UNIVERSITY OF SOUTHAMPTON

FACULTY OF LAW, ART & SOCIAL SCIENCES

School of Social Sciences

Essays on International Trade and Factor Flows

by

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Thesis for the degree of Doctor of Philosophy

September 2006

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

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Issues relating to the better explanation of commodity flows in particular contexts, the effect of trade barriers on the intensity of trade, its creation and on the classification of countries into "natural" trading partners and otherwise, in addition to its impact on the pattern of factor flows attracted a great research interest among economists. This thesis, which is constituted of three papers, further contributes to the theoretical literature on gravity models and their ability to predict South-North trade flows in a modified neo-classical framework. It also contributes to the empirical literature on trade barriers and, more specifically, to the newly evolving literature on the trade effect of inefficiencies in maritime transport. Lastly, the thesis concludes with an empirical analysis aiming at extending the work on the interaction between factor and commodity flows when they are studied in a single setting.

Chapter 2 addresses the implications of a gravity model that is based on the assumption of imperfect specialization in production within a Hecksher-Ohlin (H-O) setting that is adjusted to account for the existence of trade frictions and technological differences across countries. The major findings of this chapter lie in the testable predictions drawn from the derived model that serve to explain the underlying process of the North-South type of trade. I find evidence for income elasticities being strictly less than one. In addition, the model predicts that exports originating from South countries are more sensitive to their partners' incomes than they are to their own income. Moreover, export volumes are proven to be affected by general consumer preferences in addition to the exporter's technological productivity level. The model is estimated using panel data analysis; and empirical results are found to be consistent with the derived theoretical predictions.

Chapter 3 is an empirical study that is the first to examine the impact of seaport-related inefficiencies in three Maghreb countries (Algeria, Morocco and Tunisia) on maritime transportation costs, general trade levels and on the process of trade integration with the EU. Findings are that even when distance is controlled for, exporter-specific maritime transportation costs have a significant and negative effect on exports to the EU15. They slow down "Increased-Trade" effects induced by the Euro-Med agreements or trade diversions away from third countries, and hinder potential exports from reaching their potential, emphasizing the role of the sea barrier in the selection process of countries as none "natural trading partners". Finally, the impact of Maghreb-specific maritime inefficiency on trade is more pronounced in both the agricultural as well as the tariff-free manufacturing sector.

Chapter 4 is another empirical study that aims to identify the most suitable econometric technique for the estimation of FDI flows within a setting that joins all three components of the Migration-Investment-Trade (MIT) relationship in one framework. Findings suggest that controlling for trade when studying the effect of migration on the flow of FDI deliver estimation results that better comply with established theoretical predictions. Heckman Selection estimation is superior to both Tobit and OLS techniques given that it cures for the selection problem and, at the same time, delivers significant estimates that are more compliant to intuitive predictions.

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Acknowledgments

This thesis is made up of three papers written during my tenure (2003-2006) in the Division of Economics at the University of Southampton.

First of all, I would like to express my deepest gratitude for my supervisor, Dr. Maurice Kugler, for his invaluable advice, suggestions and moral support all through this wonderful journey as a research student. I remain indebted to him, as his commitment to research excellence has inspired me in many ways and has augmented my fascination with the discipline and the work of research. I would also like to thank Dr. Peter Smith and Dr. Xavier Mateos for their helpful comments during the mini viva, and Dr. Patricia Rice for her help in the department's financial contribution in the costs of data collection. I am also thankful to Dr. Jackie Wahba and Dr. Carmine Ornaghi for their guidance and encouragement. I thank all the staff in the Economics Division at the University of Southampton for their kind help and support.

Second, I would like to thank the National Council for Scientific Research (CNRS) in Lebanon and both the Department of Education and Skills (DFES) and the Higher Education Funding Council in the United Kingdom for their financial support to carry out this study. Special thanks to Dr. Evangelos Pongas from the Eurostat Transportation division for the supply of maritime transportation data.

Last but not least, I would like to thank my husband, Hassan El Khatib for his continuing moral support and motivation. I thank my family and my husband's family for their love and constant prayer.

Chapter 1

Introduction

The thesis tackles three different trade-related issues, which are examined in chapter 2, 3 and 4. All three chapters fall under the general realm of International Trade with each looking at a particular facet of the discipline: the first examining the theory of neoclassical trade models and the predictions of the gravity equations, the second investigating the impact of maritime transportation costs in the Mediterranean on the materialization of Free Trade Agreements between the North African Maghreb countries and those of the EU15, and the third studying the relationship and interaction between commodity flows (trade) and factor flows (FDI and labour migration), all in one integrated framework. A more detailed description of each of the papers is presented below:

Chapter 2 investigates the predictions of a Gravity Model when it is derived from Neoclassical Heckscher-Ohlin assumptions (perfect competition and constant returns to scale) that are, nonetheless, adjusted to take account of technological differences between countries, trade frictions (transportation costs) and imperfect specialization in production. Interest in such a model stems from the ultimate aim of the paper which is to better explain export flows originating from developing (South) countries and heading towards the developed (North) countries. The basis of the previous argument lies in the recent work of Evenett and Keller (2004), which provided evidence that Gravity Models derived from neoclassical Hecksher-Ohlin assumptions represent the most suitable tool to model South-North type of trade. Moreover, relaxing the three rather restrictive (and largely, unrealistic) assumptions of the H-O model - frictionless trade, perfect specialization in production and identical technologies across countries - would help circumventing other problems discussed in the related literature, such as solving the indeterminacy of the trade pattern in a multi-country H-O setting (Deardorff, 1998) and the over-prediction of trade (Haveman and Hummels, 2004)

I consider a multi-country, multi-product, multi-factor world where local markets enjoy perfect competition and where constant returns to scale are experienced at the production level. Countries are not very disparate in terms of their relative factor endowments and hence do not perfectly specialize in the production of a particular good. I consider the extreme case when countries disproportionately produce all goods depending on their relative factor endowment and goods' relative intensities in factors of production. Moreover, countries face fixed costs in order to enter a foreign market and sell their exportable commodity there. These fixed costs could emerge as a result of activities relating to foreign market information collection, advertising campaigns and transportation costs. This generates increasing economies of scale in the production of the exportable commodity aimed at foreign consumption. According to Deadorff (1982) the pattern of trade can be predicted in such a context whereby every country exports the good which, on average, uses relatively more intensively those factors present in relevant abundance. Hence, the working framework would boil down to a scenario where countries produce all goods but perfectly specialize in the exportation of a single commodity.

On the demand side, the model assumes that consumers value variety and their demand is represented by a nested CES-Cobb Douglas demand function. Goods follow the Armington assumption of country-of-origin based differentiation. On the supply side, foreign markets are not perfectly substitutable and this is represented by a constant elasticity of transformation (CET) function. Technologies are posited to be Hicks-neutral which assumes away the possibility of having Factor Intensity Reversals (FIR) across countries which could render unfeasible the determination of the trade pattern.

The predictions of the model are consequently put into test by carrying out a panel analysis of exports from a group of South countries (constituted of three North African Maghreb and twelve countries of Central and Eastern Europe) to the members of the EU15. The more suitable Fixed Effects estimates are weighed against the commonly used cross section ones and compared to other estimates obtained in the related empirical literature.

