out a simulation in order to compare the Arellano-Bond GMM estimator with the traditional LSDV estimator. Quite surprisingly, the Arellano-Bond estimator yields biased estimates of the coefficients, while the LSDV estimator is unbiased. Therefore Bun and Klaassen prefer and suggest the LSDV estimator when T is relatively large (above 30). Their simulation, however, also assumes the strict exogeneity of the regressors.

4.5 The application of gravity equation to a single-country perspective analysis

Gravity equations are principally used to model the bilateral trade flows that take place in a period in a country-group. One can rewrite (4.1) into a static fixed-effect panel model as follows:

[13] There are studies that actually estimate dynamic panels for similar analyses, like Carstensen and Farid (2003) on the FDI flows to Central and Eastern Europe, or de Nardis and Vicarelli (2003) on the short-run impact of the EMU on intra-EU trade.

$$\ln IM_{ijt} = \eta_i + \lambda_t + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_3 \ln P_{it} + \alpha_4 \ln P_{jt} + \alpha_5 \ln Dist_{ij} + u_{ijt} \qquad (4.16)$$
$$u_{i,j,t} \sim iid$$

where IM_{ijt} denotes the imports observed from country *i* to country *j* in period t, Y_{it}, $Y_{jt,}$ P_{it}, and P_{jt} are the GDP and the population of *i* and *j* in period t respectively, and D_{ij} is the geographic distance between *i* and *j*, which is time-invariant. η_i is the individual (country specific) effect, λ_t denotes the time-dummies and ε_{ijt} is the random error-term.

The model in (4.16) can be called a "multi-country approach", that is if there are N countries and T periods, one can observe Nx(N-1) trade flows, that is Nx(N-1)xT observations . The obvious consequence of this approach is that for any countries *i* and *j*, the exports from *i* to *j* are equal to the imports from *i* to *j*. This feature of the traditional "multi-country" gravity equations is often referred to as "symmetry" (see Sanso et al, 1993). Practically, this means that one either estimates exports or imports, but never both. The "single-country approach", applied in the empirical chapters, is different. Now, only those trade flows are observed that take place between a single country and its trade partners, which means that if there are N trade partners and T periods, the number of observation equals NxT only.

The "single-country approach" is not a completely new idea. It was applied to the U.S. bilateral trade as early as 1989 by Summary (1989). She carries out cross-section analyses on the U.S. trade with 66 trading partners for the years 1978 and 1982, and compares the coefficients. A similar "single-country" panel data analysis is carried out for the Netherlands as well by van Beers *et al*. (1999). The authors regress the logs of exports and imports of the Netherlands with 11 of her most developed trade partners in the period 1986-1996 on the logs of GDP, geographical distance, and the first lags of the in- and outward FDI, normalized by their average. None of these studies go into details regarding the econometric consequences of such an approach, however.

Let us take a look at the main differences between the multi-, and the single-country approach now. The first obvious finding is that the trade flows become asymmetric and therefore one has to estimate two models: one for the exports and one for the imports:

$$\ln EX_{it} = \eta_i + \lambda_t + \alpha_1 \ln Y_t^D + \alpha_2 \ln Y_{it} + \alpha_3 \ln P_t^D + \alpha_4 \ln P_{it} + \alpha_5 \ln D_i + ... + u_{it} \qquad (4.17)$$
$$u_{it} \sim iid$$

$$\ln IM_{it} = \eta_i + \lambda_t + \beta_1 \ln Y_t^D + \beta_2 \ln Y_{it} + \beta_3 \ln P_t^D + \beta_4 \ln P_{it} + \beta_5 \ln D_i + ... + v_{it} \qquad (4.18)$$
$$v_{it} \sim iid$$

where the notation is the same as with (4.16), but $Y^D{}_t$ and $P^D{}_t$, which denote the domestic (Dutch) income and population are only time-variant. For the sake of simplicity in the expositon, I specify here static models only. I assume strict exogeneity of the regressors conditional on the individual effects (Wooldridge, 2002: 266.):

$$E(u_{it} \mid \mathbf{X}_i, \eta_i) = 0, \ (t = 1, 2, ..., T)$$
$$E(v_{it} \mid \mathbf{X}_i, \eta_i) = 0, \ (t = 1, 2, ..., T) \qquad (4.19)$$

where $\boldsymbol{X_i}$ denotes the vector of all regressors appearing in (4.17) and (4.18).

There are two practical problems one faces when estimating a single-country panel model. In (4.17) and (4.18) it is assumed that there may be time-variant unobserved effects, which can be captured by time-dummies (λ_t). This does not cause problems in (4.16), but because of the two exclusively time-variant regressors, if one estimate (4.17) and (4.18) it is not possible to identify the real impact of the Dutch GDP and population on foreign trade. Consequently, either one includes year dummies and does not interpret the coefficients: α_1, α_3, and β_1, β_3, or one omits the year dummies. It is possible, however, to use polynomial time-trend to capture these time-variant effects without losing the possibility to identify the coefficients of only time-variant regressors.

Another source of identification problems is the presence of time-invariant variables, typically geographical variables (distance) or policy dummies, which do not change in the observed period. If country-specific dummies are explicitly included in the regressions (4.17) and (4.18), one will observe that some of the dummies are perfectly collinear with these variables. As a consequence, one cannot get rid of the unobserved individual effects by explicitly including country-specific dummies in the regression; instead it is necessary to find an alternative, for example the estimation method suggested by Mundlak (1978).

The single-country perspective has an important advantage, however: in a classical gravity equation one cannot distinguish exports and imports, even though, it is logical to assume that these react differently to important factors like trade liberalization and changes in the real exchange rate. A single-country approach, on the other hand, provides us with the possibility to examine these differences. Also in case of the single-country approach one may include Dutch specific variables in the regression which improves the accuracy of the model.

4.6 Conclusions

In the previous sections of Chapter 4, I have come to the following conclusions concerning gravity equation and the most important problems usually associated with it:

- Gravity equations can be derived from several different theories of international trade. I chose the approach of Bergstrand (1985) to derive a general equilibrium model of world trade, and a partial equilibrium, which led to a "generalized" gravity equation. It is important to bear in mind, that as Deardorff (1998) remarks, the gravity model is consistent with several different theories of international trade.

- This "generalized" gravity model cannot be estimated directly, one needs to use proxies for the regressors. The gravity model is flexible and can be augmented with a lot of additional regressors. The application of a fixed-effect panel model appears to be a sufficient solution to capture the impact of the unobservable "multilateral resistance" effect, proposed by Anderson and van Wincoop (2003).

- Even if the application of log-linear form can be questioned with good reason, it proves to be a very convenient tool that approximates the true functional form quite well. Consequently, I have decided not to reject the log-linearization.

- It seems that it is not possible to draw conclusions from a gravity model about the time trend of average shipping costs with certainty. Yet, some results indicate that the increasing trend of the distance coefficient in absolute term is a consequence of the disproportional reduction of average transportation costs.

- There is reasons to suspect that trade is a dynamic process, which means that a static panel model is misspecified. Therefore both a static and dynamic panel model should be estimated, but the estimates from the dynamic model should be preferred.

Also, as a consequence of our "single-country" approach, one must be aware that:

- One needs to estimate exports and imports both in individual models. This has the advantage that it is possible to observe whether exports and imports reacted differently to the process of trade liberalization.

- If one is interested in estimating the coefficients of time invariant regressors, one cannot apply a Least-Squares Dummy Variable approach, i.e. it is necessary to look for other methods than including country dummies in the regression to handle the unobserved individual effects. Also one cannot include year-dummies in our regressions if it is considered important to interpret the coefficients of regressors that vary over time only.

Finally, it is important to note that Gravity models are capable of capturing the shift in the volume (or value) of foreign trade, that mostly consists of trade creation. This is an important limitation of this approach.

In the following chapter, using our conclusions from Chapter 4, I am going to specify an empirical model of Dutch foreign trade and use it to draw conclusion about the impacts of European Economic Community/European Union on Dutch foreign trade.

V.
An Empirical Analysis of Dutch Foreign Trade 1961-2000

5.1 Introduction

In this chapter, I carry out an empirical analysis of the Dutch foreign trade in the period 1961-2000 applying the single-country perspective gravity model outlined in the previous chapter.

Chapter 5 attempts to answer the following research questions:

- Does European integration have a significant positive impact on the foreign trade of the Netherlands? In other words, did the integration lead to a redirection of Dutch foreign trade?

- If so, does the reaction of the exports and imports to the liberalization differ significantly?

- Is the impact of integration constant (as implicitly assumed by most empirical studies) or does it change over time?

- And finally: is a dynamic specification of the gravity model, as proposed by Bun and Klaassen (2002a) and represented in Chapter 4, superior to the static model and therefore necessary to be applied?

Chapter 5 adopts the following structure: first in section 5.2 I review the data sources and variables. Next, in section 5.3, I specify four (two static and two dynamic) models for the exports and the imports. In Section 5.4 I estimate the basic model and test whether the dynamic specification results in a significant improvement of the model. In Section 5.5 the basic model is augmented so that the impact of the EEC may vary over time. Finally, Section 5.6 summarizes the results and answers the research questions mentioned above.

5.2 Data sources and variables

5.2.1 Data sources

The sample consists of 62 countries observed for 40 years (1961-2000).[1] Even if the sampling is not random, which is not unusual in empirical international economics, it

[1] Austria, Belgian-Luxembourg Economic Union (BLEU), Canada, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Ireland, Japan, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, the USA, Argentina, Brazil, Saudi Arabia, Israel, Iran, Egypt, Indonesia, India, Australia, New Zealand, United Arab Emirates, Bulgaria, Chile, P. R. of China, Cameroon, Colombia, Costa Rica, Cyprus, Algeria, Ecuador, Ghana, Guatemala, Hong-Kong, Honduras, Haiti, Hungary, Morocco, Mexico, Nigeria, Pakistan, Peru, Philippines, Poland, Paraguay, Uruguay, Romania, Singapore, Syria, Thailand, Venezuela, South Africa, Turkey, Tunisia

covers about 90 percent of the Dutch foreign trade. The current value of total exports and imports between the Netherlands and 62 of her trade partners are collected from the site of the OECD (www.sourceoecd.com). The value of foreign trade is converted into constant price USD at Geary-Khamis (further G-K) international PPP rates. The reader finds the description of data and conversion methods in the Appendix. The data for the GDP and population are taken from the on-line database of the Groningen Growth and Development Centre (www.ggdc.net). For the calculation of the real exchange rates we used the Penn World Table 6.1 (pwt.econ.upenn.edu). The distances are simple geographical distances expressed in km between Amsterdam and the commercial centers of the trade partners (their capitals in most cases). This database is available at the CEPII's site (www.cepii.fr). The price of Brent oil is taken from the IMF online database (ifs.apdi.net/imf/).

Some summary statistics of our panel are reported in Table 5.1.a, and b. The normality tests suggest that the imports can be characterized by a log-normal distribution.

Table 5.1.a
Summary statistics of the most important variables, 1961-2000

	Exports (in millions of 1990 G-K USD)	*Imports (in millions of 1990 G-K USD)*	*GDP (in millions of 1990 G-K USD)*	*Population (in thousands)*
Mean	1233.1	1219.9	278500	56269
Median	156.8	189.2	77300.5	12144.4
Std. deviation	3969.8	3311.6	701000	154470
Minimum	1.09	0.35	226	109
Maximum	40642	32445	7960200	1262400
Normality test χ^2 (d.f.=2)	35939***	25694***	32347***	40670***

Note: *,**,*** denotes statistics significant at 10, 5 , 1 % respectively.

Table 5.1.b
Summary statistics of the logarithm of the most important variables, 1961-2000

	Ln(Exports)	*Ln(Imports)*	*Ln(GDP)*	*Ln(Population)*
Mean	5.19	5.30	11.25	9.59
Median	5.06	5.25	11.26	9.40
Std. deviation	1.86	1.97	1.63	1.62
Minimum	0.086	-1.04	5.42	-0.116
Maximum	10.613	10.387	15.89	14.05
Normality test χ^2 (d.f.=2)	65.271***	0.205	41.473***	57.42***

Note: *,**,*** denotes statistics significant at 10, 5 , 1 % respectively.

5.2.2 Variables

In the previous chapter the following gravity equations were specified for exports (4.17) and imports (4.18), and it was also noted that this basic specification must be augmented with further variables:

$$\ln EX_{it} = \eta_i + \lambda_t + \alpha_1 \ln Y_t^D + \alpha_2 \ln Y_{it} + \alpha_3 \ln P_t^D + \alpha_4 \ln P_{it} + \alpha_5 \ln D_i + ... + u_{it} \quad (4.17)$$
$$u_{it} \sim iid$$

$$\ln IM_{it} = \eta_i + \lambda_t + \beta_1 \ln Y_t^D + \beta_2 \ln Y_{it} + \beta_3 \ln P_t^D + \beta_4 \ln P_{it} + \beta_5 \ln D_i + ... + v_{it} \quad (4.18)$$
$$v_{it} \sim iid$$

Where EX_{it} and IM_{it} denotes the exports to/imports from country *i* in period t respectively, Y_{it}, Y_t^D, P_{it}, and P_t^D are the GDP and the population of i and the home country (superscript D) in period t respectively, and D_i is the geographic distance between *i* and and the home country, which is time-invariant. η_i is the individual (country specific) effect, and finally u_{it} and v_{it} are the identically and independently distributed error-terms.

In this subsection, I review the variables to be applied in the empirical panel analysis in the next sections.

Continuous regressors:

GDP, expressed in 1990 G-K USD, ($Y_{i,t}$) is the proxy for country *i*'s domestic income. As it was pointed out in Chapter 4, because of the single-country perspective the Dutch GDP (Y^{NL}_t) and the Dutch population (P^{NL}_t) are both time-varying variables only. As a result these coefficients are identifiable only if no time-dummies are used. The aggregate income variables are expected to have a positive impact on trade. Furthermore, the Dutch GDP is likely to be in endogenous relationship with the exports and imports. Partly, this is caused by the direct contemporary relationship between the GDP and the foreign trade through the basic macroeconomic equation: $Y=C+I+G+EX-IM$, where *C* is the consumption, *I* is investment, *G* denotes government spending and *EX-IM* is the net exports (exports minus imports), and partly by the impact of foreign trade on economic growth (see Chapter 3).

Still, IV estimation[2] results in just slightly and insignificantly different estimates than a standard regression and therefore, for the sake of simplicity, Y^{NL}_t is handled as exogenous. The differences among the coefficients were tested by the Hausman specification test (Hausman, 1978), which yields a χ^2-statistics 0.71 for the export, and 6.74 for the import equation. The degrees-of-freedom (number of regressors tested) is nine in both cases. The test statistics are below the critical value (19.023) therefore the null hypothesis of no significant difference cannot be rejected.

As usual, the impact of distance ($DIST_i$) is expected to be negative and assumed to be constant over time. The population of the partner countries ($P_{i,t}$) and the Netherlands (P^{NL}_t) are also included in the empirical model. One may expect that the impact of the population is negative, because larger countries usually tend to trade less in relative terms.

Numerous studies include the real exchange rate in gravity equations, in order to capture the impact of relative de- and appreciation. We follow this practice. The real exchange rate ($REXCH_{i,t}$) is calculated as:

$$REXCH_{i,t} = E_{i,t} \frac{\pi_t^{NL}}{\pi_{i,t}} \quad (5.1.)$$

[2] The Dutch GDP is instrumented by annual unemployment rates and all other exogenous regressors in the equation.

where $E_{i,t}$ denotes the nominal exchange rate between country *i*'s currency and the guilder in year *t*, $\pi^{NL}_{,t}$ and $\pi_{i,t}$ are the inflation in the Netherlands and country *i* in year *t*. This means if $REXCH_{i,t}$ increases the Dutch currency appreciates relatively to *i*'s currency.

Even if it is not common in gravity equations, I include the price of the Brent oil expressed in 1990 USD ($Oilprice_t$). The role of this variable is twofold: first, it reflects the impact of fuel and energy prices, which are important cost factors in production and transportation; secondly, it also captures the impact of the oil crises. I do not form any *a priori* expectations about the sign of this coefficient, since the impact of oil crises is not necessarily negative on Dutch foreign trade.

Binary regressors (dummies):

Gravity models since as early as 1961 have been using a dummy for neighboring countries (ADJ_i). The explanation is related with cross-border activities: neighboring countries (Germany and Belgium in our case) are expected to trade more than what would be estimated on ground of their economic indicators. Therefore one can expect a positive *ADJ* coefficient.

The membership of the European Economic Community/European Union can be considered as an institutional factor that reduces transaction costs and prices through lower tariffs, unified standards and the reduction of red tape. This impact is to be captured by a dummy variable ($EEC_{i,t}$), which is assumed to be constant by most studies on this field. Unlike those, however, I apply an alternative specification as well, where the impact of the European integration is allowed to change over time. For this purpose, I apply cross-effect variables (slope-dummies) ($EECyear_{i,t}$), which are calculated as the product of the EEC variable and the year dummies:

$$EECyear_{i,t} = EEC_{i,t} \cdot year_t$$

Introducing this variable results in forty new regressors. The coefficients of these variables can be interpreted as the impact of the integration on the value of foreign trade in year t. The coefficient of the $EEC61_{i,t}$, for example, is the estimated impact of integration in the year 1961.

Another regressor is introduced for the EFTA members ($EFTA_{i,t}$) since foreign trade with these countries is also liberalized.

I also introduce a dummy for the European Economic and Monetary Union membership ($EMU_{i,t}$). Even if the euro was introduced after 1 January 1999 only, the proposition of de Nardis and Vicarelli (2003) is quite convincing and therefore I set the dummy one already from 1998 onwards (see Chapter 2 about this issue). The *EMU* coefficient is expected to be positive (as assumed and confirmed by several empirical studies).

A further important variable is the OECD membership dummy ($OECD_i$), which is a time-invariant regressor (I use pre-1994 membership). This variable is important to be included because of the Linder hypothesis (1961). Linder argues that the major shortcoming of the Hecksher-Ohlin trade model, namely that wealthy countries with similar endowments tend to trade a lot with each other, can be explained by the similarities of

the consumer's preferences in those countries. If this is true, the *OECD* coefficient should be positive, reflecting that the Netherlands tends to trade relatively more with developed countries. The *OECD* dummy is probably not the best proxy for capturing the Linder-effect, still, as both the GDP and the population are included in the regression, one cannot use the GDP per capita because of perfect multicollinearity (a GDP per capita coefficient can be calculated from the GDP and the population coefficient though).

Special goods can also cause increased trade with some partners: oil exporters (OPEC members), for example, are likely to have a larger share in the total imports than their other indicators would predict. It is also possible that these significant incomes from oil exports are spent partly on the consumption of highly skill- and capital-intensive goods and consequently these lands command a relatively higher share in Dutch exports as well. In order to capture these effects another dummy is introduced (OIL_i), whose coefficient is expected to be positive.

There are three countries in the sample that were under state-socialist government before 1990. In these countries the foreign trade was strongly regulated, not to mention the political differences, which suggest their share being lower in the total imports and exports than one would expect. For this reason another dummy ($Socialism_{i,t}$) is introduced whose coefficient is expected to be negative. Finally, I apply a dummy ($COLONY_i$) to capture post-colonial relationship. Of the ex-colonies of the Netherlands only Indonesia is present in our sample. The lack of data unfortunately prevents me from including Suriname in the sample. The post-colonial effect is expected to be positive.

The variables used in different specifications are summarized in the following table:

Table 5.2
Variables of the trade model

Variable name	Explanation	Expected sign of coefficient
$\ln EX_{i,t}$ and $\ln IM_{i,t}$	Logarithm of the exports and imports to/from country *i* in year *t*	Dependent variables
$\ln(Y_{i,t})$	Logarithm of the GDP of country *i* in year *t* in thousands.	Positive
$\ln(Y^{NL}_{,t})$	Logarithm of the Dutch GDP in year *t*,	Positive
$\mathrm{Ln}(P_{i,t})$	Logarithm of the population of country i in year *t* in thousands.	Negative
$\mathrm{Ln}(P^{NL}_{t})$	Logarithm of the population of the Netherlands in year *t* in thousands.	Negative
$\ln(\mathrm{Dist})_i$	Logarithm of the distance between country *i*'s commercial center and Amsterdam	Negative
$\ln(\mathrm{REEXCH}_{i,t})$	Logarithm of the real exchange rate between country *i*'s currency and the guilder in year *t* Calculated as (5.1)	Negative in export eq. Positive in import eq.
$\ln(\mathrm{Oilprice}_t)$	Logarithm of the price of Brent oil in 1990 G-K international USD	?
$\mathrm{EEC}_{i,t}$	Dummy variable, set to one if country i was member of the EEC or EU in year *t*, null otherwise.	Positive
$\mathrm{EFTA}_{i,t}$	Dummy variable, set to one if country *i* was member of the EFTA in year *t*, null otherwise.	Positive
$\mathrm{EMU}_{i,t}$	Dummy variable, set to one if country *i* was member of the EMU in year *t*, null otherwise.	Positive
ADJ_i	Dummy variable, set to one if country *i* has a common border with the Netherlands (France, Germany, Belgium).	Positive
$\mathrm{Socialism}_{i,t}$	Dummy variable, set to one if country *i* was under a Socialist government in year *t*, null otherwise. This dummy set to null from 1990 on for all countries.	Negative
Colony_i	Dummy variable, set to one if country *i* was a colony of the Netherlands (only Indonesia).	Positive
OIL_i	Dummy variable, set to one if country *i* is an OPEC member, null otherwise.	Positive
OECD_i	Dummy variable, set to one if country *i* was an OECD member before 1994, null otherwise.	Positive
$\mathrm{EECyear}_{i,t}$	Slope-dummy variable capturing the change of integration effect over time	Positive
trend_t	Linear time trend	?

5.3 Model specifications

5.3.1. The basic model

The basic model is a simple augmented gravity equation, where it is assumed that the effect of integration on the Dutch foreign trade is constant over time. This assumption is general in gravity models, but oversimplifying.

The basic static specification:

The basic static gravity model (Static Specification 1) is the following with either the log of exports or imports as dependent variable:

$$\begin{aligned}
&\ln Q_{i,t} = \eta_i + \alpha_1 \ln Y_{i,t} + \alpha_2 \ln Y_t^{NL} + \alpha_3 \ln P_{i,t} + \alpha_4 \ln P_t^{NL} + \alpha_5 \ln(Dist_i) + \\
&+\alpha_6 \ln(REEXCH_{i,t}) + \alpha_7 \ln(oilprice_t) + \alpha_8 ADJ_i + \alpha_9 EEC_{i,t} + \alpha_{10} EFTA_{i,t} + \\
&+\alpha_{11} EMU_{i,t} + \alpha_{12} Socialism_{i,t} + \alpha_{13} Colony_i + \alpha_{14} OECD_i + \alpha_{15} OIL_i + \alpha_{16} trend_t \\
&+\alpha_{17} trend_t^2 + \alpha_{18} trend_t^3 + u_{i,t} \\
&Q_{i,t} = \left(EX_{i,t}, IM_{i,t}\right)
\end{aligned} \tag{5.2.}$$

Strict exogeneity of the regressors is assumed:

$$E(u_{it} \mid \mathbf{X}_{is}, \eta_i) = 0, \quad \text{for all } t \text{ and } s \tag{5.3}$$

Where $u_{i,t}$ is the independently and identically distributed (iid.) error-term, η_i denotes the individual effects and **X** is the vector of all regressors in the equation. In other words, (5.2) is a fixed-effects panel model (as discussed in Chapter 4, this is partly related to the critique of Anderson and van Wincoop [2003]). The null hypothesis of random-effect specification is rejected by the Hausman-specification test (Hausman 1978, not reported). Bun and Klaassen (2003) explicitly recommend using time-dummies as well (which are denoted by λ_t in 4.17 and 4.18). As I noted earlier, however, I do not to use year-dummies as some regressors are exclusively time-variant, and it would be not possible to identify their effects in presence of year dummies. As some exclusion tests suggests that there are unobserved time-varying effects in the sample, since the year dummies are in most cases significant, I use a polynomial time-trend in the model.[3] So the coefficients of only time-varying variables remain identifiable.