Given the growing literature on transportation costs and their effect on trade integration and, equivalently, the role of general infrastructure in reducing the costs of trade transactions, Chapter 3 examines the impact of maritime transportation costs on the materialization of the Euro-Med Free Trade Agreements which were signed between the members of the EU15 and the three North-African Maghreb countries (Tunisia, Algeria and Morocco). It also sets out to answer the question of whether port related inefficiency in the Maghreb countries represents a driving force for why they are not considered as among the EU15's "Natural Trading

Partners" (NTP) when NTP is defined on the basis of low transportation costs (Krugman, 1991). The paper starts by comparing *ad valorem* tariffs to *ad valorem* maritime transportation costs between those two groups of countries. A substantial disparity between the latter indicators reveals the importance of an in-depth study on the role of Maghreb maritime/port infrastructure in the determination of trade transactions with the EU15 states. To this aim, I closely follow the methodology used in the fairly recent World Bank study of Clarck, Dollar and Micco (2004) which examined port inefficiency in the Latin American Ports and quantified its influence on maritime transportation charges for shipments to the US. Hence, I obtain the Least Square Dummy Variable (LSDV) estimator of a reduced-form price equation that is based on the assumption of perfect competition in the Tramp shipping market. Shipping marginal costs are considered to be determined by characteristics relating to the country of export (port-capital distance, aggregate port efficiency and the individual port containerization rate), the country of import (port-capital distance and general road/rail/airport/telecommunication infrastructure), the exporter-importer country pair (trade imbalance in a particular product), the type of product (its value per weight) and to the length of the journey separating the two countries (the nautical distance).

After assessing the influence of port efficiency on maritime transportation, chapter 3 proceeds to investigate their subsequent impact on increased trade effects and on the actual-to-potential exports when the EU15's trade with the countries of Central and Eastern Europe (CCEs) is taken as a benchmark. In order to assess the former, a country-specific, port-related, maritime transportation cost index is developed and included in a gravity equation estimated over two five-year long (1992-1996 and 1997-2001) periods preceding and following the Euro-Med Association Agreements (following Kandogan, 2005). The five-year changes across the two periods' residuals are later regressed on distance and maritime transportation costs in order to distinguish their separate effects on trade creation. Results indicate that Maghreb country's sea-port inefficiency acts more like a barrier to "naturalness" then does distance.

An *Out-of-Sample* approach is adopted to calculate actual-to-potential trade between the EU15 and the three Maghreb countries, following similar lines of analysis as in Ferragina, Giovannetti and Pastore (2005). Potential to actual trade ratios are computed for commodities disaggregated at the 2-digit NSTR level and traded by every pair of countries in every year of the 1997-2001 period. These ratios are subsequently regressed on distance and exporter-specific maritime transportation costs.

A by-sector analysis draws important inferences on the effects of bad seaports in hindering Maghreb exports from reaching their potential in the five sectors: Agriculture, Electricity and Gas, Fishing, Manufacturing and Mining. The aim behind such an exercise is to quantify the importance of devising policies aiming at the reduction of inefficient operations at seaports along with the dismantling of tariff barriers, as a direct consequence of the Euro-Med agreements in order to better promote for additional South-North exports to the.

Chapter 4 further explores the relationship between commodity trade and the flows of labour and FDI. It provides a detailed account of previous studies on the relationships between trade and FDI, migration and FDI and FDI and trade when those relations are studied on pair-wise basis. It draws on the recommendations laid out in Faini (2004) who highlighted "the need to study globalization in a fully integrated way" by looking at the manner in which these components interact in a single setting as changes in one area feeds on another. Concerns about emigration in sending countries and its effect on the human capital and welfare in general should be analyzed by looking at the dynamic and contemporary forces of inward FDI and Trade, both of which are affected by the influx of their labour to host countries.

The empirical literature has so far overlooked the examination of those three components in a single framework - a practice anticipated to eliminate the endogeneity problem arising as a consequence of neglecting a factor in the Migration, Trade and Investment (MTI) relationship. Indeed, it was suspected that endogeneity issues maybe behind the failure of previous empirical results in obtaining significant substitution effects between International trade and FDI (Lipsey and Weiss, 1981 and Grubert and Mutti, 1991). Only very recently, did Chong-UK (April 2006) publish a paper on the MIT correlation relationships by looking at US immigrants and their influence on trade and FDI inflows to their country-of-origin via Vector Error Correction Model (VECM) estimation.

Chapter 4 is based on the theoretical framework devised by Kugler and Rapoport (2005) where they consider a small open developing economy and where total factor productivity is expressed a la Lucas or as a function of the local stock of human capital. They develop a set of Lemmas stating that if expectations are adaptive, contemporaneous substitutability and dynamic complementarity should be expected between skilled migration and FDI. If expectations are however rational, then both skilled and unskilled migration are predicted to positively influence FDI inflows back to their home country in the long run.

The aim of Chapter 4 hence is to provide empirical evidence for the question of whether skilled or unskilled migration and FDI are compliments or substitutes when trade in commodities is controlled for. By looking at the school attainment and the skill level of migrant stocks originating from 45 sending countries and residing in 12 host countries in the years 1990 and 2000, the paper intends to disentangle the effects of each migrant group on FDI outflows from migrant-host to migrant-source countries.

Three estimation techniques are employed in search for the most suitable method to estimate the regression explaining the log of the flow of FDI between 1990 and 2000, which represents the dependent variable. On the right hand side, the set of independent variables include the stocks and flows of primary, secondary and tertiary migrants in 1990 and between 1990 and 2000, respectively, along with the flow of imports and exports to/from host countries between 1990 and 2000, as well as other controls. The explanatory variables are also expressed in difference-of-difference to mitigate simultaneity and endogeneity concerns.

In the first instance, OLS estimation is used on both the whole sample of pairs with positive and zero FDI flow values. It is later applied to the sub-sample of countries with strictly positive FDI flows in order to discriminate between the impact of FDI determinants on both the extensive and intensive margins. These results are then compared to those yielding from Tobit estimation technique which handles the leftward censoring of data below a threshold: considered to be either one or the lowest positive FDI flow value. This would serve to directly compare the latter results with those obtained from the regression covering the sub-sample as they both deal with FDI elasticities when the intensity of FDI is of interest. Lastly, I follow Kugler and Rapoport (2005) and Razin et al. (2002) in curing for data censoring brought about by the possible endogeneity of the zero FDI flows and, thus, employ Heckman estimates that can allow for a separate explanation as to why the observations that are censored happen to be censored. Overlapping sets of variables are used to explain the decision to invest in migrants' source country as well as the flow intensity of that investment if there were any. One exclusion restriction is added to the selection equation and that is a dummy representing country pairs with positive FDI flows in the lagged 1980-1990 period as it is assumed that such a variable would impact the likelihood to invest in the following period rather than the intensity of any future investment.

Chapter 2

A Heckscher-Ohlin Model with Imperfect Specialization: Implications for the Gravity Equation

2.0 Introduction

Beside the Heckscher-Ohlin-Vanek factor service trade prediction model (Trefler 1995, Davis and Weinstein 2001) the gravity equation constitutes the most important result with respect to modelling the volume of international trade. The gravity model has long been identified as the "workhorse" of trade studies. This model of trade volumes was recognized to be empirically successful when applied to both developed (OECD and others) and developing countries alike (Hummels and Levinsohn, 1995). It basically says, in its most crude form, that bilateral trade should be positively related to the two trading countries' incomes (or sizes) and negatively correlated with everything that falls under the category of trade barriers: to name a few are distance, tariffs, non-tariffs barriers...etc. Deardorff (1984) stated that in spite of their "somewhat dubious theoretical heritage, gravity models have been extremely successful empirically" (p. 503). Garvity models of trade were equally useful as a stepping stone for developing other propositions. Since then, many have attempted to find theoretical grounds on which to base it. Different structural models were employed to derive the gravity equation predictions: Ricardian, Heckscher-Ohlin (H-O) and Increasing Returns to Scale (IRS) models. However, as Deardorff (1998) indicated, the gravity prediction as such cannot be used to test any of the latter trade theories.

The first attempt to formally derive the gravity equation from assuming product differentiation was in Anderson (1979) who relied on country-of-origin based product differentiation, which was labelled the Armington assumption with reference to Armington's work. Anderson aimed at investigating the econometric properties of the equation he developed rather than analysing its corollaries. Following Anderson, several other studies (Leamer 1992, Eaton and Kortum 1997, Helpman and Krugman 1985, Bergstrand 1990) worked out the derivation of the gravity equation by assuming monopolistic competition within the industry and increasing returns to scale at the firm level. These two assumptions were crucial to induce specialization in the production of a country-by-country differentiated product and the materialization of intra-industry trade[1]. Feenstra (2004) noted that the gravity equation emerges quite naturally whenever countries are assumed to be perfectly specialised in different goods.