There are several techniques to solve the problem of unobserved individual effects. The introduction of individual-specific dummies (*Least-Squares Dummy Variable - LSDV*), the simplest solution, is not applicable because the coefficients of the time-invariant regressors (*ADJ, Distance, OIL, OECD, Colony*) then cannot be identified.

Another very popular solutions are the Within-Group transformation (when y and **X** variables are replaced by deviations from their country-specific means) and the first-differencing. Both get rid of the unobserved individual effects, but also make it impossible to estimate the impact of time-invariant regressors. In order to cope with this problem, several different techniques have been developed (see Mundlak, 1978; Hausman and Taylor 1981; Amemiya and MaCurdy, 1986). I opt for Mundlak's method because of is simplicity and also because it seems to take care of the problem completely.

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[3] The year-dummy exclusion test results are the following: basic static specification exports: $\chi 2$=899.51 (p=0.000), basic static specification imports: $\chi 2$=565.37(p=0.000), basic dynamic specification exports: $\chi 2$=429.77 (p=0.000), basic dynamic specification imports: $\chi 2$=181.70 (p=0.000).

Mundlak argues that the random-effect specification (when individual effects assumed to have a common expected value and to be independently and identically distributed) neglects the correlation that may exist between the individual effects and the regressors (Hsiao, 2003). For this reason, he proposes the following specification:

$$y_{i,t} = \mathbf{X}'_{i,t}\beta + \bar{\mathbf{X}}_i\alpha + \mu_i + \varepsilon_{i,t}$$
$$\bar{\mathbf{X}}_i = T^{-1}\sum_t X_{i,t}$$
$$E(\varepsilon_{i,t}X_{i,s}) = 0 \text{ for all } t \text{ and } s \quad (5.4)$$
$$E(X_{i,t}\mu_i) = 0$$
$$\mu_i \sim (0,\sigma_\mu^2), \varepsilon_{i,t} \sim (0,\sigma_\varepsilon^2)$$

where $y_{i,t}$ denotes the dependent variable, and $\boldsymbol{X}_{i,t}$ is the matrix of regressors. In words, what Mundlak suggests is that the individual-specific means of the time-varying regressors should be included in order to capture the correlation between the regressors and the individual effects, and estimate a random-effect panel model (under the assumption of strict exogeneity). As a result, the β's should be identical to the coefficients obtained from a Within-Group estimation. Since I assume that the time-invariant regressors are uncorrelated with the unobserved individual effect, it is also possible to estimate the coefficients of the time-invariant regressors.

Finally, a few words about the meaning of the coefficients: One may interpret the coefficients of continuous variables as constant elasticities: that is one percent increase in the regressor will lead to α percent increase in the dependent variable (exports or imports). In case of the binary variables (dummies), the interpretation is not as straightforward as illustrated by Halvorsen and Palmquist (1980). If the dummy is set to one for an individual, one can infer that the dependent variable is increased by $(e^{\alpha}-1)\cdot 100$ percent.

The basic dynamic specification

In Chapter 4, I argued that gravity models estimated in a dynamic specification are preferable over the static ones as static models are very likely to suffer from misspecification. Eichengreen and Irwin (1997) use a one year lagged value of the export as regressors, while Bun and Klaassen (2002a) apply two lags of the dependent variable and the GDP. I do not make an *a priori* assumption about the number of lags, but simply use the significant ones.

The basic dynamic specification 1 is: For the exports:

$$\begin{aligned}
&\ln Q_{i,t} = \eta_i + \sum_{n=1}^{x}\gamma_n \ln Q_{i,t-n} + \alpha_1 \ln Y_{i,t} + \sum_{n=1}^{y}\delta_n \ln Y_{i,t-n} + \\
&+\alpha_2 \ln Y_t^{NL} + \alpha_3 \ln P_{i,t} + \alpha_4 \ln P_t^{NL} + \alpha_5 \ln(Dist_i) + \alpha_6 \ln(REEXCH_{i,t}) + \\
&+\alpha_7 \ln(oilprice_t) + \alpha_8 ADJ_i + \alpha_9 EEC_{i,t} + \alpha_{10} EFTA_{i,t} + \alpha_{11} EMU_{i,t} + \\
&+\alpha_{12} Socialism_{i,t} + \alpha_{13} Colony_i + \alpha_{14} OECD_i + \alpha_{15} OIL_i + \alpha_{16} trend_t \\
&+\alpha_{17} trend_t^2 + \alpha_{18} trend_t^3 + u_{i,t} \\
&Q_{i,\tau} = \left(EX_{i,\tau}, IM_{i,\tau}\right) \tau = t, t-1
\end{aligned} \quad (5.5)$$

If the coefficients of the lagged variables are statistically significant, the static model is misspecified and one should prefer the dynamic specification. Again strict exogeneity is assumed:

$$E(u_{it} \mid \mathbf{X}_{is}, \eta_i) = 0,$$
$$E(v_{it} \mid \mathbf{X}_{is}, \eta_i) = 0, \quad (5.6)$$
$$\text{for all } t \text{ and } s$$

Where $\boldsymbol{X}_{i,t}$ is the matrix of regressors. In case of a dynamic model one also needs to apply a different way of interpreting the results. In a dynamic model the impact of the variables does not exert itself immediately, but takes some time. The length of this adjustment period in years is calculated as $\lambda=1/(1-\Sigma\gamma)$ in equation (5.5). The continuous regressors' long-run elasticity is given as $\alpha\lambda$. If the lags of a regressor are also present, we can simply add the coefficients of all lags. In equation (5.5), for example, $(\alpha_1+\Sigma\delta)\lambda$ yields the long-run impact of a change in partner i's GDP.

Again individual specific effects are present in the model. If one gets rid of these with differencing, the estimates will be biased as shown by Nickell (1981). The reason is that the transformed lagged dependent variable is correlated with the transformed error-term. The magnitude of this bias is inversely proportional with the increase of the time dimension of the panel. There are four methods to correct for this bias:

The Anderson-Hsiao (1981) estimation method is the least complex solution, where the lagged level of the dependent variable is used as instrument. The Arellano-Bond (1991) procedure utilizes additional GMM restrictions on the transformed (differenced) model by using all available lagged values of the dependent variable together with lagged values of the exogenous variables. The GMM-SYS approach suggested by Arellano and Bover (1995), and Blundell and Bond (1998), goes further inasmuch that moment restrictions are posed on level equations as well. As a fourth approach one can mention the LSDV correction method of Kiviet (1995) who proposes that one first calculates the bias (with the help of any of the three methods mention above) and then the bias is simply subtracted from the LSDV estimates. This estimator is often referred to as LSDVC (Least Squares Dummy Variable Corrected), further refined by Bun and Kiviet (2003). This procedure is implemented by Bruno (2004) to a Stata module (*xtlsdvc*), which is applicable to unbalanced panels as well.

As I mentioned in Chapter 4, Bun and Klaassen (2002a) argue that the Arellano-Bond GMM estimator leads to biased estimates in their Monte Carlo simulation on a panel with exactly the same time dimension as the sample for Dutch foreign trade (T=40). For this reason, they prefer the LSDV (or Within-Group) estimation over instrumentation. Even though I do not apply a Monte-Carlo simulation to decide on this issue, the formula suggested by Nickell (1981)[4] makes it possible to estimate the magnitude of

$$\text{plim}(\hat{\rho} - \rho) = \left\{ \frac{2\rho}{1-\rho^2} - \left[\frac{1+\rho}{T-1} \left(1 - \frac{1}{T} \frac{1-\rho^T}{1-\rho} \right) \right]^{-1} \right\}^{-1}$$

[4] According to Nickell's formula the bias can be calculated as follows:
where $\hat{\rho}$ and ρ denote the estimated and the true autoregressive parameters, and T is the length of the time dimension of the panel. Note that the calculated bias applies to AR(1) type dynamic panel models only.

the bias for our panel with T=40 and a single autoregressive parameter set to 0.5 (the closer this parameter is to unity, the smaller the bias becomes), we obtain a relatively small bias, -0.0384, which could even be neglected. I used the *xtlsdvc* module of Bruno to check whether the differences are small and the results confirmed that the bias is negligible. For this reason I apply and report only the Mundlak estimation of the dynamic panel models.

5.3.2. The augmented model (Specification 2)

The augmented model is identical to the basic model with the sole difference that the impact of the integration is allowed to vary over time. In other words we introduce 40 new regressors (*EECyears*, see Section 5.2.2) in the equation and omit the *EEC* dummy.

5.4 Estimation results from Specification 1

The coefficients obtained form the regressions (5.2) and (5.5) are summarized in Table 5.3a, b and 5.4a, b.

5.4.1 Exports

Table 5.3a
Results from Specification 1 for the exports
(robust t-statistics are reported in parenthesis)

Variable	*Static Mundlak*	*Dynamic Mundlak*
$lnEX_{i,t-1}$	-	0.630*** *(18.8)*
$lnEX_{i,t-2}$	-	0.081*** *(2.68)*
$lnY_{i,t}$	0.974*** *(6.45)*	1.159*** *(5.64)*
$lnY_{i,t-1}$	-	-0.864*** *(-4.00)*
lnY_t^{NL}	2.039*** *(6.03)*	2.821*** *(9.83)*
$lnP_{i,t}$	-0.982*** *(-6.72)*	-0.319*** *(-5.91)*
lnP_t^{NL}	16.614*** *(-5.05)*	-0.303 *(-0.12)*
$lnDist_i$	-0.546*** *(-4.85)*	-0.011 (-1.04)
$lnOilprice_t$	0.174*** *(7.09)*	0.044*** *(3.27)*
$lnREXCH_{i,t}$	-0.010 *(-1.14)*	-0.001 *(-0.35)*
ADJ_i	0.830** *(2.46)*	-0.011 (-0.59)
$EEC_{i,t}$	0.734*** *(8.52)*	0.237*** *(6.94)*
$EMU_{i,t}$	-0.011 *(-0.14)*	-0.029 *(-1.35)*
$EFTA_{i,t}$	0.351*** *(4.25)*	0.087** *(2.36)*
$OECD_i$	0.540* *(1.84)*	0.020 (0.91)
$Socialism_{i,t}$	-0.834*** *(-4.49)*	-0.325*** *(-7.15)*
$Colony_i$	0.306 *(1.05)*	0.022 (0.33)
Oil_i	0.556* *(1.84)*	0.002 (0.06)
$trend_t$	-0.375*** (-6.89)	-0.224*** (-5.65)
$trend_t^2$	0.010*** (7.14)	0.007*** (6.96)
$trend_t^3$	-0.0001*** (-7.17)	-0.0001*** (-7.62)
Constant	-176.772*** *(5.86)*	-29.320 (-1.34)
R^2	0.896	0.985
AR(1)-test	4.147*** [p=0.000]	-0.925 [p=0.355]
AR(2)-test	3.984*** [p=0.000]	-0.775 [p=0.439]

Note: Robust t-statistics are reported in parentheses, the t-statistics reported for the static model are robust for both heteroscedasticity and autocorrelation.
*,**,*** denotes coefficients significant at 10, 5 , 1 % respectively. N=2224 (unbalanced panel)

Table 5.3a suggests that the dynamic specification is superior to the static one. In the static models both first- and second-order autocorrelations are present, while applying dynamic specification completely solves this problem. The best dynamic specification seems to be an AR(2) panel model where the first lag of the *lnGDP* yields significant coefficient.

In order to compare the results from the static and dynamic models, I report the long-run elasticities in Table 5.3b. After comparing the results one may conclude that the predicted long-run elasticities can be quite different in the static and dynamic models but they have the same sign.

The dynamic specification suggests that trade is indeed a dynamic process. The length of adjustment is about λ=1/(1-0.630-0.081)=3.46 years; that is any innovation exerts its effect completely in about three and a half years.

Table 5.3b
Long-run impacts calculated from the dynamic models in Table 5.3a.

Variable	*Dynamic Mundlak*
$\ln Y_{i,t}$	1.021^{***} *(χ^2=79.93)*
$\ln Y_{t}^{NL}$	9.761^{***} *(χ^2=65.80)*
$\ln P_{i,t}$	-1.104^{***} *(χ^2=42.21)*
$\ln P_{,t}^{NL}$	-1.048 *(χ^2=0.02)*
$\ln Oilprice_{t}$	0.152^{***} *(χ^2=11.54)*
$\ln REXCH_{i,t}$	-0.035 *(χ^2=0.12)*
$EEC_{i,t}$	0.820^{***} *(χ^2=54.65)*
$EMU_{i,t}$	-0.100 *(χ^2=1.79)*
$EFTA_{i,t}$	0.301^{**} *(χ^2=5.67)*
$Socialism_{i,t}$	-1.125^{***} *(χ^2=54.76)*

Note: *,**,*** denotes coefficients significant at 10, 5 , 1 % respectively. Chi-square tests are reported in parentheses. The null hypothesis is that the long-run coefficient equals zero.

The long-term impact of the partner's aggregate income (GDP), calculated from the dynamic model is about 1.021. Consequently, our static model slightly underestimates the *lnGDP* coefficient (0.974), which is in accordance with the finding of Bun and Klaassen (2002a). The static model seems to underestimate the impact of the Dutch GDP as well: the dynamic Mundlak model estimates the long-run impact at 9.761, which is much higher than in the static model. The impact of the population is found negative and significant by both the static and dynamic models. Interestingly, however, the static specification yields an , in absolute terms, much higher coefficient for the Dutch population ($lnP_{,t}^{NL}$).

In both the static and dynamic specifications the *ln(Oilprice)* coefficient is positive and significant. The possible explanation lies in the natural gas resources of the Netherlands, which provided cheap source of energy and counterbalanced the effect of increasing oil prices, but led to a shrinking of exports of manufactures and services (*Dutch-disease*). The long-run impact of a change in the price of Brent oil is estimated at the same magnitude by both specifications (0.174 in the static and 0.152 in the dynamic specification).

The real exchange rate (*lnREXCH*) coefficient is insignificant both specifications, but its sign is negative just like expected. It seems that the real appreciation or depreciation of the guilder is not an important determinant of foreign trade *ceteris paribus*.

The Mundlak-method makes it possible to estimate the impact of our four time-invariant regressors (*ADJ, OECD, Colony, OIL*). The adjacency dummy is found significant

exclusively by the static model. According to our estimates, holding all other factors fixed, the Netherlands exports 124% more ($e^{0.830}$-1=1.239) to neighboring countries (Germany and Belgium) than to elsewhere. The dynamic Mundlak-model finds this coefficient insignificant though, and as the estimates from static model are biased, the final conclusion is that there is no evidence in favor of the common-border effect.

The *OECD* coefficient is found to be slightly significant by our static model, but not by the dynamic model. It is important to note however that the GDP and population coefficients of trade partners possibly capture most of the effect of the Linder hypothesis. From the coefficients $lnY_{i,t}$, and $lnP_{i,t}$ it is possible to calculate that the impact of per capita GDP is positive on the exports. The *Colony* coefficient is insignificant in both static and dynamic specifications so it is not possible confirm the existence of any post-colonial relationship.

The *Socialism* coefficient is on the other hand significant and negative in the static and in the dynamic models, which suggests that if the destination was under state-socialist government, the Dutch exports were lower by almost 56.6% *ceteris paribus*. The dynamic specification in column 2 provides a similar estimate: the short run impact is about -27.8%, while the long-run impact is -67.5%.

From the perspective of the research questions, the *EEC* dummy is by far the most important regressor. The static panel estimation suggests that exports to EEC members are about ($e^{0.734}$-1)100=108.3% percent higher on average. The dynamic specification yields similar estimates, namely the short-run impact is 26.7%, and the long-run impact is 127%. The results also suggest that the Netherlands exported more to EFTA members in the 1961-2000 period. The EFTA's effect is estimated in the static specification to be about 42%, while the dynamic specification estimates the short-rum impact at about 9.1%, and the long-run impact at 35.1%.

Table 5.4a
Results from Specification 1 for the imports.

Variable	*Static Mundlak*	*Dynamic Mundlak*
$\ln IM_{i,t-1}$	-	0.680*** *(14.6)*
$\ln IM_{i,t-2}$	-	0.102** (2.04)
$\ln Y_{i,t}$	1.421*** *(8.31)*	0.337*** *(5.46)*
$\ln Y_t^{NL}$	2.924*** *(4.56)*	3.689*** *(7.25)*
$\ln P_{i,t}$	-1.332*** *(-5.40)*	-0.316*** *(-3.80)*
$\ln P_t^{NL}$	3.536 *(0.61)*	-8.134*** *(-2.36)*
$\ln Dist_i$	-0.253* *(-1.71)*	0.014 (0.74)
$\ln Oilprice_t$	0.226*** *(5.01)*	0.034 *(1.53)*
$\ln REXCH_{i,t}$	0.005 *(0.42)*	0.003 *(1.15)*
ADJ_i	1.294*** *(2.64)*	-0.040 (-1.53)
$EEC_{i,t}$	0.297 *(1.07)*	0.039 *(0.54)*
$EMU_{i,t}$	-0.352*** *(-2.82)*	-0.109*** *(-3.06)*
$EFTA_{i,t}$	-0.191 *(-0.66)*	-0.033 *(-0.34)*
$OECD_i$	0.152 *(0.34)*	0.017 (0.53)
$Socialism_{i,t}$	-0.686*** *(-3.18)*	-0.197*** *(-3.01)*
$Colony_i$	-0.359 *(-0.69)*	0.015 (0.18)
Oil_i	0.949* *(1.83)*	0.019 (0.33)
$trend_t$	-0.277*** (-2.99)	-0.176*** (-3.43)
$trend_t^2$	0.009*** (3.70)	0.007*** (4.79)
$trend_t^3$	-0.0001*** (-3.92)	-0.0001*** (-5.33)
Constant	-68.208 *(-1.33)*	38.817*** (4.80)
R^2	0.774	0.969
AR(1)-test	4.204*** [p=0.000]	0.868 [p=0.385]
AR(2)-test	4.115*** [p=0.000]	-0.173 [p=0.863]

Note: Robust t-statistics are reported in parentheses, the t-statistics reported for the static model are robust for both heteroscedasticity and autocorrelation. *,**,*** denotes coefficients significant at 10, 5 , 1 % respectively. N=2224 (unbalanced panel)

The expectations about the *EMU* coefficient are not justified though: the impact of the Monetary Union is insignificant but positive in all specifications.

5.4.2 Imports

The results from the basic specifications of the model for imports are reported in Table 5.4a.

In the import equations the AR(2) dynamic specification proves to be better again, but the first lag of the $lnY_{i,t}$ variable is not significant in any of the dynamic specifications and consequently is omitted from Table 5.4a. The length of adjustment is estimated to be 1/(1-0.680-0.102)=4.59 years, which is longer than in case of the exports.

The static model estimates the income elasticity of imports at 1.421, while the dynamic estimates a somewhat larger long-run impact: 1.541. The static estimation underestimates the impact of the Dutch GDP (2.924 against 16.922). The population parameters are negative and significant (except the coefficient of the Dutch population in the static model), just like predicted by theory.

Another remarkable result is, that both in case of exports and imports, the dynamic specification yields insignificant distance coefficients, while the static specification produces the theoretically expected negative and significant coefficients. A possible explanation may be offered by the single-country perspective, applied in this thesis. The sample contains now only the distance between Amsterdam and the commercial centers of the trade partners. This means that the distance variable exhibits much less variation than usual in case of the multi-country approach.

Table 5.4b
Long-run impacts calculated from the dynamic models in Table 5.4a

Variable	*Dynamic Mundlak*
$\ln Y_{i,t}$	1.545^{***} *(χ^2=55.94)*
$\ln Y_{t}^{NL}$	16.922^{***} *(χ^2=22.26)*
$\ln P_{i,t}$	-1.449^{***} *(χ^2=16.94)*
$\ln P_{,t}^{NL}$	-38.138^{**} *(χ^2=4.76)*
$\ln Oilprice_{t}$	0.156^{*} *(χ^2=2.78)*
$\ln REEXCH_{i,t}$	0.014 *(χ^2=1.25)*
$EEC_{i,t}$	0.179 *(χ^2=0.30)*
$EMU_{i,t}$	-0.500^{***} *(χ^2=8.99)*
$EFTA_{i,t}$	-0.151 *(χ^2=0.12)*
$Socialism_{i,t}$	-0.904^{***} *(χ^2=10.08)*

Note: *,**,*** denotes coefficients significant at 10, 5 , 1 % respectively. Chi-square tests are reported in parentheses. The null hypothesis is that the long-run coefficient equals zero.

The *ln(Oilprice)* coefficient is found to be positive in both specifications but significant only in the static specification. The impact of the real exchange rate is found to be insignificant in both specifications, but has the expected positive sign.

The *ADJ* coefficient is found to be significant by the static model only, the estimated impact is high: $e^{1.294}$-1=2.65, that is 265%. Again the reliability of these results is doubtful as the dynamic model in column 2 finds the adjacency coefficient insignificant. Just like before, the common-border effect cannot be confirmed.

Both specifications find the *EEC* coefficient insignificant. This implies that if economic integration has any impact on the Dutch imports, it is either interim or of a very small magnitude. The coefficient of the Monetary Union (*EEC*) is now negative and significant in both specifications. The static model estimates this effect at -29.7 %, while the dynamic specification estimates the short-run impact to be -10.3% and the long-run impact at -39.3%. Again it must be noted that these estimates are acceptable only as initial im-

pacts, but not as long-term effects. Furthermore, letting the *EEC* coefficients change over time may lead to different results.

The only significant coefficient not attended yet is the *Socialism*: as expected, this is negative and significant. The estimated impact is about -52.9% from the static model, while the dynamic specification estimates a short-run effect of about -18.7% and a long-run impact of -61.1%.

5.5 Estimation results from Specification 2

In this section the probably oversimplifying assumption of the basic specification, that the integration effect is constant over time and a simple dummy is adequate to capture its impact, is rejected. For this purpose, I estimate the augmented model (Specification 2) both as a static and a dynamic specification.

5.5.1 Exports

The results in Table 5.5a indicate that the new specification in most cases leads to very similar estimates like in the previous section. The main concern now is the behavior of the EEC-time cross-effect variables. These coefficients are summarized in the next table:

Table 5.5a
Results from Specification 2 for the exports

Variable	*Static Mundlak*	*Dynamic Mundlak*	*Calculated long-run coefficients*
$lnEX_{i,t-1}$	-	0.631^{***} *(18.4)*	-
$lnEX_{i,t-2}$	-	0.084^{***} *(2.70)*	-
$lnY_{i,t}$	0.970^{***} *(6.49)*	1.152^{***} *(5.51)*	1.014^{***} *(χ^2=76.12)*
$lnY_{i,t-1}$	-	-0.863^{***} *(-3.93)*	-
lnY_t^{NL}	1.885^{***} *(4.94)*	2.817^{***} *(8.65)*	9.884^{***} *(χ^2=52.75*
$lnP_{i,t}$	-0.928^{***} *(-6.57)*	-0.314^{***} *(-5.66)*	-1.102^{***} *(χ^2=37.32)*
$lnP_{,t}^{NL}$	16.373^{***} *(4.23)*	0.244 *(0.08)*	0.856 *(χ^2=0.01)*
$lnDist_i$	-0.545^{***} (-4.80)	-0.011 (-1.02)	-
$lnOilprice_t$	0.186^{***} *(6.48)*	0.046^{***} *(3.08)*	0.161^{**} *(χ^2=10.18)*
$lnREXCH_{i,t}$	-0.009 *(-0.94)*	-0.001 *(-0.59)*	-0.0035 *(χ^2=0.14)*
ADJ_i	0.873^{***} (2.60)	-0.010 (-0.59)	-
$EMU_{i,t}$	0.083 *(1.19)*	0.019 *(0.94)*	0.067 *(χ^2=0.88)*
$EFTA_{i,t}$	0.347^{***} *(4.06)*	0.088^{**} *(2.46)*	0.309^{**} *(χ^2=6.16)*
$OECD_i$	0.526^{*} (1.82)	0.019 (0.84)	-
$Socialism_{i,t}$	-0.853^{***} *(-4.63)*	-0.320^{***} *(-6.84)*	-1.123^{***} *(χ^2=55.75)*
$Colony_i$	0.298 (1.01)	0.022 (0.33)	-
Oil_i	0.557^{*} (1.82)	-0.0003 (-0.01)	-
$trend_t$	-0.361^{***} (-5.72)	-0.234^{***} (-5.08)	
$trend_t^2$	0.009^{***} (5.86)	0.008^{***} (6.23)	
$trend_t^3$	-0.0001^{***} (-5.88)	-0.0001^{***} (-6.79)	
Constant	18.657^{**} (2.25)	27.491^{***} (4.50)	-
R^2	0.897	0.985	
AR(1)-test	4.143^{***} [p=0.000]	-1.015 [p=0.310]	
AR(2)-test	3.983^{***} [p=0.000]	-0.817 [p=0.414]	

Note: Robust t-statistics are reported in parentheses, the t-statistics reported for the static model are robust for both heteroscedasticity and autocorrelation. EEC cross-effect variables are reported separately. The long-run coefficients are calculated from the dynamic Mundlak model (chi-square statistics are reported in parentheses). *,**,*** denotes coefficients significant at 10, 5 , 1 % respectively. N=2480

Table 5.5b

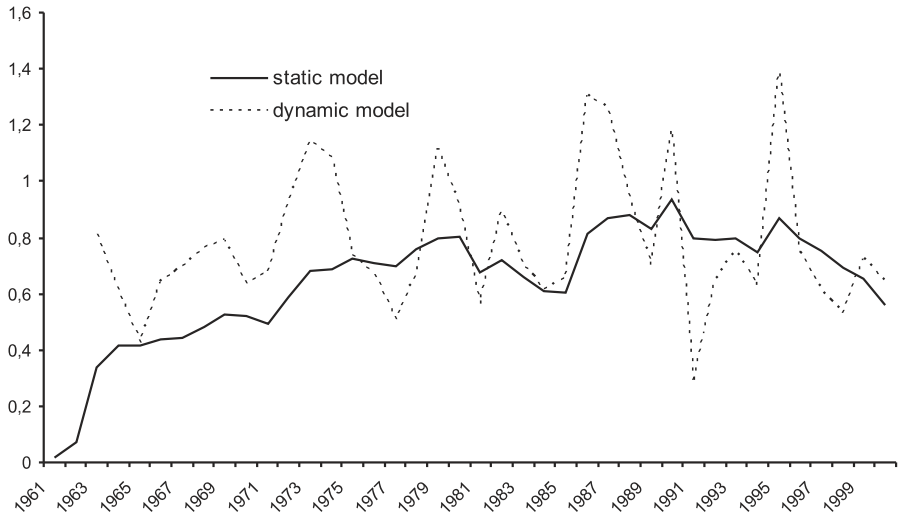
The EEC cross-effect coefficients for the exports

Year	*Static Mundlak*	*Dynamic Mundlak*	*Calculated long-run coefficients*	*Year*	*Static Mundlak*	*Dynamic Mundlak*	*Calculated long-run coefficents*
1961	0.017 *(0.08)*	-	-	1981	0.677*** *(7.37)*	0.161*** *(3.09)*	0.565*** *(χ^2=10.29)*
1962	0.070 *(0.40)*	-	-	1982	0.719*** *(8.30)*	0.255*** *(6.28)*	0.895*** *(χ^2=43.67)*
1963	0.339*** *(2.57)*	0.232*** *52.52)*	0.814*** *(χ^2=25.54)*	1983	0.660*** *(6.97)*	0.200*** *(4.59)*	0.702*** *(χ^2=2328)*
1964	0.417*** *(3.67)*	0.173*** *(4.87)*	0.607*** *(χ^2=22.12)*	1984	0.609*** *(6.47)*	0.176*** *(4.28)*	0.618*** *(χ^2=20.39)*
1965	0.414*** *(3.61)*	0.121*** *(2.96)*	0.425*** *(χ^2=8.77)*	1985	0.602*** *(6.05)*	0.186*** *(4.56)*	0.653*** *(χ^2=22.77)*
1966	0.437*** *(3.86)*	0.183*** *(4.53)*	0.642*** *(χ^2=20.19)*	1986	0.812*** *(8.86)*	0.372*** *(9.07)*	1.305*** *(χ^2=79.64)*
1967	0.442*** *(4.31)*	0.200*** *(5.96)*	0.702*** *(χ^2=34.64)*	1987	0.869*** *(10.22)*	0.360*** *(9.30)*	1.263*** *(χ^2=88.43)*
1968	0.483*** *(4.97)*	0.218*** *(3.87)*	0.765*** *(χ^2=14.93)*	1988	0.883*** *(10.47)*	0.267*** *(6.66)*	0.937*** *(χ^2=53.47)*
1969	0.524*** *(5.56)*	0.226*** *(4.95)*	0.793*** *(χ^2=24.77)*	1989	0.830*** *(9.81)*	0.201*** *(5.15)*	0.705*** *(χ^2=32.35)*
1970	0.519*** *(6.24)*	0.181*** *(3.60)*	0.635*** *(χ^2=13.16)*	1990	0.936*** *(10.44)*	0.337*** *(8.69)*	1.182*** *(χ^2=83.70)*
1971	0.490*** *(5.70)*	0.193*** *(5.88)*	0.677*** *(χ^2=34.58)*	1991	0.795*** *(9.11)*	0.081** *(2.15)*	0.284** *(χ^2=5.23)*
1972	0.585*** *(6.80)*	0.264*** *(7.22)*	0.926*** *(χ^2=50.30)*	1992	0.793*** *(9.32)*	0.185*** *(4.67)*	0.649*** *(χ^2=25.05)*
1973	0.679*** *(7.49)*	0.327*** *(9.19)*	1.147*** *(χ^2=76.75)*	1993	0.797*** *(9.08)*	0.215*** *(5.17)*	0.754*** *(χ^2=29.47)*
1974	0.686*** *(7.57)*	0.309*** *(7.13)*	1.084*** *(χ^2=48.37)*	1994	0.749*** *(8.40)*	0.179*** *(4.64)*	0.628*** *(χ^2=24.59)*
1975	0.727*** *(8.07)*	0.210*** *(4.99)*	0.737*** *(χ^2=27.35)*	1995	0.869*** *(8.64)*	0.395*** *(9.91)*	1.386*** *(χ^2=88.86)*
1976	0.709*** *(8.00)*	0.191*** *(4.68)*	0.670*** *(χ^2=25.12)*	1996	0.799*** *(7.55)*	0.213*** *(5.35)*	0.747*** *(χ^2=32.39)*
1977	0.699*** *(7.59)*	0.146*** *(3.38)*	0.512*** *(χ^2=12.84)*	1997	0.752*** *(6.50)*	0.174*** *(4.26)*	0.611*** *(χ^2=20.73)*
1978	0.757*** *(8.23)*	0.191*** *(4.62)*	0.670*** *(χ^2=24.98)*	1998	0.694*** *(5.53)*	0.152*** *(3.74)*	0.533*** *(χ^2=15.62)*
1979	0.797*** *(8.19)*	0.319*** *(7.91)*	1.119*** *(χ^2=65.88)*	1999	0.651*** *(4.98)*	0.207*** *(4.77)*	0.726*** *(χ^2=24.14)*
1980	0.802*** *(8.12)*	0.257*** *(5.80)*	0.902*** *(χ^2=37.00)*	2000	0.557*** *(4.09)*	0.182*** *(3.83)*	0.639*** *(χ^2=15.21)*

Note: Robust t-statistics are reported in parentheses, the t-statistics reported for the static model are robust for both heteroscedasticity and autocorrelation. The long-run impact has been calculated from the dynamic Mundlak model (chi-square statistics are reported in parentheses).
*,**,*** denotes coefficients significant at 10, 5 , 1 % respectively.
Wald-test of the first column: 478.89 (d.f.=40) (p=0.000)
Wald-test of the second column: 712.38 (d.f.=38) (p=0.000)

The estimated coefficients are not directly comparable from the two models. The coefficients from the static model reflect the long-run impact immediately (an average of 89.8%), while the EEC coefficients of the dynamic model reflect the short-run impact (about 24.9% on average) that is the immediate effect when a country joins the EEC/EU. In order to make the results from the two specifications comparable I report the calculated long-run coefficients in the third column. The long-run coefficients are plotted in Figure 5.1. One can observe a very important difference between the estimates from the static and the dynamic Mundlak-models: while the estimates from the static panel have a clear upward trend up to the mid 1970s, similarly to the findings of Aitken (1973), the long-run coefficients of the dynamic model seem to be stationary around their mean (0.779).

Figure 5.1
The EEC cross-effect coefficients for the exports



Source: Table 5.5b
Note: in case of the dynamic model the long-run coefficients are reported since these are comparable with the coefficients from the static model.

The results from the static model suggest the EEC effect being significant only from 1963 on (the results are similar to that of Aitken (1973) who also finds that it takes some time for the EEC to have a significant impact on trade), which is followed by an upward trend reaching its first peak in 1980 at 0.995 (170.5%). It seems that the EEC impact decreased quite quickly afterward, reaching a bottom in 1984 at 121.1%. In 1986 the EEC impact returns to its previous high value (an impact of the Southern enlargement and the new impetus of European economic integration), which remains until 1995. In the years afterwards, one can observe a gradual decrease, reaching a bottom in 2000 at 127.8% somewhat higher than in 1984. The dynamic Mundlak-model yields significant estimates as well, which strongly supports the findings from the static model: here one can ob-

serve larger fluctuations with peaks in 1973/74, 1979, 1986/87, 1990, and 1995, mostly the years when the EEC is enlarged, the sole exception is 1990.

5.5.2 Imports

While all the other coefficients remained close to the estimates from Specification 1, the *EMU* coefficient is now insignificant. Therefore, it is now possible to reject the hypothesis that the Monetary Union has any significant impact on the imports, and especially one may now argue that the significant, negative coefficients in Specification 1 were caused by the omission of the cross-effect variables.

In Table 5.6b, I summarize the EEC cross-effect coefficients from the static and dynamic Mundlak model.

Table 5.6a
Results from Specification 2 for the imports.

Variable	*Static Mundlak*	*Dynamic Mundlak*	*Calculated long-run coefficients*
$\ln IM_{i,t-1}$	-	0.678^{***} *(14.4)*	-
$\ln IM_{i,t-2}$	-	0.105^{**} *(2.05)*	-
$\ln Y_{i,t}$	1.409^{***} *(8.16)*	0.334^{***} *(5.36)*	1.539^{***} *(χ^2=54.26)*
$\ln Y_{t}^{NL}$	2.857^{***} *(3.89)*	3.758^{***} *(6.48)*	17.318^{***} *(χ^2=19.36)*
$\ln P_{i,t}$	-1.359^{***} *(-5.30)*	-0.331^{***} *(-3.85)*	-1.525^{***} *(χ^2=17.31)*
$\ln P_{,t}^{NL}$	3.872 *(0.56)*	-6.835^{*} *(-1.72)*	-31.507^{*} *(χ^2=2.71)*
$\ln Dist_{i}$	-0.254^{*} (-1.69)	0.013 (0.68)	-
$\ln Oilprice_{t}$	0.255^{***} *(5.02)*	0.044^{*} *(1.73)*	0.203^{*} *(χ^2=3.67)*
$\ln REXCH_{i,t}$	0.003 *(0.25)*	0.004 *(1.39)*	0.018 *(χ^2=0.58)*
ADJ_{i}	1.250^{***} (2.60)	-0.058^{**} (-2.34)	-
$EMU_{i,t}$	0.084 *(0.39)*	-0.003 *(-0.07)*	-0.013 *(χ^2=0.00)*
$EFTA_{i,t}$	-0.207 *(-0.74)*	-0.033 *(0.34)*	-0.152 *(χ^2=0.11)*
$OECD_{i}$	0.163 (0.36)	0.020 (0.62)	-
$Socialism_{i,t}$	-0.653^{***} *(-2.91)*	-0.184^{***} *(-2.74)*	-0.848^{***} *(χ^2=8.34)*
$Colony_{i}$	-0.351 (-0.67)	0.017 (0.20)	-
Oil_{i}	0.948^{*} (1.83)	0.019 (0.35)	-
$trend_{t}$	-0.276^{***} (-2.56)	-0.204^{***} (-3.43)	
$trend_{t}^{2}$	0.008^{***} (3.09)	0.008^{***} (4.57)	
$trend_{t}^{3}$	-0.0001^{***} (-3.20)	-0.0001^{***} (-4.98)	
Constant	-70.645 (-1.17)	21.062 (0.62)	-
R^2	0.774	0.970	
AR(1)-test	4.185^{***} [p=0.000]	0.819 [p=0.413]	
AR(2)-test	4.098^{***} [p=0.000]	-0.193 [p=0.847]	

Note: Robust t-statistics are reported in parentheses, the t-statistics reported for the static model are robust for both heteroscedasticity and autocorrelation. EEC cross-effect variables are reported separately. The long-run coefficients are calculated from the dynamic Mundlak model (chi-square statistics are reported in parentheses).
*,**,*** denotes coefficients significant at 10, 5 , 1 % respectively. N=2480

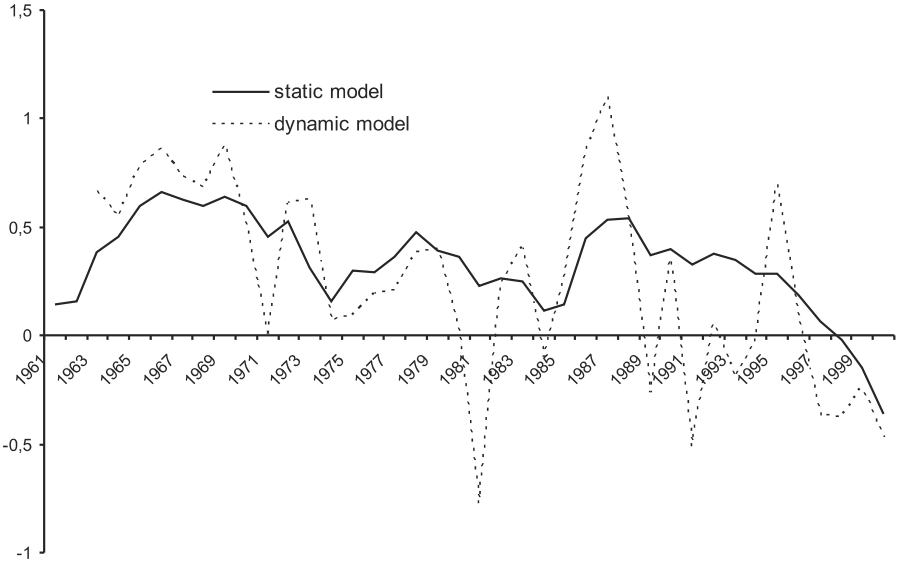
Table 5.6b
The EEC cross-effect coefficients for the imports
(robust t-statistics are reported in parenthesis)

Year	*Static Mundlak*	*Dynamic Mundlak*	*Calculated long-run coefficents*	*Year*	*Static Mundlak*	*Dynamic Mundlak*	*Calculated long-run coefficents*
1961	0.145 *(0.41)*	-	-	1981	0.231 *(0.95)*	-0.167** *(-2.14)*	-0.771* *(χ^2=3.91)*
1962	0.157 *(0.45)*	-	-	1982	0.265 *(1.08)*	0.053 *(0.67)*	0.243 *(χ^2=0.45)*
1963	0.387 *(1.19)*	0.145* *(1.68)*	0.666* *(χ^2=2.74)*	1983	0.253 *(1.00)*	0.089 *(1.12)*	0.409 *(χ^2=1.24)*
1964	0.457 *(1.44)*	0.119 *(1.47)*	0.549 *(χ^2=2.17)*	1984	0.118 *(0.44)*	-0.022 *(-0.26)*	-0.101 *(χ^2=0.07)*
1965	0.600** *(1.98)*	0.170** *(2.15)*	0.785** *(χ^2=4.65)*	1985	0.145 *(0.55)*	0.058 *(0.76)*	0.266 *(χ^2=0.58)*
1966	0.663** *(2.18)*	0.187** *(2.29)*	0.863** *(χ^2=5.26)*	1986	0.401 *(1.63)*	0.184*** *(2.37)*	0.846** *(χ^2=5.49)*
1967	0.626** *(2.13)*	0.159** *(2.03)*	0.732** *(χ^2=4.28)*	1987	0.452* *(1.84)*	0.240*** *(3.21)*	1.104*** *(χ^2=9.29)*
1968	0.601** *(2.24)*	0.145* *(1.90)*	0.680* *(χ^2=3.79)*	1988	0.540** *(2.23)*	0.116 *(1.54)*	0.532 *(χ^2=2.43)*
1969	0.644** *(2.38)*	0.191** *(2.19)*	0.879** *(χ^2=5.00)*	1989	0.371 *(1.43)*	-0.057 *(-0.76)*	-0.264 *(χ^2=0.55)*
1970	0.601** *(2.24)*	0.110 *(1.42)*	0.509 *(χ^2=2.17)*	1990	0.403 *(1.55)*	0.077 *(1.04)*	0.355 *(χ^2=1.12)*
1971	0.456* *(1.74)*	-0.001 *(-0.01)*	-0.003 *(χ^2=0.00)*	1991	0.325 *(1.25)*	-0.111 *(-1.51)*	-0.510 *(χ^2=2.02)*
1972	0.524** *(2.00)*	0.133 *(1.58)*	0.612 *(χ^2=2.63)*	1992	0.376 *(1.35)*	0.013 *(0.16)*	0.059 *(χ^2=0.03)*
1973	0.315 *(1.10)*	0.136* *(1.66)*	0.627* *(χ^2=2.78)*	1993	0.348 *(1.24)*	-0.041 *(-0.50)*	-0.191 *(χ^2=0.24)*
1974	0.155 *(0.53)*	0.015 *(0.17)*	0.070 *(χ^2=0.03)*	1994	0.286 *(0.98)*	-0.005 *(-0.07)*	-0.023 *(χ^2=0.00)*
1975	0.301 *(1.07)*	0.020 *(0.26)*	0.094 *(χ^2=0.07)*	1995	0.288 *(1.01)*	0.152* *(1.87)*	0.700* *(χ^2=3.45)*
1976	0.294 *(1.09)*	0.042 *(0.46)*	0.193 *(χ^2=0.22)*	1996	0.189 *(0.67)*	0.018 *(0.23)*	0.083 *(χ^2=0.05)*
1977	0.363 *(1.35)*	0.045 *(0.57)*	0.206 *(χ^2=0.33)*	1997	0.063 *(0.21)*	-0.080 *(-0.96)*	-0.370 *(χ^2=0.88)*
1978	*0.475** *(1.77)*	0.083 *(1.07)*	0.382 *(χ^2=1.19)*	1998	-0.016 *(-0.05)*	-0.082 *(-0.99)*	-0.377 *(χ^2=0.94)*
1979	*0.390* *(1.45)*	0.086 *(1.11)*	0.397 *(χ^2=1.25)*	1999	-0.151 *(-0.41)*	-0.053 *(-0.57)*	-0.242 *(χ^2=0.33)*
1980	*0.363* *(1.35)*	0.004 *(0.05)*	0.019 *(χ^2=0.00)*	2000	-0.360 *(-0.99)*	-0.102 *(-1.15)*	-0.471 *(χ^2=1.33)*

Note: Robust t-statistics are reported in parentheses, the t-statistics reported for the static model are robust for both heteroscedasticity and autocorrelation. The long-run impact has been calculated from the dynamic Mundlak model (chi-square statistics are reported in parentheses).
*,**,*** denotes coefficients significant at 10, 5 , 1 % respectively
Wald-test of the first column: 122.19 (d.f.=40) (p=0.000)
Wald-test of the second column: 284.09 (d.f.=38) (p=0.000)

Just like in Specification 1, the EEC effect does not seem to be significant, even though the exclusion tests suggest it is necessary to be included in the model. Specification 2 offers a more detailed picture. In most years the EEC had no significant impact on imports, but there are a few years when the effect seems to be significant. The coefficients are slightly significant in the 1960s, in 1973, 1981 and in 1986/87. The long-run coefficients are plotted in Figure 5.2,

Figure 5.2
The EEC cross-effect coefficients for the imports



Source: Table 5.6b
Note: In case of the dynamic model the long-run coefficients are reported since these are comparable with the coefficients from the static model.

One can conclude that the results from Specification 2 seem to confirm that the EEC had just temporary impact on the imports, namely during the initial trade liberalization phase of the integration (1958-1968), and around the enlargements.

This finding may seem surprising, especially in the light of the Vinerian theory of Customs Union (see Chapter 2). As the European integration levies or reduces customs duties on imports, one has a very good reason to expect the intra-EEC imports growing. This is exactly what generally happened in the EEC in this period, therefore it is necessary to look for a country-specific explanation: why is the Netherlands so different?

For the first half of the answer, one has to return to the pre-integration period, when the Netherlands followed a traditionally liberal trade policy. As a result, the Treaty of Rome led to higher customs duties (van Zanden [1997]: 211), which might even have had some negative welfare effects on the Netherlands just like as Davenport (1992) and Pelkmans

(1996) argue. This might be one reason why we find that the European economic integration had virtually no impact on the geographical composition of the Dutch imports.