In a series of papers, Bergstrand (1985, 1989 and 1990) assumed Armington differentiated goods and Dixit-Stiglitz (1977) monopolistic competition where goods are differentiated among firms and across countries in the aim of explaining production specialisation, through which he derived his gravity equation. Among the propositions he developed in his 1990 paper was one stating that the greater the inequality between two countries' economic sizes, the lower is the level of bilateral intra-industry trade, leading to a relatively low Grubel-Lloyd Index. The latter agrees with a similar proposition in Helpman (1987). This would therefore lay down the premise of this chapter and define the nature of North-South trade (or trade between developed and developing countries) as being essentially composed of inter-industry trade ensuing from factor proportion differences and comparative advantage.

Since "...the theoretical foundations of the gravity equation are actually quite general, but the empirical performance quite specific..." (Feenstra, 1998), Chapter 2, hence, aims to study the form and predictions of a gravity equation developed for a sample of countries where bilateral trade is mostly driven by differences in factor proportions. Interest in such a model lies in the special features associated with countries trading on the low scale of the Grubel-Llyod index[2] and whose trade needs to be modelled based on a set of assumptions that could

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[1] IRS models have later been proved not to be the only ones causing intra-industry trade. Davis (1995) showed that intra-industry trade in homogeneous goods could be explained by a "reciprocal dumping" model.

[2] Devised by Grubel and Lloyd (1975). In its use to measure intra-industry trade, this index was far from being uncontroversial. Greenaway, Hine and Milner (1994) point out the role of trade in intermediate products in raising the value of calculated Grubel-Lloyd Indices. Greenaway and Milner (1983) further show that the pattern of intra-industry trade is not completely accounted for by categorical aggregation. Inter-industry trade is more prevalent in Maghreb-EU15 where 86% of the observations lie below Evenett and Keller's (1998) 0.05 threshold (see Appendix 2.2 for Grubel-Lloyd computation for Maghreb-EU trade)

most suitably explain North-South trade patterns. For this purpose, a gravity model is derived after the perfect specialization in production assumption has been relaxed and both trade frictions and differences in technologies across countries are taken into account. Trade barriers and productivity differences help circumventing common H-O model restrictions like that pertaining to the Factor Price Equalization (FPE) assumption.

The reason why imperfect specialisation is a key assumption in this analysis goes back to the work of Evenett and Keller (1998, henceforth EK) and that of Feenstra, Markusen and Rose (1998) who cast light on the doubt associated with the empirical relevance of the increasing returns to scale (IRS) trade theory, whose critique was brought up in the Hummels and Levinsohn (1995) study. The fact that the gravity equation worked surprisingly well when it is applied to developing countries stirred novel inferences that gravity depends on different models when it is applied to different country samples. They empirically show that an H-O model with imperfect specialisation, constant returns to scale and factor proportion differences is prone to account for the regression results in a sample of countries where intra-industry trade level is low such as North-South trade.

On similar grounds, Haveman and Hummels (2004) defined the strengths of imperfect specialization models in resolving regularly identified "puzzles" associated with complete specialization in the supply side. They looked into two common puzzles: 1) the fact that no-trade (or zeroes in countries' trade matrices) in particular products does in fact occur and that this fact clashes with the complete specialization models' assumptions of consumers highly valuing variety; and 2) the over-prediction of trade levels when compared with observed values.

A caveat, however, in EK's (1998) work was linked to the application of data from a multi-country world to a two-country model, a problem they linked to the trade pattern indeterminacy issue associated with studying bilateral trade flows in a multi-country H-O model with constant returns to scale. A solution to this problem, came in Deardorff's (1998) well documented paper that challenged the possibility of deriving a gravity equation from a neoclassical H-O model with a multi-country, multi-product framework. Deardorff highlighted the weak property that characterizes the H-O model as being that of the Factor Price Equalization (FPE) assumption across countries. With transportation costs and identical factor prices, no two countries would trade with each other since it would be impossible for foreign producers to overcome trade barriers and sell at a price equal or below the one prevailing in the import country. He relaxes this non-factual and limiting assumption to give the H-O model a chance to operate in the real world. Deardorff points out that under impeded (or non frictionless) trade, goods can become non-traded or they can compete in the same market if the price difference caused by transport costs exactly equals the difference in production costs. Deardorff adds that if transportation costs between any pair of countries is constant and thus not dependant on the volume of exports then "the case can be made that only a negligibly small subset of all goods will be sold by any two countries to the same market". In other words, a country's consumers would be willing to purchase each good from only a single foreign country's producers besides their local producers.

This "specialization in trade" result will be used to determine the pattern of trade in a multi-country multi-product model. However, Deardorff assumes the extreme case of perfect specialization in both production and trade where each good is not only exported by only one country but also uniquely produced in that country. Deardorff admits that by doing so he is considering a special case that will be relaxed in this chapter via the introduction of transportation costs so as to end up with a gravity equation based on perfect specialization in trade and imperfect specialization in production.

Hence, this work further distinguishes itself from other studies carried out on gravity equations by explicitly deriving a gravity equation from a multi-country, multi-factor, multi-good world where trade in inter-industrial goods is largely prevalent like it is mostly the case in the South-North type of trade.

In concordance with the Haveman and Hummels (2004) paper that highlighted the different implications of models of perfect and imperfect specialisation, Chapter 2 deals with the theoretical challenges of developing a gravity model that would be able to better explain South-North inter-industry trade and pin down its unique predictions. Section 2.1 lays down the basic assumptions of the model, which will define the trade pattern in a multi-country, multi-factor H-O model. Section 2.2 will then illustrate the derivation of the model from which associated predictions regarding the sensitivity of exports to trading partners' sizes and to variations in technology and transportation costs are extracted. Section 2.3 presents the empirical analysis and Section 2.4 concludes.

2.1 Basic Assumptions

For ease of exposition and in order to determine a clear trade pattern, the theoretical framework considers the even case scenario (m×m×m) where the world is constituted of m countries (i), each producing m final goods (k) via the use of m factors of production (f). It is assumed that all m factors are employed in the production of all m goods but in different intensities. Technology levels differ across countries according to variations in factors' productivities represented by a Hicks-neutral country specific factor (θ^i). Each country is relatively (effectively) abundant in one separate factor of production and each product is relatively (effectively) intensive in one different factor of production f.

In other words, If $\lambda_{f_1k_1}$ represents the "standard unit factor requirement" of commodity k_1 in factor f_1, then imposing:

$$\begin{matrix} \lambda_{f_1k_1} > \lambda_{f_1k_2} \\ \lambda_{f_1k_1} > \lambda_{f_1k_3} \\ \vdots \\ \lambda_{f_1k_1} > \lambda_{f_1k_m} \end{matrix} \quad \text{and} \quad \begin{matrix} \lambda_{f_2k_2} > \lambda_{f_2k_1} \\ \lambda_{f_2k_2} > \lambda_{f_1k_3} \\ \vdots \\ \lambda_{f_2k_2} > \lambda_{f_1k_m} \end{matrix} \quad ,\ldots, \quad \begin{matrix} \lambda_{f_mk_m} > \lambda_{f_mk_1} \\ \lambda_{f_mk_m} > \lambda_{f_mk_2} \\ \vdots \\ \lambda_{f_mk_m} > \lambda_{f_mk_{m-1}} \end{matrix}$$

the intensity of a certain commodity k_1 in factor f_1 is defined by comparing its unit factor requirement in f_1 with the average unit requirement of all produced goods in that same factor. From the above, it can be infered that

$$\lambda_{f_1k_1} > \frac{\sum_k \lambda_{f_1k}}{m} = \overline{\lambda}_{f_1k} \quad \text{and} \quad \lambda_{f_2k_2} > \frac{\sum_k \lambda_{f_2k}}{m} = \overline{\lambda}_{f_2k} \quad ,\ldots., \quad \lambda_{f_mk_m} > \frac{\sum_k \lambda_{f_mk}}{m} = \overline{\lambda}_{f_mk}$$

Hence commodity k_1 is defined to be relatively intensive in f_1, the same applies for k_2 in f_2 and so on. Since parsimonious hicks-neutral technology differences will only be considered in this study, it is impossible therefore to have factor intensity reversals across countries as the following inequality

$$\frac{\lambda_{f_1k_2}}{\theta} > \frac{\lambda_{f_1k_1}}{\theta}$$

would never hold. If F_{11} represents the endowment of factor f_1 in country 1, then it is posited that

$$\begin{matrix} F_{11} > F_{12} \\ F_{11} > F_{13} \\ \vdots \\ F_{11} > F_{1m} \end{matrix} \quad \text{and} \quad \begin{matrix} F_{22} > F_{21} \\ F_{22} > F_{23} \\ \vdots \\ F_{22} > F_{2m} \end{matrix} \quad ,\ldots, \quad \begin{matrix} F_{mm} > F_{m1} \\ F_{mm} > F_{m2} \\ \vdots \\ F_{mm} > F_{m(m-1)} \end{matrix}$$

Hence, by defining relative abundance the same way as in the case of relative intensity, it can be concluded that country 1 is relatively abundant in factor 1, country 2 in factor 2 and so on.