The second half of the explanation is related to that important feature of Dutch foreign trade that there is a large-scale re-export activity present, mostly through the port of Rotterdam. Typically, lots of goods are being imported from the United States and the Far East so that they are almost immediately re-exported towards EEC members (Kusters and Verbruggen, 2001). The asymmetry of the re-exports, namely that re-export activities from the EU through the Netherlands toward the USA and Asia are of a much smaller extent, may be an important reason for the insignificance of the EEC coefficients in the import equation and also cause the EEC impact on exports being higher.

5.6 Conclusions

In this section I summarize the results from the empirical models, and attempt to answer the research questions in Section 5.1. The analysis of the coefficients reveals the followings:

- The exports and imports seem to be affected differently by the integration. The volume of exports to new EEC members increased by about 24.9% in the short-run, and reached the long-run impact of 118% after an adjustment period of about three and a half year. On the other hand, the EEC had no significant *ceteris paribus* impact on the volume of imports from EEC members. There are, however, a few years when the EEC coefficients become significant even in the import equation. It can be argued that this unexpected result is a consequence of the large-scale re-export activities through the Netherlands and the relatively liberal trade regime applied in the pre-integration period.

- The results reflect a picture, which is quite similar to what Aitken (1973) finds about the integration effects: the positive impact does not exert itself immediately but only after a few years. He finds 1961 the first year when the EEC dummy became significant, while I find that the EEC impact on the Netherlands becomes significant only from 1963 on. It is true however that my sample starts in 1960, when the EEC had already existed for two years.

- Specification 1 seems to indicate that the Economic and Monetary Union has a significant negative impact on imports. Specification 2 however, independently whether it is estimated in a static or dynamic model, rejects this hypothesis. Since the inclusion of time-varying EEC effect seems necessary, the conclusion is that the EMU has no significant impact on either exports or imports. This contradicts the findings of Bun and Klaassen (2002b) and de Nardis and Vicarelli (2003). I would like to emphasize, that my results in this respect are not conclusive regarding the long-run impact of EMU on Dutch foreign trade.

Furthermore, even if the research questions are not explicitly related with these features of the Dutch foreign trade, one may conclude that:

- The real exchange rate appears to have had no *ceteris paribus* impact on the foreign trade of the Netherlands.

- The *COLONY* coefficient is also not significant, that is there is no evidence in favor of the hypothesis that post-colonial relationship leads to higher trade with Indonesia.

The last conclusions are of technical nature:

- One can conclude that the static specification of the gravity model indeed suffers from misspecification, as partly indicated by the presence of autocorrelation. Therefore, it is necessary to carry out dynamic estimation as well. In this chapter I followed the rule of thumb of accepting only those estimates from the static model, which are found to be significant by the dynamic model as well.

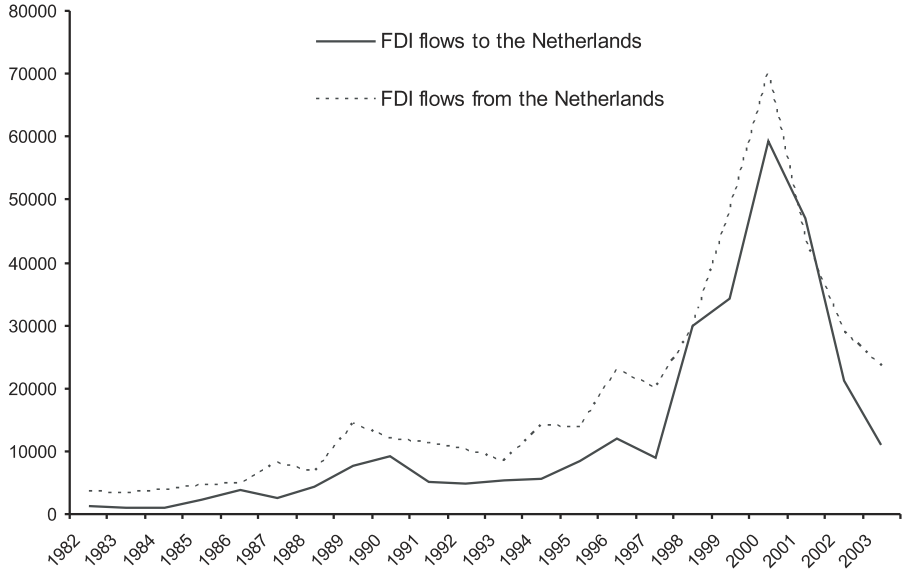
- Also Specification 2, that is enabling the EEC impacts varying over time, performs better in the empirical modeling. The EEC interaction coefficients has a clear positive time trend in case of the static model for exports, while it was about stationary around its mean in the dynamic model, paired with strong fluctuations.

VI.
A theoretical approach to Foreign Direct Investments

6.1 Introduction

Foreign direct investments seem to play an increasingly important role in international factor mobility and commerce. During the last few decades the volume of FDI flows has grown faster than that of the international trade. The magnitude of this growth is even more considerable when we turn our attention to the Dutch statistics: while the value of total Dutch imports about doubled (208%) between 1982 and 2000, according to the data of De Nederlandsche Bank the FDI flows to the Netherlands have increased from about 1379 millions to more than 59 billions of USD at 1990 prices, which is an almost 43 fold increment (4296%).[1] Even if one consider 2001 an exceptional year, in 1996 the value of FDI flows to the Netherlands was eight times more than in 1982 (see Figure 6.1).

Figure 6.1
Foreign Direct Investment to and from the Netherlands in millions of 1990 Geary-Khamis international USD



Source: De Nederlandsche Bank on-line database www.dnb.nl

[1] My calculations are based on the on-line data provided by De Nederlandsche Bank and the Centraal Bureau voor Statistiek. Both datasets are published in current price euros, which I converted into 1990 Geary-Khamis international USD, the currency unit used throughout in this thesis.

The significant rise in FDI activities is a world-wide phenomenon, and as suggested by Di Giovanni (2005), is at least partly due to the increase in cross-border mergers and acquisitions. The current price value of international M&A increased ten-fold in the 1990's, and this world-wide trend may partly explain the exceptionally high peak observed for the Netherlands at the turn of the century. There are other factors as well, which might have caused such a positive shift in the volume of FDI and both the single-market and the European monetary integration are possible candidates.

Since foreign trade and FDI are generally thought to be closely related, any attempt to measure the long-term trade effects of Regional Economic Integration without proper attention paid to FDI flows would be incomplete. The expectation that FDI and trade liberalization are closely related seems to be confirmed by a number of empirical studies. Barell and Pain (1997a), for example, find that the FDI within the EU increased at a particularly high rate after 1985, which is the period of deregulation of national capital and product markets. The pace of growth surpassed that of the rest of the OECD (Barrel and Pain, 1997b).

Chapter 6 adopts the following structure: Section 6.2 briefly summarizes the definition and the classification of FDI, which is followed by a short review of the most important theoretical works on this field. In Section 6.3, I review the Knowledge-Capital Model developed by Markusen (1997, 2002) in detail, and apply the results of his simulations to the Netherlands. Section 6.4 takes a more empirical approach and reviews the results of the most important empirical studies in this field in order to identify those factors that may possibly affect FDI but are not explicitly suggested by the standard theories. Finally, Section 6.5 summarizes the implications of the theoretical model and the indications of the reviewed empirical literature for the model that is to be estimated in the next chapter.

6.2 The classification of FDI

Depending on the way it is created, Foreign Direct Investments may take two forms (Rivera-Batiz and Oliva, 2003):

1. The establishment of new production or R&D facilities abroad or "greenfield" investments.
2. Mergers and acquisitions (M&A) of already existing foreign enterprises.

The main difference between these two forms is that while in the first case the investor owns and controls the newly founded facility, the M&A will not always lead to such situation, since these may result from a firm's portfolio investments as well. Also, Greenfield FDI investment increases the capital stock of the economy, while M&A does not. According to Lipsey (1999) there is another crucial difference between FDI and portfolio investments: while the former does, the latter does not lead to technological spillovers and thereby a growth of Total Factor Productivity (TFP). In the earliest studies on FDI (MacDougall, 1960; Kemp, 1962) though, no distinction was made between these two forms of international investments

Using another classification, which makes it possible to establish a link between international trade and FDI, there are three main forms of FDI:

1. *Horizontal FDI* means the establishment of production facilities abroad, which are engaged in the same industry as the investor.
2. *Vertical FDI*, on the other hand, takes place when the owner and the newly built or acquired firm are in different stages of the production process. Backward FDI happens when an input supplier is acquired, while forward FDI takes place when the producer of an input acquires an input user or distributor.
3. *Conglomerate FDI* involves companies engaged in different business.

The earliest models of vertical FDI are developed by Helpman (1984) and Helpman and Krugman (1985). They assume that multinational firms engage in three main types of activities: R&D, management (assumed to be a capital-intensive activity) and production (assumed to be a less capital demanding). This latter is assumed to be geographically separable from the former without extra costs. It is important to note that this model excludes trade costs completely. As a result, profit-maximizing firms transfer their production activities to countries where labor is more abundant (cheaper), while keeping their capital-intensive activities at home, where capital is relatively abundant. The Helpman-Krugman model implies that vertical FDI is expected to take place between countries with different factor endowments, while between similar countries there should be no vertical FDI at all ('factor-proportion approach' – Brainard, 1993a). Clearly, this model cannot explain the FDI-flows taking place among similar countries and is in need of augmentations.

The motives behind a horizontal FDI are different. The most important models are developed by, among others, Markusen (1984), Brainard (1993a), Markusen and Venables (1995, 1998) and Baldwin et al. (2001). They assume that multinational enterprises (MNEs) establish a number of production facilities in different countries, each serving the local market. They also allow for the existence of economies of scale at firm level. The choice of the firm whether to expand its activities abroad (FDI) or keep exporting depends on the balance between trade costs and the economies of scale. If no trade costs exist, the best way is to concentrate production in one country, export, and fully utilize the economies of scale. On the other hand, when trade costs are present, the level of multinational activities (production in foreign affiliates) increases as long as the variable costs of exporting reach the gains from economies of scale. As a result, this approach can also be seen as a choice between proximity and concentration (Brainard (1993a). Alternatively, one can say that horizontal FDI is based on a "tariff-jumping" strategy: the entrepreneur decides to become multinational in order to by-pass high tariff-barriers. The theory of horizontal FDI predicts that horizontal FDI is likely to take place between countries with similar endowments and production costs.

The above-mentioned models of the two main forms of FDI are unified by Markusen (1997, 2002) within the framework of his Knowledge-Capital (KK) Model, which I will reproduce in the following section.

Carr, Markusen and Maskus (2001) carry out an empirical analysis in order to justify the K-K Model, and show that it is more successful in explaining the US FDI activities in the 1986-1994 period, than the horizontal FDI model. Their study is, however, criticized by Blonigen et al (2002), who argue that because of misspecifications the results of Carr, Markus and Maskus are not reliable, and their own estimates appears to support the horizontal FDI model. The discussion is far from being closed hence.

6.3 The Knowledge-Capital (KK) Model

Let us see now Markusen's model in detail, following his 1997 NBER paper, and Chapter 7 of his monograph published in 2002. This model, as I will demonstrate later, has important implications that must be taken into account when creating the empirical model for the Netherlands.

The KK model is basically a 2×2×2 model, with two countries (home and foreign), two homogeneous goods (*X* and the composite good *Y*) and two factor of production (skilled and unskilled labor). Markusen assumes a CES production function:

$$Y_i = \left[aL_{iy}^{\varepsilon} + (1-a)S_{iy}^{\varepsilon} \right]^{\frac{1}{\varepsilon}} \qquad i = h, f \qquad (6.1)$$

where L_{iy} and S_{iy} are the unskilled and skilled labor used in *Y* sector in country *i*, *h* and *f* denote home and foreign. The elasticity of substitution between the two factors equals $1/(1-\varepsilon)$. *X* is produced with increasing returns to scale by imperfectly competitive (Cournot) firms, but Markusen specifies no production function for X explicitly. Scale economies exist on firm and plant levels.

The model enables three possible configurations of firms: domestic (national) enterprises (*n*-firms), vertical firms or *v*-firms and finally horizontal firms or *m*-firms. "*v*-firms" have Headquarters (HQ)[2] and plants in different countries (vertical FDI), while *m*-firms have one HQ and plants in several other countries (horizontal FDI). Since there are two countries, there are six possible firm types:

Type m_h*:* horizontal multinational enterprise (MNE) with the headquarters in *h*, and the plant in both countries

Type m_f*:* horizontal MNE with the headquarters in *f*, and the plant in both countries

Type n_h*:* national firm with both the headquarters and the plant in *h*

Type n_f*:* national firm with both the headquarters and the plant in *f*

Type v_h*:* vertical MNE with the headquarters in *h*, and the plant in *f*

Type v_f*:* vertical MNE with the headquarters in *f*, and the plant in *h*

Three main assumptions are made about the factor intensity of production:

1. Headquarters activities are more skilled-labor intensive than production.
2. Foreign affiliate plants of multinationals are more skilled-labor intensive than the Y sector of the host country in general.
3. Horizontal MNEs (*m*-firms) are more skilled-labor intensive than national or *v*-firms. The reason is that *m*-firms require additional skills to operate their affiliates.

Moreover the following notation is used:

p_i – price of *X* (in units of composite good *Y*) in country *i* (*i*=*h*,*f*)
w_i – wage of unskilled-labor in country *i*
z_i - wage of skilled-labor in country *i*
c – marginal cost of *X* production in units of *L*
τ – transport costs of *X* in units of *L*
M_i – income of country *i*
X_{ij}^k – sales of a type *k* (*k*=*n*,*m*,*v*) firm in country *i* based in *j*

e_{ij}^{k} – markup of a type k (k=n,m,v) firm in country i based in j[3]
G^k – Fixed costs of a type k firm in units of L. Subscripted as 1 or 2 depending on whether it is applied to activities in the home or the host country.
F^k – Fixed costs of a type k firm in units of S. Subscripted as 1 or 2 depending on whether it is applied to activities in the home or the host country.
n_i, m_i, v_i – number of n, m and v type firms in country i

The costs functions of firms with an HQ in country i are the following:

n-firms:

$$w_i L_i^n + z_i S_i^n = w_i \left[cX_{ii}^n + (c+\tau) X_{ij}^n + G_1^n \right] + z_i F_1^n \qquad (6.2)$$

m-firms:

$$w_i L_{ii}^m + w_j L_{ij}^m + z_i S_{ii}^m + z_j S_{ij}^m = w_i \left[cX_{ii}^m + G_1^m \right] + w_j \left[cX_{ij}^m + G_2^m \right] + z_i F_1^m + z_j F_2^m \qquad (6.3)$$

v-firms:

$$w_j L_{ij}^v + z_i S_{ii}^v + z_j S_{ij}^v = w_j \left[cX_{jj}^v + (c+\tau) X_{ji}^v + G^v \right] + z_i F_1^v + z_j F_2^v \qquad (6.4)$$

The equations above express the costs of skilled and unskilled labor used in the production (left-hand side) as the sum of the variable- and fixed-costs of production (right-hand side). In case of an n-firm (6.2), for example, the production takes place in country i, therefore we find subscripts i only at the left-hand side. At the right-hand side the costs are further broken down into the variable costs of production to the domestic market (cX_{ii}^n), to the export market ($(c+\tau)X_{ij}^n$), and the fixed costs of production (G_1^n, F_1^n), all expressed in units of unskilled and skilled labor.

Let $\bar{L}_i$ and $\bar{S}_i$ denote the total labor endowments of country i. Summing the labor demands of all firms (equation 6.2, 6.3, and 6.4), yields the following labor market-clearing equations:

$$\bar{L}_i = L_{iy} + n_i L_i^n + m_i L_{ii}^m + m_j L_{ji}^m + v_j L_{ji}^v \qquad (6.5)$$

$$\bar{S}_i = S_{iy} + n_i S_i^n + m_i S_{ii}^m + m_j S_{ji}^m + v_i S_{ii}^v + v_j S_{ji}^v \qquad (6.6)$$

In equilibrium the X sector makes no profit, that is the income of country i is:

$$M_i = w_i \bar{L}_i + z_i \bar{S}_i \qquad (6.7)$$

That is the domestic income of country i equals the sum of the wages paid for the skilled and unskilled labor employed in the total production that takes place in i.

[3] Markup is defined as the ratio of price to marginal costs. Generally used as a measure of the firm's market power.

The representative consumer has a Cobb-Douglas utility function:

$$U_i = X_{ic}^{\alpha} Y_{ic}^{1-\alpha} \qquad (6.8)$$

where X_{ic} and Y_{ic} are the consumption of X and Y in country i respectively. For X_{ic} we can write that:

$$X_{ic} = n_i X_{ii}^{n} + n_J X_{Ji}^{n} + m_i X_{ii}^{m} + m_j X_{ji}^{m} + v_i X_{ii}^{v} + v_j X_{ji}^{v} \qquad (6.9)$$

Expressed in words: the total consumption of product X in country i equals the sales by domestic firms ($n_i X_{ii}^{n} + m_i X_{ii}^{m} + v_i X_{ii}^{v}$), and the sales of foreign owned firms ($n_J X_{Ji}^{n} + m_j X_{ji}^{m} + v_j X_{ji}^{v}$) in the home market.

Maximization of (6.8) with respect to the budget constraint M_i yields the following demand functions:

$$X_{ic} = \alpha \frac{M_i}{p_i} \text{ (6.10) and } Y_{ic} = (1-\alpha) M_i \text{ (6.11)}$$

The following inequalities for the relationship between marginal revenue and marginal costs can be associated with the output of the firms:

$$\begin{aligned}
&p_i(1-e_{ii}^{n}) \le w_i c \qquad (\mathrm{X_{ii}^{n}}) \\
&p_j(1-e_{ij}^{n}) \le w_i (c+\tau) \qquad (\mathrm{X_{ij}^{n}}) \\
&p_i(1-e_{ii}^{m}) \le w_i c \qquad (\mathrm{X_{ii}^{m}}) \\
&p_j(1-e_{ij}^{m}) \le w_j c \qquad (\mathrm{X_{ii}^{m}}) \\
&p_i(1-e_{ji}^{v}) \le w_i c \qquad (\mathrm{X_{ji}^{v}}) \\
&p_i(1-e_{ii}^{v}) \le w_j (c+\tau) \qquad (\mathrm{X_{ii}^{v}})
\end{aligned} \qquad (6.12)$$

Where $e_{im}^{\ x}$ denotes the markup of an z-type firm ($z=n,m,v$) in market m ($m=i,j$).

In a Cournot model with homogenous products, the optimal markup is given by the firm's market share, divided by the Marshallian price elasticity of demand. This elasticity is –1, as calculable from (6.10). This means that the markup equals the market share of the firm. Equation (6.10) leads to the following formula for the markup:

$$e_{ij}^{k} = \frac{X_{ij}^{k}}{X_{jc}} = \frac{p_j X_{ij}^{k}}{\alpha M_j} \qquad (6.13)$$
$$k = n, m, v$$
$$i, j = h, f$$

Using (6.13) six zero profit conditions can be written:

For national firms:

$$\begin{aligned}
&p_h e_{hh}^{n} X_{hh}^{n} + p_f e_{hf}^{n} X_{hf}^{n} \le w_h G^{n} + z_h F^{n} \\
&p_f e_{ff}^{n} X_{ff}^{n} + p_h e_{fh}^{n} X_{fh}^{n} \le w_f G^{n} + z_f F^{n}
\end{aligned} \qquad (6.14)$$

for horizontal multinationals:

$$\begin{aligned} p_h e^m_{hh} X^m_{hh} + p_f e^m_{hf} X^m_{hf} &\le w_h G^m_1 + z_h F^m_1 + w_f G^m_2 + z_f F^m_2 \\ p_f e^m_{ff} X^m_{ff} + p_h e^m_{fh} X^m_{fh} &\le w_f G^m_1 + z_f F^m_1 + w_h G^m_2 + z_h F^m_2 \end{aligned} \qquad (6.15)$$

for vertical multinationals:

$$\begin{aligned} p_h e^v_{hh} X^v_{hh} + p_f e^v_{hf} X^v_{hf} &\le w_f G^v + z_h F^v_1 + z_f F^v_2 \\ p_f e^v_{ff} X^v_{ff} + p_h e^v_{fh} X^v_{fh} &\le w_h G^v + z_f F^v_1 + z_h F^v_2 \end{aligned} \qquad (6.16)$$

The zero-profit conditions (6.14-6.16) express that the markup-revenues (left-hand sides of the equations) are equal to or less than the fixed costs of production (right-hand sides).

Substituting (6.13) into the MR-MC inequalities yields:

$$X \ge \beta M_i \frac{p_i - w_i c}{p_i^2} \quad \text{for } X^n_{ii}, X^m_{ii}, X^v_{ij} \qquad (6.17)$$

$$X \ge \beta M_i \frac{p_j - w_j (c+\tau)}{p_j^2} \quad \text{for } X^n_{ij}, X^v_{jj} \qquad (6.18)$$

These can be substituted back to the (6.14-6.16), which leads to six quadratic inequalities:

For national firms:

$$\begin{aligned} \beta \left[M_h \left(\frac{p_h - w_h c}{p_h} \right)^2 + M_f \left(\frac{p_f - w_f (c+\tau)}{p_f} \right)^2 \right] &\le w_h G^n + z_h F^n \\ \beta \left[M_h \left(\frac{p_h - w_f (c+\tau)}{p_h} \right)^2 + M_f \left(\frac{p_f - w_f c}{p_f} \right)^2 \right] &\le w_f G^n + z_f F^n \end{aligned} \qquad (6.19)$$

for horizontal multinationals:

$$\begin{aligned} \beta \left[M_h \left(\frac{p_h - w_h c}{p_h} \right)^2 + M_f \left(\frac{p_f - w_f c}{p_f} \right)^2 \right] &\le w_h G^m_1 + z_h F^m_1 + w_f G^m_2 + z_f F^m_2 \\ \beta \left[M_h \left(\frac{p_h - w_h c}{p_h} \right)^2 + M_f \left(\frac{p_f - w_f c}{p_f} \right)^2 \right] &\le w_f G^m_1 + z_f F^m_1 + w_h G^m_2 + z_h F^m_2 \end{aligned} \qquad (6.20)$$

for vertical multinationals:

$$\beta\left[M_h\left(\frac{p_h - w_h(c+\tau)}{p_h}\right)^2 + M_f\left(\frac{p_f - w_f c}{p_f}\right)^2\right] \le w_f G^v + z_h F_1^v + z_f F_2^v$$
$$\beta\left[M_h\left(\frac{p_h - w_h c}{p_h}\right)^2 + M_f\left(\frac{p_f - w_f(c+\tau)}{p_f}\right)^2\right] \le w_h G^v + z_f F_1^v + z_h F_2^v \quad (6.21)$$

The equations (6.19-6.21) express that the markup revenues (left-hand side of the equations) minus the fixed costs (right-hand side) equals profits, that is the profits should be less or equal zero. Markusen (2002) rewrites the complex equations (6.19-6.21) into a more compact form:

For national firms:

$$\Pi_i^n = a_i M_i + b_j M_j - fc_i^n \le 0$$
$$\Pi_j^n = b_i M_i + a_j M_j - fc_j^n \le 0 \quad (6.22)$$

for horizontal multinationals:

$$\Pi_i^h = a_i M_i + a_j M_j - fc_i^h \le 0$$
$$\Pi_j^h = a_i M_i + a_j M_j - fc_j^h \le 0 \quad (6.23)$$

for vertical multinationals:

$$\Pi_i^v = b_i M_i + a_j M_j - fc_i^v \le 0$$
$$\Pi_j^v = a_i M_i + b_j M_j - fc_j^v \le 0 \quad (6.24)$$

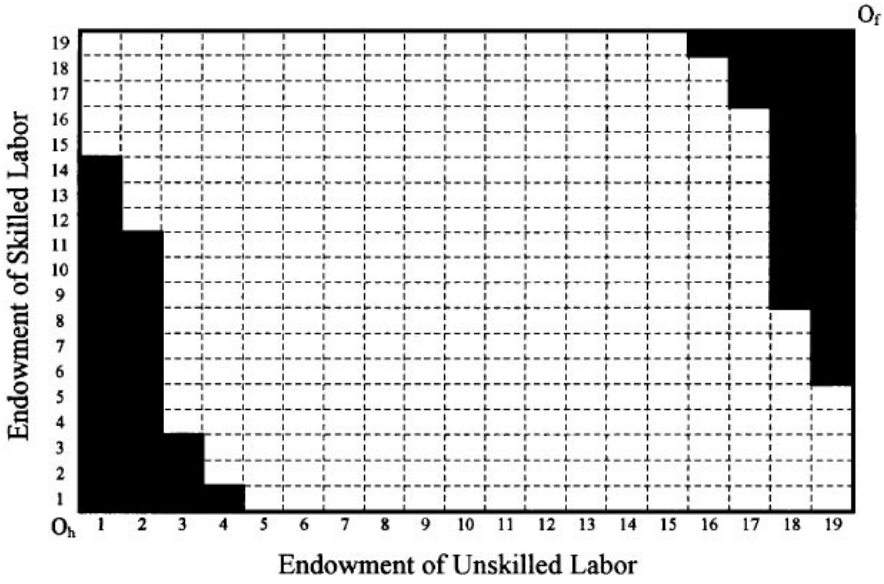
where $a_i > b_j$ if trade costs are positive. That is when the factor prices are equal, but country sizes are different, national firms will have their HQ in the larger market, while *v*-firms are likely to have their HQs in the smaller market. This implies that in this case the larger country would only have *n*-firms. But this is just one of the possible scenarios.

Unlike in former models, the three basic types of enterprises may co-exist in the model, but any of them can dominate depending on the parameters in the inequalities (6.19-6.21). Markusen (1997, 2002) simulates the possible outcomes depending on the differences in size, relative factor endowment, trade and investment costs, and trade regime.

Scenario 1 (Figure 6.2) assumes that trade costs are 25% of the marginal production costs (τ=0.25) but investments are prohibited. Near the origin of the home country (O_h) that is when the home country is small and the partner country is large, only foreign national firms are active (due to economies of scale). This is true for a reverse situation as well: if home country is much larger than the partner country (around O_f), independently of the differences in endowments, only domestic national firms will exist. If one moves

away northwards or eastwards from O_h, the situation will change: if the home country is better endowed with skilled labor than the partner country, or sufficiently endowed with unskilled labor, mutual trade arises, and national firms exist in both countries.

Figure 6.2
Possible outcomes of the K-K Model under trade protection and immobile investments (legend in Figure 6.3)

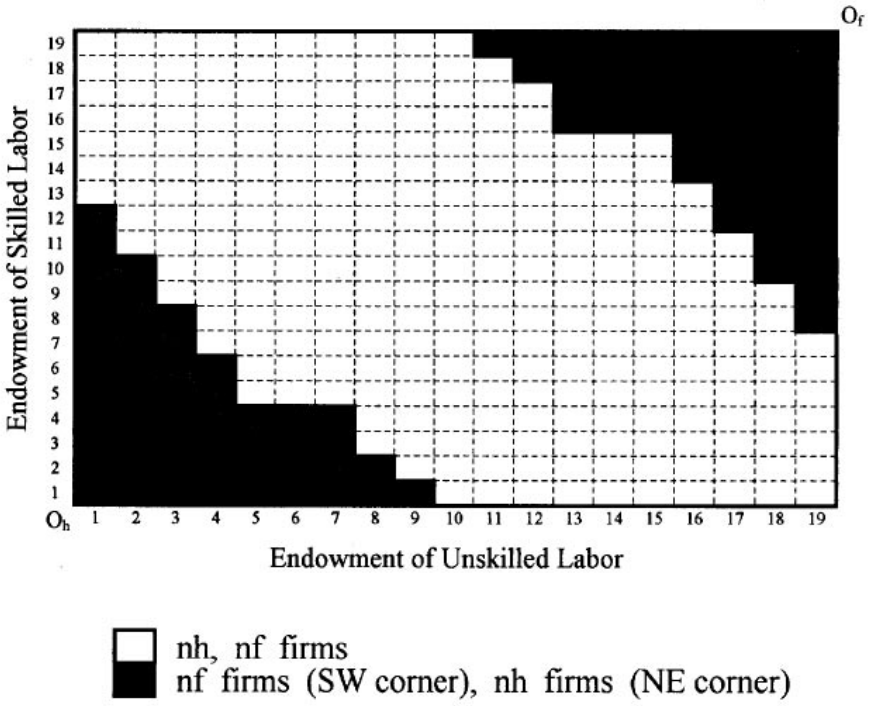


Source: Markusen (1997) Figure 1

Scenario 2 (Figure 6.3) assumes that trade liberalization takes place but investments are still immobile. In this case the outcomes are very similar to the first scenario, that prohibition on foreign investments assures that only national firms exist. Because of the lack of protection on trade, less difference in skill endowments are required so that national firms become active in both countries. If one of the countries is very small, however, all firms are still located in the large country.

Figure 6.3

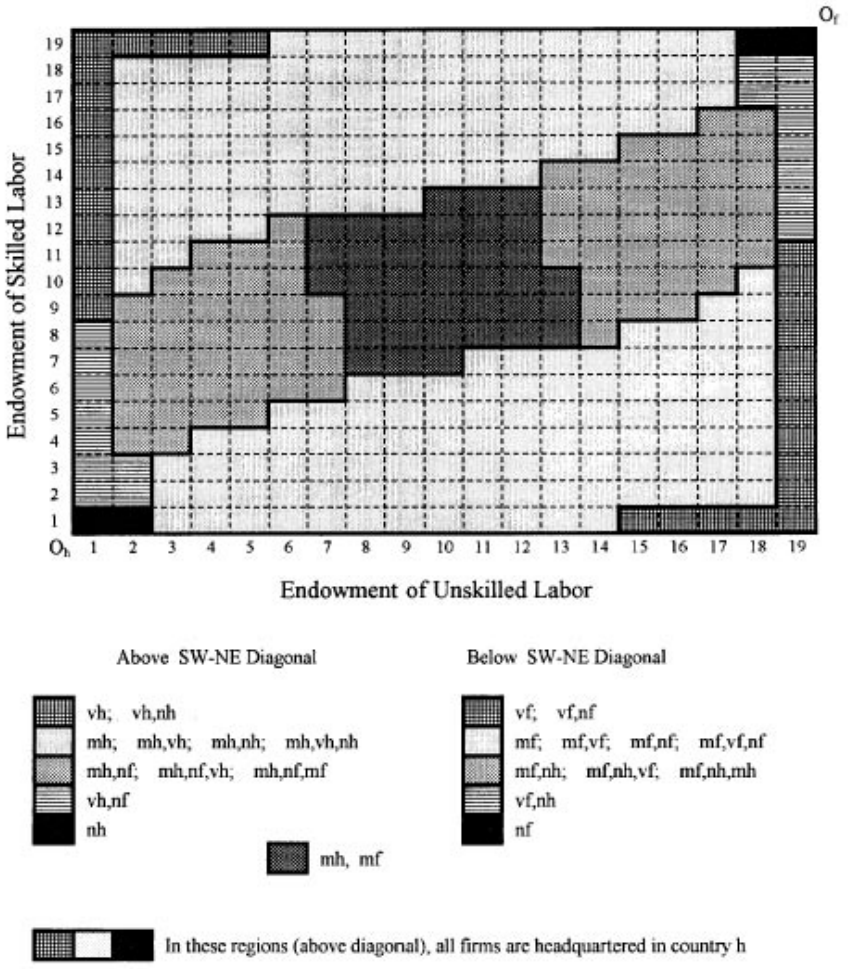
Possible outcomes of the K-K Model under liberalized trade and immobile investments



Source: Markusen (1997) Figure 2

Scenario 3 is much closer to the reality as now trade is not fully liberalized and investments are mobile. If the two countries are of similar endowments and size only horizontal multinationals will exist in the model (the center of Figure 6.4). If countries are similar in endowment but differ in size (moving closer to the SW or the NE corner on the diagonal), vertical FDI activities and national firms also appear. The closer one goes to the SW corner, the more differentiated the activities become. If the two countries are similar in size but differ in endowments, all type of firms will be active, except if size differences take extreme proportions. As Markusen notes, firm headquarters are based in the skill abundant country in this model.

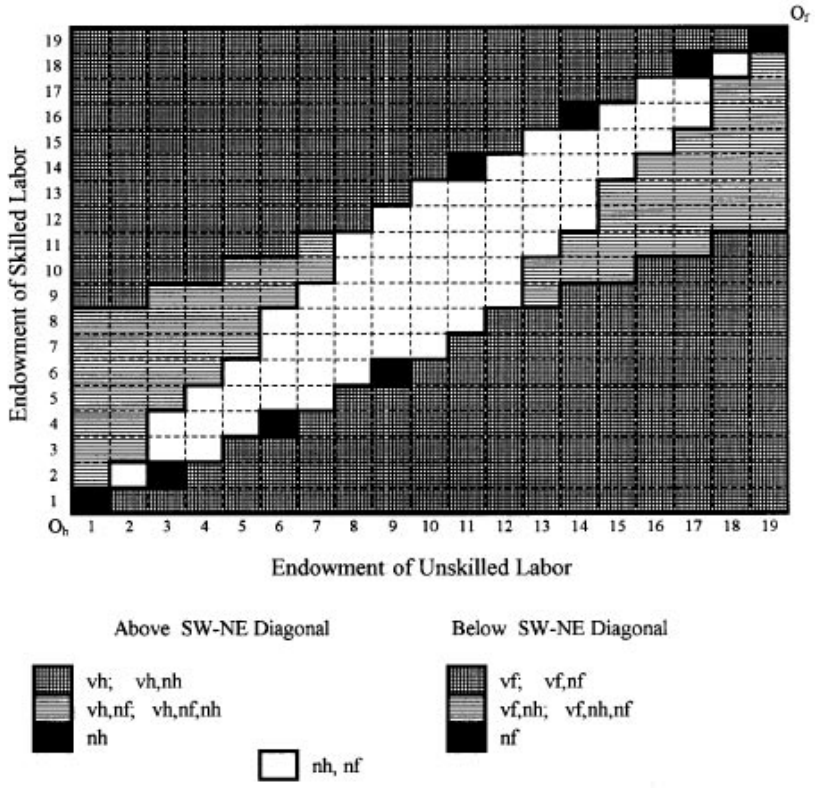
Figure 6.4
Outcomes from Scenario 3, protection on foreign trade, fully mobile investments



Source: Markusen (1997) Figure 3

Finally, Scenario 4 (Figure 6.5) assumes that both trade and investments are fully liberalized. Under this assumption, there are no multinationals in the diagonal (when countries differ in size but not in endowments). This is caused by the factor price equalization by free trade. If the two countries differ in endowments, vertical MNEs will appear to exploit these factor price differences. As expected under completely liberalized trade, no horizontal multinationals will exist.

Figure 6.5
Outcomes from Scenario 4, liberalized foreign trade, fully mobile investments



Source: Markusen (1997) Figure 4

The most important question is which of the above-mentioned scenarios best describe the situation of the Netherlands, a small, open, and skill-abundant economy. Since economic integration had already removed a lot of obstacles before the 1980's, and liberalized both foreign trade and the flow of investments, the most likely conclusion is that the truth lies between Scenario 3 and 4. This leads to the hypothesis that as liberalization within the EU evolves, the volume of FDI flows by horizontal multinationals must decrease and be replaced by foreign trade (national firms) and vertical FDIs. This latter probably was given an impetus in 2004 when 10 Central and Eastern European countries joined the EU, even if it is probably too early now to look for evidence for this hypothesis.

The Knowledge-Capital model of Markusen implies that decisions regarding foreign direct investments are governed by four factors: the skill endowments, the market size, the transaction costs of trade, and finally the degree of the liberalization of capital flows. These are thus the key variables in the empirical model that I will estimate in the next

chapter.[4] Still, there are several empirical works in this field that suggest that there are factors outside the K-K Model that are probably important determinants of the FDI and these should not be disregarded. The next sub-section is devoted to these factors.

6.4 Determinants of FDI

In this section, I summarize the most important empirical variables that have been found by previous studies to be of importance, even though they are not explicitly supported by such a sophisticated theoretical model as that of Markusen. The most recent overview of the empirical works on this field, which the reader may wish to consult, is Blonigen (2005).

Market-related variables

As discussed earlier, market size is an important variable of the K-K Model, still the empirical literature seems to be divided on this issue. Gross Domestic Product, GDP per capita are by far the most popular variables used as proxies for market-size and development level (see Agarwal, 1980 or Nunnenkamp, 2002), making most of the empirical FDI models some kind of gravity equations. A lot of empirical studies seem to confirm the importance of such variables, like Bandera and White (1968), Root and Ahmed (1979), Schneider and Frey (1985), Wheeler and Mody (1992), Taylor (2000), Razin et al. (2003). There are results however indicating that globalization actually diminishes the importance of GDP per capita. Loree and Guisinger (1995) find that GDP per capita of the host countries became less important in the turn of the 1980's, which was probably caused by the change in the motives behind FDI activity: instead of market-seeking FDI, world market oriented FDI became dominant.

Sociopolitical factors

As for political instability of the recipient countries, empirical studies seem to have come to contradictory conclusions. Benett and Green (1972) find that the U.S. direct investments were independent of the political instability of the host countries. On the other hand, Root and Ahmed (1979) come to the conclusion that constitutional changes in governments of developing countries have a significant impact on FDI. Schneider and Frey (1985) find that strikes and riots have a negative impact on the inflow of investments. This puzzle does not seem to be solved very soon, as Wheeler and Mody (1992) concludes that political risk and administrative inefficiency had no significant effect on FDI, while Lucas (1993) finds that some events (like Olympics, or political changes) actually increase the attractiveness of a country.

[3] It is important to note that the K-K Model is a two-country model, which is difficult to generalize to a multi-country case.

Wages

Wage costs are theoretically expected to be important determinants of efficiency seeking FDI activities. In the K-K Model when trade fails to equalize factor prices, vertical MNE may exploit these differences. Still, empirical investigations provide a somewhat ambiguous picture. Owen (1982) and Gupta (1983) find that in case of FDI flows between Canada and USA, wage differences are not significant. On the other hand, several studies (Schneider and Frey, 1985; Lucas, 1993; Wheeler and Mody, 1992; Singh and Jun, 1995) argue that difference in real wages is an important, even though not the most important variable in explaining FDI flows to developing countries.

Exchange rate

There are several works that emphasize the role of exchange rates behind FDI flows. Exchange rate is indeed a likely candidate for an explanatory variable, as the relative price of currencies affects transaction costs directly. On the other hand, it is not only the level of exchange rates that are of importance but also their volatility. If FDI and trade are deemed substitutes (which is clearly true for the tariff-jumping strategy – horizontal FDI), they produce for the same market, and exchange rates should have the opposite effect on FDI flows than on trade. While export is reduced if the home currency appreciates (rising transaction costs), outward FDI is expected to rise. The opposite is also true: depreciating currency makes foreign investors relatively wealthier and results in more inward FDI.

If trade and FDI complement each other, for example if FDI serves for producing for re-exports (Bénassy-Quéré et al, 1999), appreciation decreases FDI inflows, because of the deteriorating competitive position.

Froot and Stein (1991) open a new direction in the debate and argue that under imperfect capital markets the internal costs of capital is lower than borrowing from external sources. This means that if the home currency depreciates, inward FDI may actually increase. The authors also provide empirical evidence based on US data, but their result is criticized by Stevens (1998). Blonigen (1997) works out another scenario under which the depreciation of the host country's currency may increase inward FDI. If FDI is motivated by the aim to acquire firm-specific assets that are transferable over borders without currency transactions, the depreciation of the host-country's currency will lower the price of that asset without reducing its returns. Accordingly, Blonigen finds that Japanese investors reacted to real dollar depreciations by acquiring assets in high-technology industries.

Apparently the direction of the impact of exchange rate on FDI flows depends on the reason for the investment decision, which is normally not observable through aggregated statistics. There are empirical studies reinforcing both hypotheses. Ito et al. (1996), Goldberg and Klein (1997) show that a depreciation increases FDI inflow, while Cushman (1988) and Barrel and Pain (1998) provide evidence for the opposite. Obviously, the fact that aggregated data reflect too many different motives makes it difficult to draw conclusions.

Export orientation of the host country

This topic is closely related to the previous point: since exports may possibly be substitutes or complements of FDI, it is very logical to include exports in the model. The direction of the causal relationship is a main question of course: Singh and Jun (1995) show that in case of developing countries, exports usually Granger caused FDI, serving as a market signal. The same is confirmed for Austria by Pfaffermayr (1994) and for Spain by Bajo-Rubio and Monter-Munoz (2001). Even though Beers et al. (1996) do not explicitly focus on this question, the results of their empirical analysis on the Dutch FDI are indicative of a substitution relationship with exports, and complementarity with imports.

Agglomeration

Agglomeration, that is a positive relationship between the flow of FDI to and the FDI stock already present in a host-country, is also thought to be an important variable. This has several reasons: first, it is realistic to assume that it takes more than one period for a firm to carry out an investment abroad, and secondly it is quite likely that countries with larger stock of inward FDI are more attractive than others. If the empirical model neglects this, it will lead to a misspecification, and the model is likely to suffer from serial-correlation. This of course will change the way one interprets the results from the model. When the lagged value of FDI stock is included it cannot be estimated any more by a simple fixed-effect panel model. It is necessary to take first difference (which take care of the spurious regression problem as well), and to use more sophisticated estimation methods (an Arellano-Bond estimator for example). This model therefore can be seen as a Partial Adjustment Model, which measures the impact of the regressors on the equilibrium level of FDI, and also estimates the speed of the adjustment process.

6.5 Conclusions

In this chapter, I have shown that the Foreign Direct Investment activities of the Netherlands rose sharply during the last two decades, which coincides with the general trends of the World Economy. While there are several models explaining the motives behind FDI, I have reviewed the Knowledge-Capital (K-K) Model developed by Markusen in detail. Based on this, the following hypotheses can be formed about Dutch FDI activities:

- The K-K Model suggests that the decisions concerning FDI are governed by four factors: relative skill endowment, market size, transaction costs of trade, and the costs of the movement of capital.

- In the case of the Netherlands, the most applicable scenarios of Markusen's simulations are Scenario 3 and 4, where the movement of capital is not limited, and trade is gradually liberalized.

- Using these assumptions, one may expect that as European Integration developed, the importance of horizontal (or tariff-jumping) FDI reduced in the intra-EU flows of investments, while the importance of vertical multinationals increased.

- Accepting the previous point, it can be expected that the relationship between FDI and foreign trade might gradually have shifted from substitution toward complementarity.

- The empirical works I reviewed in Section 6.4 indicate that there are further factors that may possibly influence FDI. Among these, market-related variables, such as the GDP or GDP per capita have been found the most important, which indicates that the empirical model will be gravity-like, and due to the importance of agglomeration effects one needs to estimate a dynamic panel model.

VII.
An empirical analysis of the Dutch FDI activities 1984-2002

7.1 Introduction

In Chapter 6 I briefly reviewed the most important theoretical aspects of Foreign Direct Investments and the Knowledge-Capital (K-K) Model in detail and also I attempted to identify the most important factors and variables affecting investment decisions. In this chapter I apply empirical methods to answer the following research questions:

- What is the relationship between the Dutch FDI and trade? This question frequently arises in the literature, and there is evidence for both substitution and complementarity. The direction of this causal relationship can be related to the investment motives.

- What are the main determinants of the out- and inward FDI activities from/to the Netherlands, in other words, what are the main motives behind investments? The causal relationship between FDI and trade may give us hints about the main motives behind FDI activities, but whether this is related to a tariff-jumping, an efficiency- or resource-seeking strategy can be decided on ground of a structural model only.

- Finally, do the European economic (EEC/EU) and monetary (EMU) integration have any significant impact on the Dutch FDI activities? On ground of the K-K model, one has reason to expect that both EEC and EMU lead to a rise of the vertical multinationals while the weight of horizontal MNEs decreases. If this really happened so, the EEC or the EMU should not only have a positive impact on the value of FDI, but also affect its relationship with foreign trade.

The chapter is structured as follows: Section 7.2 briefly reviews the data sources and provides a general picture about the evolution of Dutch FDI activities in the last twenty years. In Section 7.3, after a short literature overview, I carry out a causality test in order to obtain a clear picture about the relationship between foreign trade and FDI. In Section 7.4, I will estimate static and dynamic panel model for both out- and inward FDI and look for answers to the above-mentioned research questions. Finally, Section 7.5 summarizes the findings.

7.2 Data and sources

In this chapter, similarly to many empirical works, I use FDI stock data rather than flows. The main reason is that flows may often be negative (caused by repatriation of

profits for example), while stocks are strictly positive.[1] This enables one to loglinearize the empirical model, which makes the estimation more convenient.

The panel for outward FDI consists of 37 countries and 19 years (1984-2002), while the panel for inward FDI has 23 countries and 19 years. The reason for the difference in the number of countries is that inward FDI are more concentrated geographically than outward FDI. In 2000, for example, the five most important sources and destinations of FDI (the USA, Belgium, Germany, the United Kingdom, and France) accounted for about 63.6 percent of the total Dutch FDI stocks abroad and roughly 71.6 percent of the foreign FDI stocks in the Netherlands (see Table 7.1). The evolution of the share of different continents and country-groups in total FDI stocks, however, shows a quite similar picture (see Figure 7.1a and b).