The analysis follow Deardorff's (1982) conclusions from the extension of the H-O model to a more generalized version that might cover any number of goods and factors and where factor prices need not be equalized across countries in order for the pattern of trade to be determined. Deardorff derives a corollary that represents a fairly weaker statement of the two-country, two-good H-O theorem: "goods that are exported must, on average, use relatively more intensively those factors in relative abundance". Then every country would export the good that embodies most of the abundant factor and import the rest of the commodities from the remaining (m-1) countries in such a way that the following equation is satisfied

$$p_{k_iii}\psi_{ij} = p_{k_iij} = p_{k_ijj} \tag{2.1}$$

where

p_{k_iii} is the price of country i's exportable commodity (k_i) that is produced in i and consumed in i

p_{k_ijj} is the price of country i's exportable commodity (k_i) that is produced and consumed in country j

$p_{k_i ij}$ is the price of country i's exportable commodity (k_i) that is produced in i and consumed in j. It is inclusive of transportation costs.

ψ_{ij} is the transportation cost factor reflected in the cif/fob price ratio.

Since perfect competition is assumed, $p_{k_1 ii}\psi_{ij}$ can not be greater or less than $p_{k_1 jj}$ since in the first case country j would not import the good for it would be cheaper to produce it locally and in the second case country j would not produce the good at all and would rely on imports for its consumption.

Evenett and Keller (1998) stressed that in a constant return to scale H-O model, only large enough factor proportion differences across countries can lead to specialization in production. In order for all countries to produce all goods, the countries should be sufficiently similar in their relative factor endowments. Consequently, the factor endowment vector $\{[F_{1i}, F_{2i}, \ldots F_{mi}]'\}_{i=1}^{m}$ in every country, m, is assumed to lie within the space spanned by the m commodities' factor requirement vectors so that there would be no specialization in production and all m goods are produced. This is a mere generalization of EK's 2x2x2 unicone Heckscher-Ohlin case.

2.2 The Model

2.21. The Demand Side in Country j

Preferences are identical across countries and the utility function of the representative consumer has a constant elasticity of substitution (CES) between home and foreign consumption and Cobb-Douglas across industries within the one country. The locally produced and imported goods are not perfectly substitutable since they conform to the Armington assumption of country-of-origin based differentiation. However, the corresponding elasticities of substitution (σ) are constant across industries and across pairs of home and foreign goods.

Hence, a representative consumer in country j has nested CES-Cobb-Douglas cross-product preferences

$$U_j = \prod_k^m \left[\left(c_{kjj}^{\frac{\sigma-1}{\sigma}} + c_{kij}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \right]^{B_k} \qquad \text{where } \sigma > 1 \text{ and } \sum_k^m \beta_k = 1 \qquad (2.2)$$

c_{kjj} is country j's consumption of commodity k produced in j

c_{kij} is country j's consumption of commodity k produced in i

β_k is consumers' fixed share of expenditure for commodity k

σ is the constant elasticity of substitution between home and foreign-produced goods

The income constraint is given by

$$I_j = \sum_k^m p_{kjj} c_{kjj} + \sum_{i \neq j}^{m-1} \sum_{k \neq k_j}^{m-1} p_{kij} c_{kij} \qquad (2.3)$$

where I_j is the income of the representative consumer in country j, p_{kjj} and p_{kij} represent the prices of commodity k that is consumed in j and produced in country j and i respectively. p_{kjj} and p_{kij} are equal, given condition (2.1). Consumers maximize their utility subject to this income constraint. First order conditions result in the following equality

$$c_{kij} = c_{kjj} \qquad (2.4)$$

Hence, local and foreign consumption of home produced commodities are equal. Taking the partial derivatives of U_j relative to both c_{kjj} and $c_{k_j jj}$ - where k_j is country j's exportable product - and imposing $p_{k_j jj}$ as the numeraire, the following two equations are obtained:

$$c_{kjj} = \frac{\beta_k c_{k_j jj}}{\beta_{k_j} p_{kjj}} \tag{2.5}$$

and

$$c_{k_j jj} = I_j \beta_{k_j} \tag{2.6}$$

Where β_{k_j} is the consumption share of country j's exportable good (k_j) and $c_{k_j jj}$ is country j's consumption of its locally produced and exportable good (k_j). Replacing (2.5) and (2.6) in (2.4):

$$c_{kij} = c_{kjj} = \frac{\beta_k I_j}{2p_{kjj}} = \frac{\beta_k I_j}{2p_{kij}} \tag{2.7}$$

Given that demand is identical within and across countries and aggregating across all consumers in country j to compute total import demand in country i, (2.7) yields:

$$x_{kij} = \frac{\beta_k GDP_J}{2p_{kij}} \tag{2.8}$$

where x_{kij} is country j's total import demand of commodity k that is produced and exported from i. Equation (2.8) represents the Import Demand Function.

2.2.2 The Supply Side in Country i

The home market in final goods is considered to be perfectly competitive. National markets are not regarded as perfectly substitutable. In order to enter foreign markets, exporters are faced with some fixed costs whilst studying the market and tailoring products to foreign consumers' specific needs along with implementing introductory marketing and distribution strategies. Consequently, firms face constant returns to scale in the production targeted to local consumers while they face increasing returns to scale in the production of the exportable good to be consumed abroad.

The imperfect substitutability between importing markets is represented by a Constant Elasticity of Transformation (CET) function where the elasticity of transformation of production is some positive definite number γ. If γ equalled infinity (as in Anderson 1979), this would imply that output is perfectly substitutable between home and foreign markets and across foreign markets, in addition, the expenditure constraint would have a linear form[3].

Total output of a representative firm in the exportable commodity's industry (k_i) in country i is represented by:

$$y_{k_i i} = \left[\sum_{k}^{m} \left(\tau_{ij} x_{k_i ij} \right)^{\frac{1+\gamma}{\gamma}} \right]^{\frac{\gamma}{1+\gamma}} \tag{2.9}$$

Where $\gamma > 0$ and τ_{ij} corresponds to a Samuelson (1952) iceberg transportation cost factor (one plus the percentage of the commodity lost along the way) as part of the commodity's shipment melts or drowns in the sea on its way to its destination country. Hence, for every unit of country i's exportable good, only a fraction $(\tau_{ij} - 1)$ arrives at country j's shore. $x_{k_i ij}$ is the quantity of imports of country i's exportable commodity, k_i, that reaches the port of entry of country j. Thus the output of commodity k_i produced in i to be exported to country j can be represented by

$$y_{k_i ij} = x_{k_i ij} \tau_{ij} \tag{2.10}$$

As in Trefler (1995), the way technological differences vary across countries is restricted by the use of hicks-neutral factor augmenting productivity measures ($\theta_i > 0$) where $\theta_c = 1$ for some benchmark country, c. if $\theta_i > 1$, than country i is assumed to be more technologically advanced than this benchmark country since it corresponds to fewer inputs per unit of