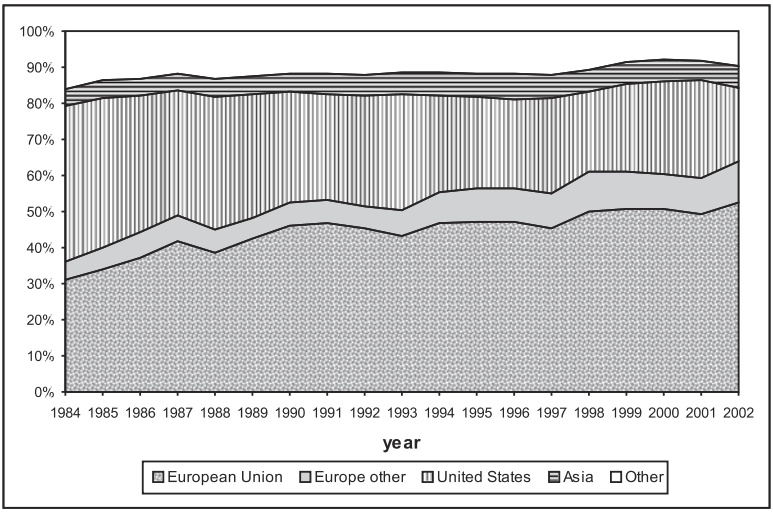
Table 7.1
Share of different sources and destinations of Dutch FDI in 2000

Partner	***Share in Dutch FDI stocks abroad***	***Share in foreign FDI stocks in the Netherlands***
USA	25.8%	21.5%
Belgium	10.9%	15.7%
United Kingdom	10.6%	15.6%
Germany	10.2%	13.7%
France	6.1%	5.1%
Top5 total	***63.6%***	***71.6%***
Other EU	13%	11.8%
EU total	**50.8%**	**61.9%**
Europe other	9.6%	6%
Asia	6%	4.5%
Rest of the World	**7.8%**	**6.2%**

Source: De Nederlandsche Bank
Note that the table is constructed so that it does not add up to 100%.

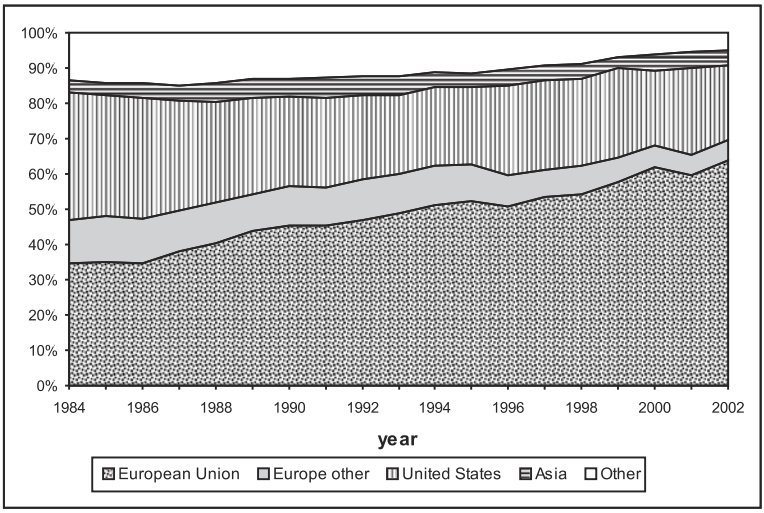
[1] I omit those observations however where the FDI stock is zero. This is a general practice in empirical research even though leads to a sample-selection bias.

Figure 7.1a
The geographical distribution of Dutch FDI stock abroad (outward FDI stocks) 1984-2002



Source: De Nederlandsche Bank

Figure 7.1b
The geographical distribution of foreign FDI stock in the Netherlands (inward FDI stocks) 1984-2002



Source: De Nederlandsche Bank

In both figures one can observe a significant increase of the share of EU members, apparently mostly at the expense of the United States: the US investors' share in total FDI

stocks in the Netherlands falls from 36% in 1984 to 21.2% in 2002. The weight of USA as a destination of Dutch FDI also decreases significantly from 49.2% in 1984 to 20.3% in 2002. In the same period the share of EU countries in total incoming FDI stock grows steadily from 34.8% to 63.9%, and the share of EU countries in total Dutch outward FDI stocks expands from 31% to 52.3%. Whether this is an impact of the European integration is a main question of this chapter. An important difference is that while the share of non-EU member European countries increased in total Dutch FDI stocks abroad, their share decreased in the foreign FDI stocks in the Netherlands. It appears as if the increase of the share of EU members occurred also at the expense of non-EU members. One should not forget, however, that both in 1986 and 1995 new members joined the EU and this resulted upward shift in the share of the European Union. The sum of the shares of EU members and other European countries increases in both figures, which indicates that the share of Europe increased at the expense of other continents.

Data on the Dutch FDI (both stocks and flows) is available online on the homepage of De Nederlandsche Bank (http://www.dnb.nl). The collection of FDI statistics is, however, often problematic, and one may find serious differences between the theoretical and statistical definition of foreign direct investments. The widely accepted definition of Foreign Direct Investments states that "FDI occurs when an investor based in one country, acquires an asset in another country with the intent to manage that asset."[2] As the FDI statistics are collected as part of the balance of payment statistics according to IMF guidelines, an increase in the FDI does not necessarily mean that a new investment really took place. A large share of FDI flows occur in order to acquire existing firms or finance merger operations, without directly creating a new stock of assets. Another source of measurement problems is that profits of foreign-owned firms are generally measured as outflows from the host country, while undivided profits are taken into account as inward FDI, even though there is no guarantee that these resources will be spent on investments. Also, if a foreign-owned affiliate borrows from the host-country, it will also appear in the FDI statistics as inward investment. Problems may arise from different institutional and legal structures too. For example, some may regard 20% foreign ownership as the lower limit of a firm being under foreign control, others may find the threshold being at 50% (see South Centre, 1997).

These differences in national rules and definitions should not cause any problem for now, since only the definitions of the De Nederlandsche Bank are used. According to this, all transactions that are meant to acquire or found an enterprise with the intent to manage it, and also all financial transactions between the owner company and its affiliates count as FDI.

The GDP and GDP per capita are taken from the Groningen Growth and Development Center (http://www.ggdc.nl). The real exchange rates are calculated from the data available in the Penn World Table 6.1 (http://pwt.econ.upenn.edu). The data on the average years of schooling are from the Barro-Lee dataset[3]

[2] World Trade Organization: Annual Report, Vol.1. Trade and Foreign Direct Investment, WTO, Geneva

[3] There are other similar datasets available, for example that of Domenech and de la Fuente (2002), still the data of Barro and Lee are still the most widely used.

(http://www.cid.harvard.edu/ciddata//Appendix%20Data%20Tables.xls), which provides data for each fifth year only. I use the "spline smoothing" function of the GiveWin2 to interpolate the missing observations. The data on the competitive position of the Netherlands expressed as annual change in percentages are published as Appendix B1 in the Central Economisch Plan (Central Economic Plan) by the Centraal Planbureau (http://www.cpb.nl/nl/data/cep2005/b1.xls). The competitive position of the Netherlands indicator is calculated as the difference of the average annual change of unit labor costs in the competitor countries and in the Netherlands. Consequently, a negative value indicates that the unit labor costs increases in the Netherlands at a higher pace than in the rest of the World, which has a detrimental impact on the competitiveness of Dutch goods. This indicator is applied as a proxy for the relative efficiency of the Dutch producers. The data sources and conversion methods are summarized in the Appendix.

7.3 Does FDI cause trade or *vica versa*? A causality analysis.

7.3.1 Substitutes or complements?

Before building an empirical model for FDI, an important question arises, namely the direction of causal relationship between FDI and foreign trade. As it was shown in the previous chapter, the expectations about the direction of causal relationship between trade and FDI depend mainly on the incentives behind FDI.

In case of horizontal (or tariff-jumping) FDI, multinationals move their production abroad because the variable costs of exporting (tariffs and transaction costs) are high enough to make it profitable. From this perspective one can expect that exports and FDI are negatively related, that is, FDI is a substitute for exports. In other words, as the Heckscher-Ohlin Model suggests, factor movements eliminate the price differentials and therefore the reason for trade (Mundell, 1957).

On the other hand, theories concerning the possession of intangible assets (Dunning, 1981; Caves, 1982), or increasing returns to scale (Helpman, 1984; Helpman and Krugman, 1985) all support the possibility that outward FDI and exports are complements. Ethier (1986) shows that under uncertainty, FDI between countries with similar endowments becomes higher in both directions, paired with an increasing intra-industry and intra-firm trade. The K-K Model (Markusen, 1997) that was reviewed in detail in the previous chapter, also suggests that under liberal investment policy and gradually liberalized international trade one may expect the increase of vertical FDI activities and foreign trade (exports) at the expense of horizontal MNEs. This should also lead to the further strengthening of the complementary relationship.

Many empirical studies appear to confirm the complementarity hypothesis. Lipsey and Weiss (1981, 1984) carry out a cross-section analysis for the year 1970 and found exclusively positive coefficients (not all are significant though). Blomström et al. (1988) use data for the FDI from the USA and Sweden in the period 1978-1982, and find a positive relationship between exports and FDI, which is especially evident, when FDI is regressed on the change of exports. Furthemore, Yamawaki (1991), Pfaffermayr (1994, 1996) and Bajo-Rubio and Montero-Munoz (2001) also find evidence that FDI and ex-

ports are complements, however, only Pfaffermayr (1994, 1996) and Bajo-Rubio and Montero-Munoz apply Granger causality tests for Austria and Spain respectively.

There are results, which question complementarity though: Kim and Rang (1997) use a cross-section approach for South-Korea and Japan cannot find any relationship between exports and outward FDI. The work of Beers *et al*. (1996) is especially important for this dissertation as they estimate an empirical model on the Dutch exports and imports to/from 11 partners in the period 1986-1996 with the out- and inward FDI among the regressors. They find the impact of outward FDI stock on exports significant and negative, which also indicates a relationship of substitution. In case of imports, however, the relationship between inward FDI and imports is found to be positive and significant, an evidence in favor of complementarity.

Independently of the interpretation of results, however, the link between FDI and foreign trade seems to be firmly confirmed. Aizenman and Noy (2005) apply disaggregated trade and FDI data to analyze the two-way relationship between trade and investments. Using a decomposition method proposed by Geweke (1982) they find that 81% of the feedback observed between trade and FDI are attributable to a two-way Granger causality while the rest is explained by the simultaneous correlation of the time-series.

In the followings, I carry out a Granger causality test for the outward FDI and exports of the Netherlands in the period 1984-2002. On ground of the previous chapter and the results from earlier studies, the following hypotheses can be formed about the causal relationship between outward FDI (inward FDI) and exports (imports):

- *Hypothesis 1:* It is expected that outward (inward) FDI causes exports (imports), that is there is a positive, statistically significant causal relationship. This would reinforce the complementariness hypothesis. Pfaffermayr (1994) could not reject the existence of such a causal link for Austria at 10% level of significance, and Bajo-Rubio and Montero-Munoz (2001) found the same for Spain.

- *Hypothesis 2:* It is less straightforward whether exports (imports) also cause outward (inward) FDI. If exports are indeed market signals, the relationship should be positive. Bajo-Rubio and Muntero-Munoz, however, cannot confirm the existence of such a causal relationship in Spain, and Pfaffermayr found it to be negative for Austria.

- *Hypothesis 3:* As a third possible outcome, one may hypothesize that a two-way relationship exists between outward (inward) FDI and exports (imports). In case of time-series analysis or with a panel with a longer time dimension one can even go further and expect cointegration (a long-run equilibrial relationship between FDI and trade). The evidence for cointegration would indicate that there is a long-run equilibrium between FDI and foreign trade. The results are contradictory though: Pfaffermayr cannot confirm that outward FDI and exports are cointegrated, while Bajo-Rubio and Montero-Munoz actually find a cointegrating relationship for Spain.

7.3.2. A test of causal relationship

My approach is somewhat different from that of Pfaffermayr (1994, 1996) and Bajo-Rubio and Montero-Munoz (2001): they applied time-series analysis while I opt for a panel causality test. This decision is motivated by the relatively short observation period (19 years). The panel applied for this analysis has consequently a relatively small time dimension but contains 37 countries. As such, it is not likely that foreign trade and FDI are found cointegrated.

The Granger test was used in Chapter 3 already to explore the relationship between openness and per capita GDP growth, and there I presented the main idea behind this causality test. In short, if one finds that the past values of process X can significantly explain the variation of the present value of Y, one can argue that X Granger causes Y. Pfaffermayr (1994) proposes the use of a third variable for Granger causality tests in order to avoid the omitted variable bias. In case of an open economy, one may assume that GDP affects both FDI and exports, and omitting it would result in a biased estimation. For this reason, I will carry out the Granger test both with and without the GDP as third regressor (Y).

The causality regressions are the following (if GDP is included):

$$\ln Y_{i,t} = \eta_i + \sum_{n=1}^{p} \alpha_n \cdot \ln Y_{i,t-n} + \beta \cdot \ln Z_{i,t} + \sum_{m=1}^{q} \gamma_m \cdot \ln X_{i,t-m} + \varepsilon_{i,t}$$
$$E(\varepsilon_{i,t} X_{i,s}) = 0 \text{ for all i and s} \qquad (7.1)$$
$$E(\varepsilon_{i,t} Z_{i,s}) = 0 \text{ for all i and s}$$

and

$$\ln X_{i,t} = \eta_i + \sum_{n=1}^{p} \alpha_n \cdot \ln X_{i,t-n} + \beta \cdot \ln Z_{i,t} + \sum_{m=1}^{q} \gamma_m \cdot \ln Y_{i,t-m} + \varepsilon_{i,t}$$
$$E(\varepsilon_{i,t} Y_{i,s}) = 0 \text{ for all i and s} \qquad (7.2)$$
$$E(\varepsilon_{i,t} Z_{i,s}) = 0 \text{ for all i and s}$$

Where $Y_{i,t}$ denote the Dutch FDI stock in country i (outward FDI), or the foreign FDI stock in the Netherlands (inward FDI) originated from country i in year t. $X_{i,t}$ denotes the exports to or the imports from country i respectively, while $Z_{i,t}$ denotes GDP of the country i in year t. The variable η_i denotes the country-specific effect that is a fixed-effects specification is used. The strict exogeneity of the regressors is assumed.

A simple GLS estimation of the transformed equations would be biased, since the lagged endogenous variable is correlated with the lagged error-term (Nickell, 1981). This bias diminishes as the time dimension of the panel gets large, but as the T is just 19, it is necessary to apply the GMM-SYS estimation proposed by Arellano and Bover (1995), Blundell and Bond (1998), or a bias-correction method suggested by Kiviet (1995) and Bun and Kiviet (2003). The standard Arellano-Bond (1991) estimator assumes the following standard moment restrictions:

$$E\left[\Delta\varepsilon_{i,t} \ \ln Y_{i,s}\right]=0$$
$$E\left[\Delta\varepsilon_{i,t} \ \ln X_{i,s}\right]=0 \qquad (7.3)$$
$$s=1,\ldots,t-2$$

The GMM-SYS estimator utilizes not only transformed but also level equations and therefore is more efficient than the Arellano-Bond estimator. The additional restrictions are:

$$E\left[\varepsilon_{i,t} \ \Delta\ln Y_{i,t-1}\right]=0$$
$$E\left[\varepsilon_{i,t} \ \Delta X_{i,t-1}\right]=0 \qquad (7.4)$$

As (7.3) suggests, almost all lagged values of the endogenous variable can be used as instrument. Using all available lags however results in too many instruments, which is the reason why I choose to maximize the number of lags used for instrumentation at 2. Furthermore, I assume the strict exogeneity of the log of GDP (that is I use it as a standard instrument):

$$E\left[\Delta\varepsilon_{i,t} \ \Delta Z_{i,t}\right]=0 \qquad (7.5)$$

The estimation yields the following results (I report the coefficients of the parsimonious regressions, that is, the model is reduced until only significant coefficients remain), from a two-step GMM-SYS estimation:

Table 7.2a
Results of the Granger causality test without GDP as exogenous regressor

	exports→FDI^{out}	FDI^{out}→exports	imports→FDI^{in}	FDI^{in}→imports
α_1	0.701*** (6.50)	0.628*** (4.66)	0.958*** (42.98)	1.018*** (33.80)
α_2	-	0.253* (2.00)	-	-
α_3	0.208*** (4.34)	0.164** (2.36)	-	-
γ_1	0.117* (1.72)	-	0.061* (1.77)	-
γ_2	-	-0.034* (-1.88)	-	-0.023* (-2.00)
AR(1)	-1.30 (p=0.194)	-1.90* (p=0.057)	-3.21*** (p=0.001)	-3.25*** (p=0.001)
AR(2)	-0.81 (p=416)	0.05 (p=0.964)	0.02 (p=0.520)	0.79 (p=0.429)
Hansen-test of overi-dent. restrictions	36.73 (d.f.=89)	36.03 (d.f.=88)	22.30 (d.f.=96)	22.94 (d.f.=96)
Exclusion F-test of the γ coefficients	2.95* (d.f.= 1, 36)	3.53* (d.f.= 1, 36)	3.15* (d.f.= 1, 22)	3.98* (d.f.=1, 22)

Note: Robust t-statistics are reported in parentheses. All coefficients and statistics reported are from the two-step estimation, where robust standard errors are finite sample corrected by the method of Windmeijer (2000).

***,**,* denote that the coefficient is significant at 1, 5, 10 percent level of significance respectively.

Table 7.2b
Results of the Granger causality test with GDP as exogenous regressor

	Exports→FDI^{out}	FDI^{out}→exports	imports→FDI^{in}	FDI^{in}→imports
α_1	0.695*** (5.77)	0.606*** (4.71)	0.948*** (30.19)	0.999*** (25.07)
α_2	-	0.255** (2.04)	-	-
α_3	0.184*** (3.33)	0.125* (1.95)	-	-
β	0.042 (0.93)	0.029 (1.60)	-0.028 (-0.80)	0.013 (0.57)
γ_1	0.066 (0.96)	0.027** (2.12)	-	-
γ_2	-	-0.060** (-2.28)	0.111 (1.43)	-0.019** (-1.58)
AR(1)	-1.29 (p=0.197)	-1.92* (p=0.054)	-3.24*** (p=0.001)	-3.24*** (p=0.001)
AR(2)	-0.82 (p=0.410)	-0.07 (p=0.943)	0.03 (p=0.505)	0.78 (p=0.434
Hansen-test of overident. restrictions	35.96 (d.f.= 89)	36.75 (d.f.= 87)	22.09 (d.f.=96)	22.84 (d.f.=96)
Exclusion F-test of the γ coefficients	0.91 (d.f.= 3, 36)	4.33** (d.f.= 2, 36)	2.04 (d.f.= 1, 22)	2.50 (d.f.=1, 22)

Note: Robust t-statistics are reported in parentheses. All coefficients and statistics reported are from the two-step estimation, where robust standard errors are finite sample corrected by the method of Windmeijer (2000).
***,**,* denote that the coefficient is significant at 1, 5, 10 percent level of significance respectively.

The results in Table 7.2b indicate that the log of the GDP is not significant in any of the equations. It seems that the inclusion of the GDP is much more important in time-series causality tests but has no apparent role in case of a panel based Granger-test. For this reason, I accept and interpret the results from Table 7.2a.

Based on the Granger-test results, it can be concluded that there exists a two-way causal relationship between FDI and trade in the 1984-2002 period, even though the lack of cointegration means that there is no long-run equilibrial relationship between foreign trade and FDI. The decisions about the causal relationships are summarized in Table 7.3. The sign of the causal relationship is determined on ground of the sum of the jointly significant gamma coefficients. If their sum is positive, the causal relationship is also positive, that is an increase of the X variable in the past increases the Y variable in the present.

Table 7.3
Causality relationships between FDI and foreign trade

	Sign of causal relationship at 10% of significance
exports→FDI^{out}	+
FDI^{out}→exports	**-**
Imports→FDI^{in}	+
FDI^{in}→imports	**-**

Exports appear to have a positive effect on outward FDI, which coincides with what Pfaffermayr (1994) and Bajo-Rubio and Montero-Munoz (2001) found for Austria and Spain.[4] Export therefore indeed seems to function as market-signal, and consequently has a positive impact on outward FDI.

The results show, however, that outward FDI negatively Granger-causes exports. This finding is similar to Pfaffermayr (1994) who also finds a negative causal relationship from FDI toward exports in Austria, reinforcing the substitution hypothesis. On the other hand, Bajo-Rubio and Montero-Munoz provides evidence in favor of both short- and long-run positive causal relationship (complementarity). It can be concluded that this result indicate substitution in case of outward FDI and exports.

As for imports the direction of causal relationships is basically the same. Imports indeed Granger-cause inward FDI, but with a positive sign: imports tend to increase future inward investments. The results suggest inward FDI having a negative impact on the imports, which is indicative of substitution again.

The final conclusion is that the Granger tests seem to confirm all hypotheses except cointegration. Both out- and inward FDI Granger cause exports and imports, indicating a substitution relationship. This is somewhat different from what Beers *et al.* find. Their results confirm substitution in case of outward FDI and exports, but complementarity in case of inward FDI and imports. Most likely this difference is caused by the different estimation techniques and the difference in the sample size.

The significant substitution relationship is indicative that the majority of investments were horizontal. This appears to be a quite general among developed countries both in- and outside the EU, even though, this contradicts the theoretical expectations: in Chapter 6 the K-K Model indicated that trade liberalization should lead to a dominance of vertical FDI and a gradual disappearance of vertical FDI. This does not seem to have happened, but before drawing final conclusions I turn to a more detailed panel analysis.

7.4 A panel analysis of FDI

7.4.1. Model specifications

In this section, an empirical model is applied to explore the motives behind foreign direct investments. As shown in Chapter 6, one may need to include the lagged value of FDI in the right-hand side of our regression, which makes the model dynamic. This is important because of the agglomeration effect and also because investments are expected to be at least partly lumpy and inflexible.