[3] Empirical evidence from Baier and Bergstrand (2001) find a point estimate of 8.56 for γ. However, Bergstrand and Baier consider a monopolistic competition model with differentiated goods only. In this study, goods exhibit lower degrees of differentiation as it is based on Armington assumptions, thus γ would be expected to rank higher in this case.

output[4]. Hence, the θ's reflect the relative technological position of a country with respect to c (i.e. $\theta_i = \frac{\theta_i}{\theta_c}$). The use of hicks-neutral productivity differences assumes away the possibility of Factor Intensity Reversals (FIR) across countries. This fact explains why each country, being abundant in one separate factor of production, is the sole exporter of the good, the production in which is intensive in that same factor. Firms choose their output levels by maximising their profits. A representative firm in industry k_i will maximize

$$\pi_{k_i} = \sum_j p_{k_i ij} x_{k_i ij} - \sum_{j \neq i}^{m-1} F_j - \sum_f \lambda_{fk_i} \frac{r_f}{\theta_i} \left[\sum_j^m \left(\tau_{ij} x_{k_i ij} \right)^{\frac{1+\gamma}{\gamma}} \right]^{\frac{\gamma}{1+\gamma}} \tag{2.11}$$

where F_j is the fixed cost incurred in marketing and tailoring product k to the needs of consumers in country j, λ_{fk_1} is factor f 's unit requirement for k_i, r_f is the return on factor f in country i and θ_i is the hicks-neutral technology term for country i. Factor Price Equalization (FPE) does not occur as it would under the assumption of the Heckscher-Ohlin model with frictionless trade as transportation costs and technology differences prevent this from happening[5]. Since perfect competition prevails in the final goods market in country i, it is expected that prices equal marginal costs:

$$p_{k_i ii} = \frac{\sum_f^m \lambda_{fk_i} r_f}{\theta_i}$$

Where $p_{k_i ii}$ is the price of country's i exportable commodity k_i that is produced and consumed in i. First order conditions from the maximization problem yield:

[4] Trefler (1995) has taken the United Stated of America as being his benchmark country with $\theta_{USA} = 1$ since the USA is considered to be the most productive country in the world, he therefore imposed the restriction that all other countries' θs are smaller than 1. Davis and Weinstein (2001) have also taken the USA as their benchmark country.

[5] Studies like in Davis and Weinstein (2001), Deardorff & Hakura (1995) and Debaere (1998) were more successful in explaining Trefler's (1995) "missing trade" partly because they have departed from the common FPE assumption.

$$x_{k_i ij} = \psi_{ij}^{\gamma} \tau_{ij}^{-(1+\gamma)} x_{k_i ii} \tag{2.12}$$

Placing (2.12) in (2.9) would yield another expression for $y_{k_i i}$:

$$y_{k_i i} = x_{k_i ii} \left[\sum_{j}^{m} \left(\frac{\psi_{ij}}{\tau_{ij}} \right)^{1+\gamma} \right]^{\frac{\gamma}{1+\gamma}} = x_{k_i ii} Z_{ij}^{\gamma} \tag{2.13}$$

Where $Z_{ij} = \left[\sum_{j}^{m} \left(\frac{\psi_{ij}}{\tau_{ij}} \right)^{1+\gamma} \right]^{\frac{1}{1+\gamma}}$ and ψ_{ij} is the c.i.f / f.o.b price differential. Under perfect competition, profits are zero. Hence, equating (2.11) to zero and solving for $y_{k_i i}$, two expressions are obtained for $y_{k_i i}$:

$$y_{k_i i} = \frac{\sum_{j \neq i}^{m-1} F_j}{p_{k_i ii}(Z_{ij} - 1)} \tag{2.14}$$

and

$$y_{k_i i} = \frac{(\eta - 1)\sum_{j \neq i}^{m-1} F_j}{p_{k_i ii}} \tag{2.15}$$

where η is the price elasticity of demand for commodity k_i. Equating (2.14) to (2.15):

$$Z_{ij} = \left(\frac{y_{ki}}{x_{kii}} \right)^{\frac{1}{\gamma}} = \frac{\eta}{\eta - 1} > 1$$

The above implies that $\eta > 1$ or else Z_{ij} would have an implausible negative value. In other words, consumers in country j have elastic demand. This stresses the fact that prices of both home and foreign produced goods should be equal; otherwise a minor price differential would shift consumption from home to foreign and increase the possibility of ending up with specialization in production. From (2.14), the export supply function of a representative firm in industry k_i is derived by combining both (2.12) and (2.14):

$$x_{k_i ij} = \left(\sum_{j \neq i}^{m-1} F_j\right)(\eta - 1)\left(P_i^F\right)^{-\gamma} \psi_{ij}{}^{\gamma} \tau_{ij}{}^{-1-\gamma} p_{k_i ii}^{\gamma - 1} \tag{2.16}$$

Where $P_i^F = \left[\sum_j \left(\frac{p_{k_i ij}}{\tau_{ij}}\right)^{1+\gamma}\right]^{\frac{1}{1+\gamma}}$. The same is performed on equation (2.15) and another expression for $x_{k_i ij}$ is obtained:

$$x_{k_i ij} = \left(\sum_{j \neq i}^{m-1} F_j\right) \psi_{ij}{}^{\gamma} \tau_{ij}{}^{-1-\gamma} Z_{ij}{}^{-\gamma} (Z_{ij} - 1)^{-1} p_{k_i ii}^{-1} \tag{2.17}$$

f_i is considered as being the factor that is used most intensively in the production of k_i. Factor market clearing conditions necessitate equating the total endowment of factor f_i in country i (denoted by V_i^i) to the sum of its allocation in the production of all m commodities in country i:

$$V_{f_i}^i = m\left[\frac{\lambda_{f_i k_i} y_{k_i i} + \sum_{k \neq k_i}^{m-1} \lambda_{f_i k} y_{ki}}{\theta_i}\right] \tag{2.18}$$

The value of $y_{k_i i}$ from (2.14) is replaced in the above equation and given that production of the (m-1) non-exportable goods is locally consumed in whole; this yields:

$$V^i_{f_i} = \frac{\lambda_{f_i k_i} X_{k_i ii}\left(Z^{\gamma}_{ij} - 1\right) + \sum_k^m \lambda_{f_i k} X_{kii}}{\theta_i} \tag{2.19}$$

Where $A^i_{f_i} = \frac{\sum_k^m \lambda_{f_i k} X_{kii}}{\theta_i}$ is defined as the total factor absorption of f_i in country i. x_{kij} is replaced with X_{kij} to reflect aggregation over all firms operating in all m industries. Adjusting (2.19):

$$X_{k_i ii} = \frac{(V^i_{f_i} - A^i_{f_i})\theta_i}{\lambda_{f_i k_i}\left(Z^{\gamma}_{ij} - 1\right)} \tag{2.20}$$

Where $X_{k_i ii}$ is the quantity of locally oriented production of all firms functional in industry k_i (the exportable industry) in country i and $(V^i_{f_i} - A^i_{f_i})$ represents implicit gross exports of factor f_i from country i. Replacing (213) in (2.20):

$$Y_{k_i i} = \frac{(V^i_{f_i} - A^i_{f_i})\theta_i Z^{\gamma}_{ij}}{\lambda_{f_i k_i}\left(Z^{\gamma}_{ij} - 1\right)} \tag{2.21}$$

The above equation clearly depicts the generalized, multi-country Ribzinsky effect developed by Bergtsrand (1989): The total level of k_i's output in country i is positively correlated with the endowment of the abundant factor $V^i_{f_i}$. Plugging (2.21) in (2.12), this generates:

$$X_{k_i ij} = \frac{(V^i_{f_i} - A^i_{f_i})\theta_i \left(\frac{\psi_{ij}}{\tau_{ij}}\right)^{\gamma}}{\lambda_{f_i k_i}\tau_{ij}\left(Z^{\gamma}_{ij} - 1\right)} \tag{2.22}$$