Also as market-related variables such as GDP and population are thought to be an important determinant of Foreign Direct Investments, the empirical model is gravity-like. I estimate the following dynamic models with and without the interaction variable:

[4] Bajo-Rubio and Montero-Munoz found that exports affect FDI positively only in the long-run, and they found no relationship in the short-run. Since in this case no cointegration is found, one can conclude that only a short-run relationship exists.

$$\ln FDI^{out}_{i,t} = \eta_i + \sum_{j=1}^{p} \gamma_j \ln FDI^{out}_{i,t-j} + \beta_1 \ln Y_{i,t} + \beta_2 \ln Y^{NL}_t + \beta_3 \ln pop_{i,t} + \beta_4 \ln pop^{NL}_t + \beta_5 \ln EXP_{i,t-1} +$$
$$+\beta_6 \ln REXCH_{i,t} + \beta_7 concpos_t + \beta_8 \ln schoolyears_{i,t} + \beta_9 EEC_{i,t} + \beta_{10} EMU_{i,t} + \quad (7.6)$$
$$+\beta_{11} \cdot trend_t + \beta_{12} \ln(EXP_{i,t-1} \cdot EEC_{i,t-1}) + u_{i,t}$$

and

$$\ln FDI^{in}_{i,t} = \eta_i + \sum_{j=1}^{p} \gamma_j \ln FDI^{in}_{i,t-j} + \beta_1 \ln Y_{i,t} + \beta_2 \ln Y^{NL}_t + \beta_3 \ln pop_{i,t} + \beta_4 \ln pop^{NL}_t + \beta_5 \ln IMP_{i,t-1} +$$
$$+\beta_6 \ln REXCH_{i,t} + \beta_7 concpos_t + \beta_8 \ln schoolyears_{i,t} + \beta_9 EEC_{i,t} + \beta_{10} EMU_{i,t} + \quad (7.7)$$
$$+\beta_{11} \cdot trend_t + \beta_{12} \ln(IMP_{i,t-1} \cdot EEC_{i,t-1}) + u_{i,t}$$

The notation is summarized in Table 7.4:

Table 7.4
Notation and variables in the FDI models

Variable	Description	Variable	Description
$FDI^{out}_{i,t}$	Dutch FDI stocks in country *i* in year *t*	$concpos_t$	The competitive position of the Netherlands in year *t*. (see Section 7.2)
$FDI^{out}_{i,t}$	FDI stocks in the Netherlands originated from country *i* in year *t*	$schoolyears_{i,t}$	The ratio of the average educational attainment expressed in years in country *i* and the Netherlands in year *t*.
$Y_{i,t}$ Y^{NL}_t	GDP of country *i* in year *t*, superscript "NL" denotes the Netherlands	$EEC_{i,t}$	Dummy variable, set to unity if country *i* is a member of the EEC/ EU in year *t*.
$POP_{i,t}$ POP^{NL}_t	population of country *i* in year *t*, superscript "NL" denotes the Netherlands	$EMU_{i,t}$	Dummy variable, set to unity if country *i* is a member of the EMU in year *t*.
$EXP_{i,t}$	Exports from the Netherlands to country i in year *t* (in millions of 1990 USD)	$EXP_{i,t} \cdot EEC_{i,t}$	Interaction variable for the relationship between EEC membership and the impact of exports on outward FDI.
$IMP_{i,t}$	Imports from country *i* in year *t* to the Netherlands (in millions of 1990 USD)	$IMP_{i,t} \cdot EEC_{i,t}$	Interaction variable for the relationship between EEC membership and the impact of imports on inward FDI.
$REXCH_{i,t}$	Real exchange rate between the guilder and country *i*'s currency in year *t*.	$trend_t$	Time trend

The use of the first lags exports and imports are important because of the possible endogenous relationship between FDI and trade. Because of the only time-variant Dutch specific variables I include no year dummies in the regression but attempt to capture the unobserved time-varying effect with the help of a linear time trend (a higher order polynomial time trend proved to be insignificant). With help of models (7.6) and (7.7), I test the following five hypotheses:

- Hypothesis 1 assumes that both outward and inward FDI can be modeled by a very simple gravity-like equation with market-related variables (GDP, population) among the regressors. This assumption is very general in FDI modeling, and is supported by a considerable amount of empirical evidence (see Chapter 6). Furthermore, market-size is suggested to be of importance in the Knowledge-Capital (K-K) Model of Markusen (1997, 2002), as discussed in Chapter 6. Both GDP and population capture a different aspect of market size. The Dutch GDP and population (Y^{NL}_t and POP^{NL}_t) are also important variables because the K-K Model emphasizes the relative differences in size.

- Hypothesis 2 assumes that the real exchange rate ($REEXCH_{i,t}$) is an important factor that influences the decision of investors. The direction of the impact of real exchange rate on FDI depends strongly on the relationship between FDI and trade: in case of substitution, for example, the sign of the coefficient should be exactly the opposite of what one would obtain in an export (import) regression. The same sign, on the other hand, reinforces the complementarity relationship. This variable is also connected to the K-K Model since real exchange rates are generally regarded as important components of transaction costs.

- Hypothesis 3 is related to the main motives behind foreign investments. For this purpose two variables are used in the regression: the competitive position of the Netherlands ($concpos_t$), and the logarithm of the ratio of the average schooling years in a partner country and the Netherlands ($schoolyears_{i,t}$). This latter is again directly related to the Knowledge-Capital Model discussed in Chapter 6. Markusen's model implies that the relative abundance in skills might be of importance for FDI. In other words, these variables are used to test for the "efficiency-seeking", and the "resource-seeking" hypothesis. At least one of these coefficients is expected to be positive and significant.

- Hypothesis 4 assumes that the EEC and EMU membership results in a positive shift in the value of FDI. Therefore, I include the $EEC_{i,t}$ and the $EMU_{i,t}$ dummies. It is expected that both variables have a significant positive impact on both out- and inward FDI. These policy variables represent institutional factors that directly affect transaction costs and the freedom of capital flows. Therefore they can also be considered as practical counterparts of a key factor of the K-K Model: the degree of liberalization of trade and capital flows.

- Finally, Hypothesis 5 assumes that complementary relationship between exports (imports) and outward (inward) FDI strengthens over time. Namely, this is what one can expect on ground of the Scenarios 3 and 4 of the K-K model: the simulations indicate that when the free flow of capital is paired by trade liberalization, horizontal FDIs gradually cease to exist. As horizontal FDI is substitute for foreign trade, the positive relationship between exports (imports) and outward (inward) FDI should be stronger within the EU. In order to test this hypothesis, a cross-effect variable $EEC{\cdot}EXP$ ($EEC{\cdot}IMP$) is included in the empirical model.

7.4.2 Estimation

The above mentioned dynamic specification is essentially Partial Adjustment Models (PAM), as I demonstrate below. Before doing so, one has to make two assumptions: there is an equilibrium level of FDI stock (FDI^*), and the FDI stock tends to move toward this equilibrium but this process requires time.
Algebraically:

$$\Delta \ln FDI_{i,t} = \varphi(\ln FDI^*_{i,t} - \ln FDI_{i,t-1}) \qquad (7.8)$$

where

$$\Delta \ln FDI_{i,t} = \ln FDI_{i,t} - \ln FDI_{i,t-1} \qquad (7.9)$$

The coefficient φ reflects the speed of adjustment. Convergence requires that $0<|\varphi|<1$.

(7.8) and (7.9) after some transformations yields:

$$\ln FDI_{i,t} = \eta_i + (1-\varphi)\ln FDI_{i,t-1} + \varphi \ln FDI^*_{i,t} \qquad (7.10)$$

Where η_i denotes the individual (country-specific) effect. Also it is assumed that the equilibrium value of FDI stock depends on some exogenous regressors (***X***) and the individual effects α_i:

$$\ln FDI_{i,t} = \eta_i + (1-\varphi)\ln FDI_{i,t-1} + \varphi\theta \mathbf{X} + u_{i,t} \qquad (7.11)$$

or using another notation.

$$\ln FDI_{i,t} = \eta_i + \gamma \ln FDI_{i,t-1} + \boldsymbol{\beta}\mathbf{X} + u_{i,t} \qquad (7.12)$$

The speed of adjustment can be calculated as $1/(1-\gamma)$ and is expressed in years. This can be interpreted as the time needed for the system to return to its equilibrium, or as the time which is needed for the impact of an innovation to completely wear out. $\boldsymbol{\beta}$ denote the short-term impacts of the exogenous variables on *lnFDI*, and $\beta/(1-\gamma)$ are the long-term impacts of an exogenous regressor on *lnFDI* and the equilibrium FDI stock *ceteris paribus* in an AR(1) specification. Equation (7.11) states implicitly that the speed of adjustment is the same for all countries. Finally, the strict exogeneity of the regressors is assumed.

Unlike in Chapter 5, the time dimension of the panel is relatively low, 19 years, and therefore one may not hope that the bias in the dynamic panel estimation is negligible.[5] Consequently, the coefficients from the GMM-SYS estimation are reported only. Again the length of the dependent variable used as instruments is maximized at 2. Furthermore, I treat the two population variables as strictly exogenous, and the two GDP variables as predetermined, that is their first lag is used as instrument.

[5] Using the formula of Nickell (1981) for the magnitude of bias, I calculated that the bias would be about -0.0937, under the assumption of an autoregressive coefficient 0.5. In other words, the relative bias is almost 20%.

7.4.3. Results

The results from the estimation of the outward FDI model are reported in the Table 7.5 below. In the third column I report the parsimonious version of the dynamic model, that is, all regressors of the original model with a t-statistics less than one is excluded.

Table 7.5
Estimation results from the outward FDI model. GMM-SYS estimation. The dependent variable is Ln($FDI_{i,t}^{out}$)

	Dynamic GMM-SYS	***Dynamic with interaction variable***	***Parsimonious dynamic model***
ln($FDI_{i,t-1}^{out}$)	0.516** (2.51)	0.520** (2.68)	0.671*** (7.66)
ln($Y_{i,t}$)	0.603** (2.65)	0.640** (2.44)	0.597*** (3.04)
Ln(Y^{NL}_t)	0.140 (0.10)	0.233 (0.16)	2.514*** (3.17)
ln($POP_{i,t}$)	-0.378** (-2.05)	-0.394* (-2.01)	-0.403*** (-3.09)
Ln(POP^{NL}_t)	-0.637 (-0.41)	-0.751 (-0.49)	-2.951*** (-3.37)
ln$EXP_{i,t-1}$	0.188 (0.75)	0.157 (0.57)	-
ln$REXCH_{i,t}$	-0.041 (-0.88)	-0.033 (-0.69)	-
concpos$_t$	0.009*** (3.20)	0.009* (1.91)	0.006** (2.73)
ln($schoolyears_{i,t}$)	0.583 (0.67)	0.648 (0.74)	-
$EEC_{i,t}$	-0.045 (-0.10)	0.119 (0.17)	-
$EMU_{i,t}$	-0.217 (0.86)	-0.135 (0.17)	-0.289 (-1.03)
trend$_t$	0.063** (2.10)	0.056 (1.52)	
ln($EEC_{i,t-1}$·ln$EXP_{i,t-1}$)	-	-0.005 (-0.04)	-
AR(1)	-1.27 [p=0.205]	-1.28 [p=0.201]	-1.32 [p=0.188]
AR(2)	-0.99 [p=0.325]	-0.98 [p=0.329]	-1.05 [p=0.295]
Hansen-test of overidentification	27.36 (d.f.=33)	25.34 (d.f.=32)	33.46 (d.f.=4)

Note: Robust t-statistics are reported in parentheses. All coefficients and statistics reported are from the two-step estimation, where robust standard errors are finite sample corrected by the method of Windmeijer (2000).
***,**,* denote coefficients significant at 1, 5 and 10% respectively.

One can observe in Table 7.5 that the lagged dependent variable yields significant coefficients. Even if one can argue that the Within-Group estimator in a static specifica-

tion is consistent, one needs to be very cautious in choosing the specification. There are theoretical reasons (see Chapter 6) for preferring the dynamic specification.

The results from the dynamic specifications support an AR(1) model with a coefficient of 0.516-0-671, that is, the effect of any innovations takes about (1/0.484=2.07 or 1/0.329=3.04) 2-3 years to diminish to zero.

The results from column 1 and 2 seem to confirm that market-related variables like GDP and population are indeed important determinants of the outward FDI. In the parsimonious specification (column 3) even the Dutch GDP and population are significant, which can be caused by the exclusion of the linear time trend, which in column 1 yields a significant and positive coefficient. On ground of the positive *GDP* coefficients it is reasonable to argue that the Dutch investors prefer countries with a larger market.

The coefficient of the real exchange rate remains insignificant in all specification that is one can now argue that exchange rate differences have no *ceteris paribus* impact on the outward FDI. The same applies to the differences in educational attainment: the *schooly-ears* coefficient is insignificant, however positive, in all specifications. Even though one would expect, especially on ground of the Knowledge-Capital Model that differences in relative skill-endowment are important, this hypothesis cannot be confirmed. It is likely, however, that this result is attributable to the fact that most Dutch foreign investments are directed toward developed countries with similar skill-endowments.

The differences in wage-costs are important however, as indicated by the significant, positive *concpos* coefficient in all columns. The positive *concpos* coefficient is related to the market-signal feature of the exports found in the previous section: the relative improvement of the efficiency of Dutch producers increases exports, which leads to higher FDI as well. The impact of the improvement of the relative efficiency of the Dutch producers is quite remarkable. One percentage point increase of the *concpos* variable leads to a 0.6-0.9% increase of the outward FDI immediately, and to a 5.7 percent increase in the long-run.

Another very crucial difference between the static and the dynamic panel analysis is that while the coefficients of real exchange rate and the EEC dummy are found to be significant in the static model, they are insignificant by the dynamic specification. Even though the difference in relative skill endowments is expected to be important an explanatory variable both the static and dynamic specifications find it statistically insignificant.

In the parsimonious specification, besides GDP, only the *concpos* and the *EMU* coefficients are significant, both with positive sign. The positive *concpos* coefficient is related to the market-signal feature of the exports found in the previous section: the relative improvement of the efficiency of Dutch producers increases exports, which leads to higher FDI as well. The impact of the improvement of the relative efficiency of the Dutch producers is quite remarkable. One percentage point increase of the *concpos* variable leads to a 1.4% increase of the outward FDI immediately, and to a 1.8-1.9 percent increase in the long-run.

Neither the *EEC* nor the *EMU* coefficients are significant in any of the specification in Table 7.5, which can be interpreted so that the European integration had no *ceteris paribus* impact on the Dutch investments abroad. One should be critical with the result regarding monetary integration (EMU) though, since the sample ends in 2002, and it is

not possible to tell anything about the long-run impacts of the Economic and Monetary Union based on four years.

The interaction variable (*EEC·EXP*) is insignificant in column 2. This provides an indirect evidence about the share of vertical FDI in the sample. The assumption is that vertical FDI has a complementary relationship with foreign trade, and since Scenario 3 and 4 of the K-K Model in Chapter 6 suggest that in case of trade liberalization and free movement of capital, the share of vertical multinationals should increase, one can expect a strengthening of the positive relationship between exports and outward FDI within the EEC/EU. This is not the case however: the results from the Granger-test and the structural panel analysis both indicate that horizontal FDI remained dominant in the foreign direct investments, even after trade has significantly been liberalized.

Now, let us see the results for the inward FDI stocks (Table7.6).

Table 7.6
Estimation results from the inward FDI model. GMM-SYS estimation

	Dynamic GMM-SYS	***Dynamic with interaction variable***	***Parsimonious dynamic model***
$\ln(FDI_{i,t-1}^{in})$	0.685** (2.66)	0.656 (1.63)	0.967*** (30.38)
$\ln(Y_{i,t})$	0.890 (1.16)	0.892 (0.66)	-
$Ln(Y^{NL}_t)$	0.818 (0.51)	0.268 (0.16)	-
$\ln(POP_{i,t})$	-0. 748 (-1.17)	-0.795 (-0.72)	-
$Ln(POP^{NL}_t)$	-1.514 (-0.87)	-1.169 (-0.61)	-0.047** (2.24)
$\ln IMP_{i,t-1}$	0.027 (0.02)	0.232 (0.76)	-
$\ln REXCH_{i,t}$	-0.025 (-0.22)	-0.034 (-0.17)	-
$concpos_t$	-0.003 (-0.70)	-0.001 (-0.19)	-
$\ln(schoolyears_{i,t})$	1.133 (0.33)	-1.722 (-0.33)	-
$EEC_{i,t}$	-0.749 (-0.99)	-0.342 (-0.28)	-0.303* (-1.88)
$EMU_{i,t}$	-0.068 (-0.27)	0.066 (0.24)	0.221* (1.94)
$trend_t$	0.027 (0.70)	0.048 (0.86)	
$\ln(EEC_{i,t-1}\cdot\ln IMP_{i,t-1})$	-	-0.111 (-0.72)	-
AR(1)	-1.27 [p=0.205]	-1.33 [p=0.183]	-3.23 [p=0.001]
AR(2)	-0.99 [p=0.325]	-0.76 [p=0.446]	-0.34 [p=0.735]
Hansen-test of overidentification	11.13 (d.f.=36)	10.60 (d.f.=35)	19.45 (d.f.=47)

Note: Robust t-statistics are reported in parentheses (the t-statistics reported for the static model are also robust for serial correlation). All coefficients and statistics reported for the dynamic models are from the two-step estimation, where robust standard errors are finite sample corrected by the method of Windmeijer (2000).
***,**,* denote coefficients significant at 1, 5 and 10% respectively.

Again, the first lag of the dependent variable seems to yield significant coefficient, however, in the column 2 the inclusion of the interaction variable causes the AR coefficient to become insignificant. The autoregressive coefficient is 0.685 in the first column that is the time needed for the adjustment is about 3 years. In column 3 the coefficient is much higher, close to unity which indicates a much more persistent process.

It is important to remark, however, that the model for inward FDI underperforms even the most pessimistic expectations. Even though I do not report the results from alternative estimation methods (Anderson-Hsiao estimator and the corrected LSDVC method implemented by Bruno (2004)), these yield very similar results, that is only the lagged dependent variable has a significant coefficient and in case of the LSDVC method the $lnGDP_{i,t}$ coefficient is also significant and positive. If the model (7.7) is estimated with an uncorrected fixed-effect (within group) estimator, the $lnGDP_{i,t}$, the $lnPOP_{i,t}$, the lagged imports and the $ln(schoolyears_{i,t})$ coefficients are significant at 10%, but because of the low time dimension of the panel these results are certainly biased.

As a result, I must conclude that even though my empirical model contains those variables which are favored by most empirical models and thought to be important in explaining FDI, a very important determinant of inward FDI is still missing. The only hypothesis which this model can confirm is that the dynamic specification is preferable over the static one.

In column 3, I report the results from the reduced model, which contains significant variables only. These results indicate the importance of the European integration, with a significant negative *EEC* and a positive *EMU* coefficient, but as this model is basically an AR(1) model with two policy variables, the chance of omitted variable bias is quite high and these results are not convincing. The interaction term (*EEC·IMP*) is again insignificant, which is in accordance with the findings for outward FDI, and the conclusion suggested by the Granger-test.

7.5 Conclusions

In this chapter I applied Granger causality test and a dynamic panel model to analyze the causal relationship between FDI and foreign trade and in order to obtain a clear picture about the motives behind in- and outward FDI activities.

Based on the results in Section 7.3, the followings can be concluded:

- It is confirmed that there is a two-way causal relationship between FDI and trade. Outward (inward) FDI has a negative impact on the exports (imports), which indicates a relationship of substitution, while exports (imports) positively Granger-cause outward (inward) FDI. Thereby the market-signal hypothesis is confirmed, that is, important trade partners are also likely to be important sources and destinations of investments.

In Section 7.4 five hypotheses were tested concerning the motives behind in- and outward FDI. Based on the results from the dynamic panel analysis, the following conclusions can be drawn:

- There is no evidence in favor of the hypothesis that trade liberalization has any significant *ceteris paribus* impact on outward FDI. In case of the inward FDI, the empirical model underperforms all expectations, and even if it yields significant estimates for the *EEC* and the *EMU* coefficients, I do not accept these results.

- It is somewhat unexpected but it seems the differences in knowledge endowment have no *ceteris paribus* impact on either in- or outward FDI. This finding clearly contradicts the K-K Model, but can be explained nevertheless. As most Dutch investments take place in countries where the population has similar educational attainment than in the Netherlands, this variable has no significant *ceteris paribus* impact.

- On the other hand, the competitive position of the Dutch producers, measured in terms of wage changes relative to competitors, seems to be an important determinant of outward FDI. The relative improvement of the Dutch producers' efficiency leads to higher exports and profits that are partly invested abroad.

- Both the Granger-test and the gravity- like dynamic panel model suggest that even if trade barriers were significantly reduced, horizontal FDI was not replaced by vertical FDI. This hypothesis of the K-K Model cannot be confirmed thus. A possible explanation can be offered by the export-platform hypothesis, that is, investors outside the EU use the Netherlands as an export-platform to gain access to other EU members' markets (see Ekholm *et al*., 2003 for a theoretical paper and Blonigen *et al.*, 2004 for an empirical analysis).

- And finally, the results for the outward FDI confirm that a gravity-like model is applicable to empirical FDI analysis. The market size is indeed an important factor in the decision of Dutch investors, who seem to prefer countries with larger markets.

- Finally, a technical conclusion: The theoretical considerations and the empirical results suggest that it is advisable to prefer dynamic panel specifications over static models in empirical FDI analysis.

VIII.
Conclusions

8.1 Introduction

The main objective of this dissertation is to analyze how the European integration (the EEC and the EMU) affected Dutch foreign trade and foreign direct investments.

Chapter 2 reviews the great variety of methodological approaches that have been applied to this problem so far. Of the possibilities, I opt for the regression analysis of panel data for its relative simplicity and because relatively few assumption need to be made. The "single-country approach" offers a possibility to analyze exports and imports independently of each other, and also makes it possible to apply Dutch specific variables in the regressions. Also, I take the dynamic of trade and investments explicitly into account.

In this last chapter, I attempt to review the results of the different chapters and to form the final conclusions of this thesis, this time by combining the theoretical expectations, the ex-ante hypotheses and the empirical outcomes of the estimated models.

8.2 What is to expect?

It is beyond doubt that economic integration has an impact on the foreign trade of the Netherlands. All empirical investigations so far strongly confirmed this hypothesis. The main question is therefore how large these effects are, and whether they affect exports and imports differently.

The theory (Chapter 2) suggests that the pre-integration position of a country is of crucial importance in deciding what integration effects are most likely to take place. When a country is initially protectionist, the effect of integration will be significant on both exports and imports. On the other hand, if a country had been relatively liberal before integration (just like the Netherlands), integration will not change the import structure fundamentally and even will cause trade diversion or external trade destruction. Such a country will therefore experience an opening-up of the markets of other Customs Union members, and she will experience significant changes in the direction and volume of exports.

Conclusion 1:
Theory suggests that European integration should have had a significant impact on the structure of Dutch exports but not necessarily on that of the imports.

Further, one can be quite certain about the existence of dynamic (restructuring) effects. It can even be hypothesized that these effects are at least as important as the static trade effects, but they are difficult to separate empirically. The controversies about the empirical results and the methodological issues concerning the estimation of these dynamic effects let me decide to limit the scope of my research in this direction. Still, in

Chapter 3, I find some statistical evidence that the increasing openness indeed has a positive temporary impact on growth.

Conclusion 2:
The results from the Vector Autoregression model in Chapter 3 indicate that the growing openness of the Dutch economy contributed about one percent to the GDP annually on average in the 1950-1995 period.

In Chapter 3, I look for some historical evidence on the effect of economic integration on Dutch foreign trade. In other words, I examine what conclusions or rather what hypotheses can be drawn on ground of basic statistics only. If one focuses on the post 1945 period, one may come to the conclusion that the significant increase of the share of Europe in the total Dutch exports and imports is caused by economic integration. However, taking also the interwar period into account fundamentally changes this view. Dutch foreign trade experienced a re-Europanization after World War II, which does not appear to be directly related to the integration. If the share of Europe in total trade in the interwar period is used as a point of reference, it becomes obvious that the possible effects of integration on the geographical composition of exports are of a limited magnitude, and the effects on imports are even smaller.

Conclusion 3:
The post-1945 period saw at least two simultaneous processes in the Dutch foreign trade: a re-Europeanization, that is the return to the "normal" level of trade with European countries, and the impact of integration. These are difficult to separate.

8.3 The effects on trade

The regression analysis offers a solution to the problem of identifying the effects of economic integration on foreign trade and to separate them from other factors. For this purpose, I chose a gravity model, which has become a standard tool of empirical trade analysis during the last three decades.