Assuming that all firms in a single industry are symmetric, consequently each firm will end up producing and exporting the same level of output and x_{k_iij} will be the same across all firms in country i producing k_i. Therefore and in order to determine the number of firms, N, in k_i, Y_{k_ii} is either divided by y_{k_ii} or X_{k_iij} by x_{k_iij}. Proceeding with the latter calculation:

$$N = \theta_i (V_{f_i}^i - A_{f_i}^i)\left(P_i^F\right)^{\gamma}\left(\lambda_{f_ik_i}\right)^{-1}\left(Z_{ij}^{\gamma}-1\right)^{-1}\left(\sum_{j\neq i}^{m-1} F_j\right)^{-1}(\eta-1)^{-1} p_{k_iii}^{1-\gamma} \tag{2.23}$$

and solving for p_{k_iii} by equating (2.16) and (2.17):

$$p_{k_iii} = P_i^F Z_{ij}^{-1} \tag{2.24}$$

replacing (2.24) in (3.23):

$$N = \theta_i\left(V_{f_i}^i - A_{f_i}^i\right) P_i^F \left(\lambda_{f_ik_i}\right)^{-1}\left(\sum_{j\neq i}^{m-1} F_j\right)^{-1}\left(Z_{ij}^{\gamma}-1\right)^{-1}\left(Z_{ij}^{\gamma}-1\right) Z_{ij}^{\gamma-1} \tag{2.25}$$

Multiplying (2.25) by (2.16), this generates the total Export Supply Function in country i:

$$X_{k_iij} = \theta_i (V_{f_i}^i - A_{f_i}^i)\psi_{ij}\left(P_i^F\right)^{-\gamma}\left(\lambda_{f_ik_i}\right)^{-1}\left(Z_{ij}^{\gamma}-1\right)^{-1} Z_{ij}^{\gamma}\tau_{ij}^{-(\gamma+1)} p_{k_iij}{}^{\gamma} \tag{2.26}$$

With the purpose of obtaining the equilibrium c.i.f price of k_i in j, the total Export Supply Function (2.26) is equated to the total Import Demand Function (2.8), this yields:

$$p_{k_iij} = \frac{GDP_j^{\frac{1}{\gamma+1}} \beta_{k_i}^{\frac{1}{\gamma+1}} \left(\lambda_{f_ik_i}\right)^{\frac{1}{\gamma+1}} \left(Z_{ij}^{\gamma} - 1\right)^{\frac{1}{\gamma+1}} \tau_{ij}}{2.\theta_i^{\frac{1}{\gamma+1}} (V_{f_i}^i - A_{f_i}^i)^{\frac{1}{\gamma+1}} \left(P_i^F\right)^{\frac{\gamma}{\gamma+1}} Z_{ij}^{\frac{\gamma}{\gamma+1}}} \tag{2.27}$$

replacing (2.27) in (2.26):

$$X_{k_iij} = \frac{GDP_j^{\frac{\gamma}{\gamma+1}} \beta_{k_i}^{1+\gamma} \theta_i^{\frac{1}{\gamma+1}} (V_{f_i}^i - A_{f_i}^i)^{\frac{1}{\gamma+1}} Z_{ij}^{\frac{\gamma}{\gamma+1}}}{2.\left(P_i^F\right)^{\frac{\gamma}{\gamma+1}} \left(\lambda_{f_ik_i}\right)^{\frac{1}{\gamma+1}} \left(Z_{ij}^{\gamma} - 1\right)^{\frac{1}{\gamma+1}} \tau_{ij}} \tag{2.28}$$

Solving for the value of $(V_{f_i}^i - A_{f_i}^i)$ by equating the implicit gross exports of factor f_i in country i to its total endowment minus the level of f_i allotted to local consumption, this produces:

$$V_{f_i}^i - A_{f_i}^i = V_{f_i}^i - N \sum_{k \neq k_i}^{m-1} \frac{\lambda_{f_ik} y_{kii}}{\theta_i} - \frac{\lambda_{f_ik_i}}{\theta_i} X_{k_iii} \tag{2.29}$$

Where X_{k_iii} is local consumption of commodity k_i aggregated over all consumers in i and y_{kii} is a representative's firm production of commodity $k \neq k_i$ in country i. Full employment in the factors of production market entails:

$$V_{f_i}^i = N \sum_{k}^{m} \frac{\lambda_{f_ik} y_{kii}}{\theta_i} = N \sum_{k \neq k_i}^{m-1} \frac{\lambda_{f_ik} y_{kii}}{\theta_i} + N \frac{\lambda_{f_ik_i} (\eta - 1) \sum_{j \neq i}^{m-1} F_j}{\theta_i p_{k_iii}} \tag{2.30}$$

Replacing $V_{f_i}^i$ by its value from equation (2.30), equation (2.29) yields:

$$V_{f_i}^i - A_{f_i}^i = N \frac{\lambda_{f_ik_i} (\eta - 1) \sum_{j \neq i}^{m-1} F_j}{\theta_i p_{k_iii}} - \frac{\lambda_{f_ik_i} \beta_{k_i} GDP_i}{\theta_i} \tag{2.31}$$

Replacing N with its value in (2.23) and solving for $(V_{f_i}^i - A_{f_i}^i)$:

$$V_{f_i}^i - A_{f_i}^i = \frac{\beta_{k_i}\lambda_{f_i k_i} GDP_i}{\theta_i\left[\frac{\left(P_i^F\right)^\gamma}{\left(Z_{ij}^\gamma - 1\right)p_{k_i ii}{}^\gamma} - 1\right]} \tag{2.32}$$

Replacing P_i^F with its value from (2.24):

$$V_{f_i}^i - A_{f_i}^i = \frac{\beta_{k_i}\lambda_{f_i k_i}\left(Z_{ij}^\gamma - 1\right) GDP_i}{\theta_i} \tag{2.33}$$

Replacing $(V_{f_i}^i - A_{f_i}^i)$ and P_i^F with their values from (2.33) and (2.24), respectively, and substituting $p_{k_i ii}$ by its marginal cost value, the final gravity equation is obtained:

$$X_{k_i ij} = \frac{GDP_i^{\frac{1}{\gamma+1}} GDP_j^{\frac{\gamma}{\gamma+1}} \theta_i^{\frac{\gamma}{1+\gamma}} \beta_{K_i}}{2\left(\sum_f^m \lambda_{fk_i} r_f\right)^{\frac{\gamma}{1+\gamma}} \tau_{ij}} \tag{2.34}$$

Equation (2.34) implies that exports of commodity k_i from country i to country j are positively correlated with the size (GDP) of both the exporting and importing country as is common in any gravity equation. Furthermore, imports are also positively correlated with the weight product, k_i, holds in general consumers' preferences. On the other hand, exports are inversely related to transportation costs (τ_{ij}) and to the f.o.b price of the exported commodity, $p_{k_i i} = \frac{\sum_f^m \lambda_{fk_i} r_f}{\theta_i}$, which is in turn inversely correlated with the technological attainment in the exporting country.

Equation (2.34) offers novel theoretical predictions related to the sensitivity of trade vis-à-vis its different determinants. It predicts that trade elasticities relative to the two countries' sizes are strictly less than one. This result is compliant with the many critiques revolving around the standard gravity model's predictions of unitary trade elasticities relative to the trading partners' incomes as in Haveman and Hummels (2004). Furthermore, empirical studies have found evidence for elasticities strictly different than one (Matyas (1997) and Bergstrand (1985)).

The model also predicts that exports from South to North are more sensitive to partner's income than to own income. This is line with the predictions laid out in Feenstra, Markusen and Rose (2001) where they too considered an Armington-type model (national differentiation) with perfect competition but looked at the case where there is perfect specialization in production. The intuition behind such a result works its way through "aggregate production and consumption" (Feenstra, Markusen and Rose, 2001) and stems from the fact that prices of the home and imported varieties of products are equal in the North market and are therefore demanded by consumers there in the same ratio. With production being proportional to income creating excess demand for South countries products, this would put pressure on the latter countries to shift part of their production capacity to foreign consumption, hence the greater sensitivity of South exports to partners' incomes.