The traditional way of estimating gravity equations, that is the estimation of the bilateral trade flows among a group of countries, is not capable of separating the effects on exports and imports. For this reason, I carry out the analysis on the trade between Netherlands and her 62 trade partners in the period 1960-2000 on both exports and imports individually. I refer to this method as the "single-country" approach, which is not without precedents but also not very common.

Another methodological-technical issue I addressed is that the gravity equations should be estimated in a dynamic specification, even though static gravity model are still predominant in the empirical literature. In agreement with the critiques of Eichengreen and Irwin (1997) and Bun and Klaassen (2002a), I argue that the static gravity models are misspecified and consequently yield biased estimates. In practice, this means that in a static estimation one is likely to find more significant coefficients than in case of a dynamic estimation. This cast some doubt on the reliability of results from static gravity models. My argument is consequently that:

Conclusion 4:
The results from dynamic gravity equations should be preferred over the results from the static specification.

Furthermore, it is generally assumed that the impact of the integration is constant over time. I reject this assumption as well, and argue that the impact of integration changes over time.

The results indicate that the trade liberalization indeed had a positive impact on exports, and this impact had a positive trend through the 1960s and 1970s. On the other hand, the results suggest that integration had virtually very small, temporary impact on the imports. As mentioned above, this is not surprising if the starting-position of the Dutch economy is taken into account.

Conclusion 5:
European integration had a significant positive impact on the exports, but had just a limited, temporary impact on imports. When the effects of integration on exports are allowed to change over time, they reflect the impacts of the enlargements in 1973, 1985, and 1995. The Monetary Union, on the other hand, seems to have had no ceteris paribus impact on either exports or imports until 2000.

8.4 The effects on Foreign Direct Investments

Another focus of my research is the impact of economic integration on Foreign Direct Investments (FDI). There are several theoretical explanations for the motives behind Foreign Direct Investments, but these are only capable to capture a smaller part of the phenomenon and concentrate on a single form of the foreign investments. Markusen (1997, 2000) is the first to come up with a sophisticated theoretical construct (the Knowledge-Capital Model or K-K Model) that is capable of explaining how and why the different types of FDI come into being. His model is, however, not accepted unanimously and his attempt of an empirical underpinning has been criticized. He argues that if capital is free to move, and trade is gradually liberalized, vertical multinationals and national firms should prevail at the expense of horizontal multinationals.

It was not explicitly my objective to test the K-K Model, but since I used its implications to formulate some ex-ante hypothesis, and also to identify the key regressors in the empirical FDI Model in Chapter 7, my results are still indicative in this respect.

Another important issue is the relationship between trade and investments. Whether they are substitutes or complements is determined by the motivation behind investments. In case of tariff-avoidance and horizontal FDI, the dominant relationship should be substitution, while in case of vertical FDI, the relationship should be complementarity. In Chapter 7, I applied a panel analysis on the Dutch in- and outward FDI stocks in the period 1984-2002 and estimated two models: a panel-based Granger causality-test and a more structural model.

The results from the Granger test suggest the followings:

Conclusion 6:
There is a two-way relationship between FDI and trade. The dominant relationship directing from investments toward foreign trade is substitution.

If one accepts that the relationship between FDI and trade is substitution, and horizontal FDIs are predominant, it is straightforward to argue that the avoidance of tariff or non-tariff barriers remained an important motive until 2002. A possible answer to this puzzle is offered by the export-platform hypothesis.

The dynamic panel model yields somewhat surprising results, however. While a dynamic gravity model could explain the outward FDI relatively well, the same model underperformed all expectations in case of inward FDI, and yields hardly any significant coefficients.

Conclusion 7:
A dynamic gravity model is an appropriate empirical tool of modeling Dutch outward FDI. The same mode when applied to inward FDI, however, underperforms, and seems not to be able to capture the main factors and motives behind investments.

The difference in relative skill endowment, a key variable in the Knowledge-Capital Model, yields an insignificant coefficient in both directions. This is not what one would expect on ground of the K-K Model. This surprising result might be, however, explained by the fact that the most important destination and source countries of FDI have similar skill endowments to the Netherlands.

Conclusion 8:
The relative skill endowment is found insignificant factor in both in-and outward investments, which finding contradicts the Knowledge-Capital Model.

Neither the European Economic Community (EEC) nor the Economic and Monetary Union (EMU) variables yield significant coefficients in the outward FDI model. Even though these two variables are significant in case of inward FDI, in the light of the poor performance of that model, I decide not to trust those results.

Conclusion 9:
There is no decisive evidence whether EEC or EMU had any significant ceteris paribus impact on either out- or inward investments.

8.5 Recommendations for future research

This analysis is far from being the last word on the subject. The results are limited by several factors: the highly aggregated data, the limits of regression analysis, and finally my focus on two markets (goods and services and capital market) only. But these limitations were necessary in order to carry out this project with some success. Concerning data limitations, for a better understanding of the long-run impact of integration, fur-

ther research should be carried out on a more disaggregated level of data. This goes for both foreign trade and investments. Also it is likely that within a few years there will be enough data available for the extension of the analysis toward the effects of the recent enlargement of the EU in May 2004.

Another limitation of this thesis is the use of regression analysis. One may consider choosing different empirical tools that are more capable of identifying and distinguishing the different effects of integration. The link between economic growth and economic integration, which has an extended theoretical and empirical literature but was given relatively little attention in this work, is also worth of more detailed investigations. Alternatively, one may choose a more qualitative approach in the analysis, with a focus on the broader, social and historical, aspects of integration.

Even though I attempted to focus on my main research questions, my dissertation addresses other problems than the effects of integration as well. To some extent it has become a critique of static empirical models of international trade and investments, and also an implicit but certainly imperfect test of the Knowledge-Capital Model. The limited success of Chapter 7 on FDI, is indicative that there remains much work to be done in this field as well: while the K-K Model does not seem to be adequate to explain the most important determinants of investments, the export-platform hypothesis can be a very promising alternative. The next logical step could be an empirical analysis of Dutch FDI utilizing a model similar to Blonigen *et al*. (2004).

The reader may have the feeling that my dissertation raises at least as many questions as it actually answers. This is probably the nature of empirical research: the results are rarely in complete accordance with the expectations.

I sincerely hope that my results and arguments can and should be subject of further debates.

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Appendix

A.1. Data on foreign trade

The data on Dutch foreign trade used through this dissertation originate from two sources. The first one is the Central Statistics Bureau (CBS) of the Netherlands, which is freely available through the Statline online database: (http://www.cbs.nl/nl/cijfers/statline/).

This source offers good quality aggregated and by partner country disaggregated data on foreign trade for the period 1917-2003 expressed in euro. I used this data for the historical overview of Dutch foreign trade in Chapter 3. Even though this data is easily accessible and very accurate, its level of geographical disaggregation is relatively low, as it includes 14 countries only. Even after I expanded this data with further countries from statistical yearbooks of the CBS, the number of countries in my sample did not exceed 23. A panel for the period 1950-2000 with 23 countries may be sufficient for a working paper, but I felt that a dissertation requires a much wider dataset. For this reason, I opted for an alternative source, the OECD online dataset (www.sourceoecd.org), which contains highly disaggregated data for all OECD member countries from 1961 onwards, expressed in current US dollars. By this choice I sacrificed 11 years (1950-1960), but gained 40 new countries for my panel, which now includes 40 years and 62 countries.

An important problem is that the foreign trade statistics contain re-export activities as well. Re-exports have exhibited a growing pattern since the 1980's, reaching as high as 40% of the total exports in 2000 (see Kusters and Verbruggen, 2001). The high share of re-exports has an impact on the results in Chapter 5, and may be at least partly responsible for the insignificance of the economic integration coefficient in case of imports.

A.2. Data on Foreign Direct Investments

The data on Foreign Direct Investments is available online on the homepage of the De Nederlandsche Bank (www.dnb.nl) in current prices euro. Both flows and stock data are available, and similarly to the bulk of literature I opted for using the stocks as their value is larger or equal to zero, while negative values would strongly limit my choice of the functional form. The annual flow data is available from 1982, while the stocks (according to the situation of summer 2005) are accessible for the period 1984-2003.

Both the incoming and outgoing FDI data are disaggregated according to origin and destination, but since incoming FDI seems to be much more concentrated than outward FDI, the data for the inward FDI contains 19 countries only. On the other hand, the data for outward FDI is much more diversified and has 37 countries.

A.3. Macroeconomic indicators

GDP, GDP per capita, and population data are available from 1950 on at the homepage of the Groningen Growth and Development Center (www.ggdc.nl). The GDP is expressed in 1990 Geary-Khamis international USD. This currency unit has become standard in international comparisons and economic historical databases (see Agnus Maddison's "The World Economy: A Millennial Perspective", OECD, 2001). For this reason I chose the 1990 G-K international USD as the uniform currency unit for my dissertation. As a result, I converted all data that was expressed in different currency unit into 1990 G-K international USD (see A.6.). The data on physical capital stock is available from the dataset of Groote et al. (1996) for the period 1900-1995 expressed in 1990 Geary-Khamis international USD.

A.4. Oil price, distance, and real exchange rates

The price of Brent oil per barrel is available on the site of the International Monetary Fund (http://ifs.apdi.net/imf/), and expressed in current price USD. The data on geographical distance in kilometers between any pair of commercial centers (mostly capitals) is accessible on the CEPII's site (http://www.cepii.fr/distance/geo_cepii.xls).

The calculation of real exchange rate was the most problematic issue. As equation (5.1) suggests:

$$REXCH_{i,t} = E_{i,t} \frac{\pi_t^{NL}}{\pi_{i,t}} \quad (5.1)$$

in order to calculate real exchange rate ($REXCH_{i,t}$) one needs data on the nominal exhange rate ($E_{i,t}$) between the guilder and country i's currency, and the price levels in the Netherlands (π_t^{NL}) and country i ($\pi_{i,t}$). The idea of real exchange rate is closely related to the Purchasing Power Parity theory, which predicts that the real exchange rate between two countries should remain constant in the long-run. For example, if the price level in the Netherlands increases relatively to the country i (the $\pi_t^{NL}/\pi_{i,t}$ ratio increases), the nominal exchange rate ($E_{i,t}$) must decrease (depreciation) so that $REXCH_{i,t}$ remains constant. If this does not happen or the magnitude of depreciation is too small, the guilder is said to be overvalued against the currency of country i.

Unfortunately these data are hardly or absolutely not available for several of the 63 countries, especially those in Africa and Latin America. The most complete data on exchange rates and price levels is offered by the Penn World Table 6.1 (pwt.econ.upenn.edu), where these data are all expressed relatively to US dollar ($E_{i,t}^{PWT}$) and the US price level ($\pi_{i,t}^{PWT}$) respectively.

The nominal exchange rate between the guilder and any other currency's can be simply calculated as the ratio of the nominal exchange rate between i's currency and the USD ($E_{i,t}^{PWT}$) and the nominal exchange rate between the guilder and the USD ($E_{NL,t}^{PWT}$).

Algebraically:

$$E_{i,t} = \frac{E_{i,t}^{PWT}}{E_{NL,t}^{PWT}} \quad \text{(A.1)}$$

The ratio of price levels can be obtained by a similar way: country *i*'s price level relative to the US price level ($\pi_{i,t}^{PWT}$) must be divided by the Dutch price level relative to the US price level ($\pi_{NL,t}^{PWT}$):

$$\frac{\pi_{i,t}}{\pi_{t}^{NL}} = \frac{\pi_{i,t}^{PWT}}{\pi_{NL,t}^{PWT}} \quad \text{(A.2)}$$

Now, using (A.1.), and (A.2.) one can calculate the real exchange rate between country *i*'s currency and the Dutch guilder in year t.

A.5. Relative skill endowments and competitive position

For the FDI analysis in Chapter 7 one needs a proxy for relative endowments in skill and the competitive position of the Netherlands.

As there are no generally accepted human capital estimates for the Netherlands and the other countries in the sample, I chose a possible, however not perfect proxy variable, the average educational attainment (average years of schooling) that is available in the Barro-Lee dataset (2000) for 138 countries for the period 1960-2000.

(http://www.cid.harvard.edu/ciddata/Appendix%20Data%20Tables.xls)

The Barro-Lee dataset is not a complete time-series, the data is available for every fifth year only, so the missing years were interpolated by the Spline smoothing function of the GiveWin2 software.

If we denote the average years of schooling in country *i* in year t by $Sch_{i,t}$, and the difference in educational attainment is calculated as a ratio, the variable *schoolyears* is obtained as:

$$schoolyears_{i,t} = \frac{Sch_{i,t}}{Sch_{NL,t}}$$

The competitive position of the Dutch producers is measured as the difference in changes of the most important competitors' prices and the Dutch producers' prices. If this value is positive, the prices of the competitors increase more than those of the Dutch producers, and therefore the competitive position of the Dutch export goods improves. The data on the competitive position is accessible in the Appendix B1 of the 2005 Centraal Economisch Plan of the Centraal Planbureau and available from the 1976 on (http://www.cpb.nl/nl/data/cep2005/b1.xls).

A.6. The conversion to 1990 G-K international USD

Since the 1990 G-K international USD is chosen as the currency unit of this dissertation, all data expressed in other currencies had to be converted. For the conversion I

calculated the Geary-Khamis GDP deflator with the help of two time-series: the current price GDP of the United States published in the Economic Report of the President of the United States (http://www.gpoaccess.gov/eop/) and the US GDP expressed in 1990 G-K international USD, accessible on the homepage of the GGDC. The ratio of these two time series is a kind of GDP deflator, which can be used to convert any current prices USD series into 1990 G-K international USD.

As the FDI data of the De Nederlandsche Bank is published in current prices euro, I also had to create a conversion rate which serves as exchange rate and GDP deflator both. For this purpose I used the Dutch GDP of the CBS available on the Statline expressed in euro, and the GGDC time-series on Dutch GDP expressed in 1990 G-K USD. The obtained ratio converts any current prices euro time-series into 1990 G-K international USD. The calculated conversion rates are the following:

Table A.1
Conversion rates between current prices USD and 1990 Geary-Khamis international USD

year	conversion rate	year	conversion rate
1961	0.260552	1981	0.72214
1962	0.264102	1982	0.765993
1963	0.267053	1983	0.797383
1964	0.271082	1984	0.8269
1965	0.276187	1985	0.852768
1966	0.284116	1986	0.871327
1967	0.292919	1987	0.896481
1968	0.305557	1988	0.926618
1969	0.320265	1989	0.962406
1970	0.337357	1990	1
1971	0.355117	1991	1.036686
1972	0.37065	1992	1.061769
1973	0.391758	1993	1.08706
1974	0.425607	1994	1.109263
1975	0.464965	1995	1.133113
1976	0.492791	1996	1.154668
1977	0.525068	1997	1.177155
1978	0.561407	1998	1.191661
1979	0.606908	1999	1.208798
1980	0.660811	2000	1.234214

Table A.2
Conversion rates between current prices euro and 1990 Geary-Khamis international USD

year	conversion rate
1984	0.88662
1985	0.898867
1986	0.903016
1987	0.90055
1988	0.912261
1989	0.923571
1990	0.943691
1991	0.971934
1992	0.989493
1993	1.006963
1994	1.035279
1995	1.056231
1996	1.068577
1997	1.090044
1998	1.10868
1999	1.125907
2000	1.17028
2001	1.233877
2002	1.276291

Summary

The main objective and motivation of this thesis is to provide the reader with a quantitative analysis focusing on the impact of the European Integration on the Netherlands exclusively. To this end, three research questions are addressed: the relationship between openness and economic growth, the impact of integration on foreign trade, and finally the impact of the integration process on investments.

In Chapter 2, I briefly review the most fundamental concepts of economic integration, which is followed by a discussion of the most important works and methodological approaches that so far have been applied to measure the effects of economic integration. On ground of methodology I classify the empirical works into three generations. The first generation remains very close to the classical Vinerian concepts and definitions but its results are based on very strong assumptions. The second generation relies mainly on regression analysis, which requires less explicit and risky assumptions, but in return its objectives must remain much more limited. The third generation utilizes simulations of general equilibrium models. This demands extensive technical skills, but, due to its limited time scope, serves primarily as a tool for policy analysis.

Chapter 3 offers a sketch of the historical development of Dutch foreign trade and especially its geographical distribution. The main argument of this part is that the Netherlands experienced a re-Europeanization of its trade relationships after World War 2. As a consequence, the increasing share of European countries in Dutch foreign trade can just partly attributed to the integration. In Chapter 3, I address the first research question as well by analyzing the long-run relationship between the openness and the economic growth in Netherlands. The applied VAR analysis suggests openness having significant positive impact on economic growth between 1950 and 2000. This impact is temporary though and does not lead to a permanent growth effect. With the steady increase of openness in the last five decades, this thesis estimates that the growing openness contributed to the Dutch economic growth by one percent on average annually.

Chapter 4 is devoted to the gravity equation that has been a popular and successful tool of empirical research in International Economics since the 1960s. After a detailed presentation of Bergstrand's microeconomic founded generalized gravity model, I address some of the most important problems and puzzles including the functional form, the interpretation of the distance coefficient, and the reason for preferring a dynamic specification.

Chapter 5 focuses on the impact that European Integration has on the Dutch foreign trade. The thesis applies a dynamic panel analysis, to measure the effect of the European Economic Community and the European Union on the foreign trade of the Netherlands in the 1961-2000 period. The results indicate that the integration had a significant positive impact on the exports, but imports seem to be just affected temporarily. A possible

explanation is the relatively liberal pre-integration trade policy of the Netherlands, and the large share of re-exports, which significantly influence the trade patterns.

In Chapter 6, I review some theoretical aspects of Foreign Direct Investments, including a detailed description of Markusen's Knowledge-Capital Model. Also, I review the literature in order to identify the most important factors affecting investment decisions.

The third objective, the analysis of Foreign Direct Investments between 1984 and 2002, is addressed in Chapter 7. The Granger causality tests indicate a two-way relationship between trade and investment: trade has a positive impact on investments, serving as a market-signal, while investments seem to negatively Granger-cause trade, suggesting a substitution relationship. Based on the Knowlegde-Capital Model of Markusen, a dynamic panel model is estimated on the Dutch in- and outward FDI. Quite surprisingly, the results do not seem to support that relative skill endowment would play an important role in the investment decisions. However, the competitive position of the Netherlands proves to a significant factor in case of outward FDI.

Finally, in Chapter 8, I summarize the results and conclusions.

Samenvatting

Het doel van dit proefschrift is het geven van een kwantitatieve analyse die gericht is op het effect dat de Europese integratie heeft op Nederland. Om dit te analyseren tracht ik drie vragen te beantwoorden: wat is de relatie tussen openheid en economische groei, het effect van economische integratie op buitenlandse handel en tot slot de invloed van integratie op investeringen.

In hoofdstuk 2 komen de meest fundamentele concepten van economische integratie aan de orde. Dit wordt gevolgd door een discussie van de belangrijkste literatuur en van de methodologieën die worden gebruikt voor het meten van het effect van economische integratie. Op methodologische gronden classificeer ik het empirische werk in drie generaties. De eerste generatie zit dicht aan tegen de klassieke Vineriaanse definities en concepten, maar haar resultaten zijn gebaseerd op sterke aannames. De tweede generatie maakt vooral gebruik van regressie analyses. Aan de ene kant vereist dit minder strikte assumpties maar aan de andere kant beperkt het tevens het spectrum van mogelijke analyses van deze methode. De derde generatie gebruikt simulaties van algemene evenwichtsmodellen. Dit vereist grote technische vaardigheden en functioneert, vanwege de beperkte mogelijkheden tot tijdreeksanalyse, met name als een instrument voor beleidsanalyses.

In hoofdstuk 3 wordt een schets geboden van de historische ontwikkeling van de Nederlandse buitenlandse handel en in het bijzonder zijn geografische spreiding. Het belangrijkste argument is dat Nederland na de Tweede Wereldoorlog een her-Europeanisering van zijn handelsrelaties meemaakte. Het gevolg hiervan was dat het aandeel van de Europese landen in de Nederlandse buitenlandse handel slechts gedeeltelijk geweten kan worden aan integratie. In hoofdstuk 3 ga ik dieper in op deze eerste hoofdvraag door de

lange termijn relatie tussen openheid en economische groei in Nederland te analyseren. De gebruikte VAR-analyse suggereert dat openheid een significante en positieve invloed uitoefende op economische groei in de periode 1950-2000. Dit effect is echter tijdelijk en leidt niet tot een permanent groei-effect. Niettemin wordt in dit proefschrift berekend dat de geleidelijke toename van openheid in de afgelopen vijf decennia heeft bijgedragen aan een extra economische groei van 1 procent per jaar.

Hoofdstuk 4 is gewijd aan de gravity vergelijking, hetgeen, gebruikt in empirisch onderzoek, een succesvol en populair instrument was in de internationale economie sinds de jaren ’60. Na een gedetailleerde presentatie van Bergstrand’s gegeneraliseerde gravity model gebaseerd op micro-economie, ga ik dieper in op de belangrijkste problemen en puzzels. Deze hebben betrekking op de functionele vorm, de afstandscoëfficiënt, en de redenen waarom de voorkeur gegeven kan worden aan een dynamische specificatie.

Vervolgens komt in hoofdstuk 5 de invloed van de Europese integratie op de Nederlandse buitenlandse handel aan de orde. Dit proefschrift gebruikt een dynamische panelanalyse om het effect te meten van de Europese Economische Gemeenschap en de Europese Unie op de Nederlandse buitenlandse handel tussen 1961 en 2000. Het resultaat duidt op een permanent significante positieve invloed op de export. De import lijkt echter maar een tijdelijke invloed te ondervinden. Een mogelijke verklaring kan gevonden worden in het relatief liberale handelsbeleid in de periode vòòr de Europese integratie. Een andere verklaring is het grote aandeel van de her-exporten wat een sterke invloed heeft op de handelspatronen.

In hoofdstuk 6 komen enkele theoretische aspecten van de Buitenlandse Directe Investeringen aan de orde. Dit bevat ook een uitgebreide beschrijving van het Knowlegde-Capital Model van Markusen. Verder grijp ik terug op de literatuur om de belangrijkste factoren te identificeren die de investeringsbeslissingen beïnvloeden.

Het derde doel, de analyse van de Buitenlandse Directe Investeringen tussen 1984 en 2002, wordt behandeld in hoofdstuk 7. De Granger causaliteitstoets geeft aan dat er een wederzijds verband bestaat tussen handel en investeringen: handel heeft een positief effect op investeringen, terwijl investeringen een negatieve invloed lijken te hebben op handel. In dit verband lijkt het positieve effect te werken als een marktsignaal terwijl de negatieve relatie lijkt te duiden op een substitutierelatie. Met gebruikmaking van de Nederlandse in- en uitstroom van de Directe Buitenlandse Investeringen is een dynamisch panelmodel is geschat op basis van het Knowlegde-Capital Model van Markusen. Verrassenderwijs geeft deze panelschatting niet aan dat de relatieve beschikbaarheid van kapitaal een belangrijke factor speelt bij de investeringsbeslissingen. Hiertegenover staat dat de concurrentiepositie van Nederland een belangrijke rol speelt in het geval van de Directe Buitenlandse Investeringen van Nederland in het buitenland.

Tot slot geef ik in hoofdstuk 8 een samenvatting van de resultaten en conclusies.