Lastly, the gravity equation (2.34) provides justification for the inclusion of some variables that, previously, have not formally and theoretically emerged from a derivation of the gravity model. These variables are the technological productivity level (imbedded in the price) in the exporting country and the general consumer preferences. Previous empirical studies, however, did proxy technological productivity with per-capita income as an extension to the specification of the standard gravity model or in concordance with Bergstrand's (1989) generalized gravity equation to substitute for differences in capital-labour ratios. Helmers and Pasteels (2005) point out that a theoretical back up for trends in general preferences toward a particular commodity would give more credibility for the inclusion of such a variable in empirical estimation as it would considerably increase the fit of the regression and render it more apt for trade level predictions and for studies on trade potential.

2.3 Empirical Analysis

2.3.1 Data Description

A panel of commodity export volumes from three Arab Maghreb countries[6] and twelve Central and Eastern European Countries[7] to all fifteen members of the EU-15[8] is analyzed. Commodities are disaggregated at the 4-digit level of the ISIC-Rev3 classification code as this would allow an empirical study for reasonably differentiated products. Commodities' consumption shares are obtained from the United Nations Industrial Development Organization (UNIDO) and are disaggregated at the 4-digit level of the ISIC-Rev3 classification code. Data on Commodities' export volumes is acquired from the United Nation's COMTRADE database which disaggregates products according to the SITC, HS and BEC classifications. 4-digit level SITC-Rev3-classified commodities are linked to their equivalents at the 4-digit level of the ISIC-Rev3 classification code in harmony with data on consumption shares. Data for GDP is taken from the World Bank's World Development Indicators (WDI) and is deflated by the corresponding exporter's consumer price index obtained from the same source (base year is 1995). Data on labour productivity is extracted from the Eurostat-New Cronos database is available from all exporting countries.

Transportation costs are proxied by the use of data on bilateral distance so as to be able to compare the empirical results of this study with previously obtained estimates in the literature albeit this might lead to possible misspecification in the regression. This issue is further explored in the next chapter. Distance is defined as the great circle distance separating the capitals of the two trading partners. Data for distance, common border, common language, landlocked-ness and colonial relationships is taken from Andrew Rose's database.

The panel is unbalanced and involves 17,889 categorical groups. It extends longitudinally over the period 1997-2001 since data on some explanatory variables was not available for the years preceding 1997 and following 2001. Only 52.69% percent of the commodities have export observations recorded in all 5 years of the 1997-2001 period. Checks were carried out on the presence of outliers having studentized residuals (residuals weighted by their standard

[6] Algeria, Morocco and Tunisia

[7] Czech Republic, Cyprus, Estonia, Bulgaria, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak, Slovenia.

[8] In contrast to other empirical studies involving data on the EU-15 countries, I use separate data for Belgium and Luxembourg rather than compounding them together.

deviation) with absolute values greater than 3.5 and none was found. Hence, the data is considered to be generally consistent.

2.3.2 Methodology

The gravity model was, in most of the corresponding literature, estimated via cross-section analysis (Bergstrand 1985, Wang and Winters 1991, Nilsson 2000) which does not account for heterogeneous trade relationships. Few studies exploited panel econometric methods (Baldwin 1994, Matyas 1997 and 1998, Egger, 2000) for the purposes of modelling trade and computing un-exhausted trade potential. Cross-section analysis is argued to yield biased estimates due to omitted explanatory variables that should be included in the specification. A panel framework offers several advantages over cross-section analysis by incorporating the time dimension which permits a disentanglement of country and time-specific effects. It increases the number of available observations and, thus, increases the degrees of freedom which would in turn decrease the variance of the parameter's estimates.

Matyas (1997), Egger (2000) and Egger and Pfaffermayr (2003) consider the unobserved heterogeneity which is reflected in the country, time and bilateral-specific effects as being fixed and not random. They justify the use of a within estimator to model bilateral trade by the fact that fixed export effects are mostly due to omitted variables relating to export supporting or impeding variables that are not random but deterministically linked to historical or geographical ties. Hence, in the above mentioned studies, the fixed effects model (FEM) was intuitively preferred over the random effects model (REM). In addition, Egger (2000, 2003 and 2004) justified his preference for a fixed effects model by computing the Hausman test statistic that determines the specification to be used: the statistic was highly significant (at 1%) leading to inconsistent REM estimates. Thus, Egger concludes that the proper econometric specification is one with fixed country and time effects.

The problem that is commonly associated with FEM is its inability to estimate the coefficients on the time-invariant (or one-dimensional) variables. Egger (2004) shows that this can be circumvented by either following Hausman and Taylor (1981) two-stage-least squares error components approach or by adopting the two-step approach where in the first stage a fixed effects model is estimated yielding Least-Squares Dummy Variable (LSDV) coefficient estimates for the bilateral-specific effects; and in the second stage, the estimated parameters (obtained from the first stage LSDV regression) are regressed on the time-invariant explanatory variables using OLS[9]. The estimation approach adopted in this chapter is as follows:

1) Data is pooled and both OLS and instrumental variable (IV) estimations of both the basic gravity equation (derived in the theoretical part of the paper, equation (2.34) and of an "extended" type of that equation that includes dummies for additional trade influencing factors between two countries such as a common border, common language, a colonial relationship or if one of the two countries is landlocked) is carried out..

2) Subsequently, endogeneity is tested for in the regression estimated via instrumental variables by applying a Durbin-Wu-Hausman (DWH) test, the null hypothesis for which states that an OLS estimator of the same regression would yield consistent estimates and hence the endogenous regressor's (in this case, price) effects on the estimates would not be significant.

Steps 1 and 2 represent the benchmark estimation technique, which does not control for unobserved heterogeneity across countries

3) In the case of the rejection of the null, OLS estimates are not consistent and IV estimates are compared to those yielding from panel techniques.

4) Again, the Durbin-Wu-Hausman (DWH) test is applied in order to compare between random effects and Two-Stage Least Squares GLS (which are denoted by IV-GLS) panel estimates.

5) In the case of rejection, I compare panel IV-GLS with pooled IV estimates by running the Lagrange Multiplier (LM) test devised by Breusch and Pagan (1980), the null hypothesis states that there is no significant individual or time random effects ($H_0 : \sigma_\mu^2 = 0$ or $\sigma_\lambda^2 = 0$). In case of rejection, pooled estimates are biased and panel techniques are adopted.

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[9] In a still unpublished paper, Egger argues that the second-step regression should be estimated by GLS rather than OLS since the former accounts for the variances and distribution of the estimated coefficients whereas OLS does not.

6) Random and Fixed Effects estimates of the basic gravity equation are compared to each other and the Hausman-Taylor specification test is applied. Random Effects are consistent and efficient under the null and inconsistent under the alternative. Fixed Effects estimates are conversely consistent under both the null and the alternative hypothesis.

7) If the null is rejected, then random estimates are inconsistent and Least Square Dummy Variable (LSDV) estimates are preferred. Again, DWH test is performed to investigate the consistency of the non-instrumented LSDV estimates. If the endogeneity of the price variable is significant, then the Two-Stage Least Squares Within Estimator (which is denoted by IV-LSDV) will be computed for three different Fixed Effects model specifications:

a- A three-way model having fixed time, exporter and importer effects

b- A three-way model + fixed bilateral effects

c- A three-way model + fixed bilateral and commodity effects

8) Different model selection criteria are used to choose the more appropriate specification of the IV-LSDV regression.

9) Given that all time-invariant regressors are dropped out of the IV-LSDV regression, the OLS regressions of the estimated bilateral fixed effects' parameters from the first-step IV-LSDV equation are regressed, in a second step, on the time-invariant regessors of interest.

2.3.3 Model Specification

As mentioned earlier, three different fixed effects gravity specifications are considered: (1) a three-way model like in Matyas (1997), (2) a three-way model with bilateral interaction effects like in Egger and Pfaffermayr (2003) and (3) one that has all the former effects and that additionally accounts for commodity-specific unobserved heterogeneity. Time and commodity-specific effects (λ_t, η_k) should be included in the regression as the dependent variable is quadruple indexed and reported by exporter, importer, commodity exported and year. Time effects (λ_t) represent the common business cycle over the whole sample. The import country effects (γ_j) may reflect the degree of openness of the importing economy whereas the exporter-country effect (α_i) may indicate export efficiency of the exporting country relative to others in the sample. Noteworthy to mention that, since only one-way exports (from Maghreb and CEEC countries to EU-15 members) are considered in this study, any country in the sample is either an exporter or importer and can not be both. A dummy for each country pair (δ_{ij}) is added to pick up time-invariant bilateral interaction effects which measure deviations from a country pair's "normal" tendency to trade.

This section is devoted to studying the signs, significance and magnitude of estimated elasticities in a gravity equation that either possesses equation (2.34)'s basic specification or an extended version of it to see how close they conform to the theoretical predictions of a gravity equation with imperfect specialization. For the basic theoretical specification, the log of products' export volumes (from the three Maghreb countries and the 12 CEECs to each of the EU-15 members) is regressed on the log of each of the exporting and importing countries' GDP (after they have been deflated by the consumer price index (CPI) of the corresponding export country), the log of deflated export prices, the log of the share of the exported commodity in the world's total consumption and the log of distance between the two trading partners' capitals. The estimated equation is hence specified as:

$$\log EX_{ijkt} = \beta_1 \log GDP_{it} + \beta_2 \log GDP_{jt} + \beta_4 \log w_{kt} + \beta_3 \log pr_{ikt} + \beta_5 \log d_{ij} + \varepsilon_{ijkt},$$
$$\varepsilon_{ijkt} = \alpha_i + \gamma_j + \delta_{ij} + \lambda_t + \eta_k + v_{ijkt}$$

X_{ijt} represents export volume of commodity k from i to j. GDP_{it} and GDP_{jt} are real incomes of exporter country i and importer country j respectively at time t. w_{kt} denotes the weight of commodity k in the world's total consumption at time t. pr_{ikt} corresponds to the price exporters in i receive for commodity k at time t. d_{ij} is distance between i and j.

For the extended version, dummies are added for common border, b_{ij}, pairs in colonial relationship, COL_{ij}, common language, L_{ij}, and a dummy if either of two the partners is landlocked, LND_{ij}. Thus in a given year, t, export flows from exporting country i to importing country j are estimated as:

$$\log EX_{ijkt} = \beta_1 \log GDP_{it} + \beta_2 \log GDP_{jt} + \beta_4 \log w_{kt} + \beta_3 \log pr_{ikt} + \beta_5 \log d_{ij} + \beta_6 D_{ij} + \varepsilon_{ijkt}$$
$$D_{ij} = \beta_7 b_{ij} + \beta_8 L_{ij} + \beta_9 COL_{ij} + \beta_{10} LND_{ij}$$
$$\varepsilon_{ijkt} = \alpha_i + \gamma_j + \delta_{ij} + \lambda_t + \eta_k + v_{ijkt}$$

2.3.4 Empirical Results

Table 2.1 depicts OLS and 2SLS estimations of both the basic and extended versions of equation (2.34). Heteroscedasticity tests are significant and, consequently, White Heteroscedasticity-robust standard errors are reported in parentheses.

To check whether the endogeneity of the price variable yields inconsistent OLS estimates, the Durbin-Wu-Hausman endogeneity test is applied on the price variable. The test strongly rejects the null and, hence, indicates that the endogeneity effects on the estimates are meaningful. The price variable is therefore instrumented with labour productivity in the exporting country assuming that it would proxy for the general technological productivity there.

In columns 1 and 2 of Table 2.1, changes in the independent variables explain around 95% of the variation in the South-North export volumes in the sample. Both OLS and 2SLS results in all columns of Table 2.1 conform to the predictions of equation (2.34): the effect of the importer country's GDP on the volume of exports is higher than that of the exporting country. Column 4 of Table 2.1, for example, predicts that a 1% increase in the exporter's and importer's GDP would lead to an increase of 0.31% and 0.69% in the volume of exports, respectively. In addition, exports are close to being unitary elastic to variations in transportation costs, solely proxied in the basic regression by distance, which corresponds to the predictions of equation (2.34). According to column 3 of Table 2.1, if the two trading partners are 1% further apart, then exports are expected to drop by approximately 0.99%. The coefficient on the price variable is negative and significant at the 1% level across Table 2.1, but it decreases in magnitude when it is instrumented with labour productivity as it better signals the individual effect of technology on the trade level. Hence, it is inferred that failing to correct for endogeneity would result in an upward bias in the coefficient on the technological variable. A negative sign translates the inverse effect of higher productivity on prices, inducing increased trade.

Almost all coefficients are significant and their signs are in line with the general predictions of the (2.34) gravity equation. After adding one trade-impeding (landlocked-ness) and three trade-enhancing (common border, common language and colonial relationship) dummies in the extended regressions in columns 2 and 4 of Table 2.1, coefficients on the main regressors do not vary significantly, except for the one on distance as it no longer uniquely represents transportation costs. The effects of common border and language on exports are positive and significant at the 1%. The 2SLS estimates for colonial relationship are insignificant and the effect of landlocked-ness, however minor, is counter-intuitively positive and significant. The latter may be due to the fact that only three (Austria, Hungary and Slovakia) out of the thirty countries, considered in the study, are in fact landlocked with two of them (Hungary and Slovakia) being CEEC exporters located in the European continent, in geographical proximity to the EU-15 members.

The coefficient on the consumption weight of k in World's consumption at time t, w_{kt}, has a robust , positive and significant coefficient across all regressions which is congruent to the predictions of the gravity equation (2.34) regarding the positive effect of general preferences on South-North export volumes.

Albeit 2SLS estimation is more appropriate in that it deals with the endogeneity bias of the pooled regression, it does not, however, control for unobserved heterogeneity that is most likely present across importing and exporting countries or even across pair-wise trading relationships. The Breusch-Pagan LM test rejects the null that pooling the data delivers non-biased estimates. The Hausman specification test is also performed in Table 2.2. Results show that a Random Effects model does not yield consistent estimates and, therefore, suggests treating the time-invariant specific effects as fixed and not random. Wald tests, carried out on all fixed effects, strongly reject the null of insignificance.

The Fixed Effects estimates for the three-way, bilateral and commodity-specific dummies are omitted for space considerations. The 2SLS-Within estimator (denoted in table 3.2 by IV-LSD[10]) is reported for three different specifications of the gravity equation, all of which yield an insignificant impact of exporter's GDP. The coefficient on the exporter's GDP variable is insignificant in columns 2, 3 and 4 of Table 2.2. On the other hand, the coefficient estimates for the time-varying regressors, importer GDP and price of k, are significant and have the correct sign in IV-LSDVI. They, however, gradually lose significance as bilateral and commodity-specific dummies are respectively added, in the IV-LSVII and IV-LSDVIII regressions. The significance of these variables diminishes as their explanatory power is explained by other unobserved bilateral or commodity-specific features captured by the respective dummies.

IV-LSVDIII is considered to have the "full set" of Fixed Effects dummies needed to obtain the most appropriate coefficient estimates for both the time-varying and the dropped time-invariant regressors. In addition, IV-LSVDIII possesses the highest goodness of fit being equal to 97%.

[10] The IV-LSDV is short for the Least Square Dummy Variable estimator with Instrumental Variables.

Table 2.1: Gravity Equation: Pooled OLS and 2SLS Estimation

The Dependent Variable is log of Exports (log EX_{ijkt})

	OLS [a]		2SLS [a]	
	Basic Model	**Extended Model**	**Basic Model**	**Extended Model**
Exporter GDP (log GDP_{it})	0.403*** (0.011)	0.384*** (0.011)	0.338*** (0.012)	0.314*** (0.013)
Importer GDP (log GDP_{jt})	0.640*** (0.014)	0.664*** (0.015)	0.674*** (0.017)	0.691*** (0.016)
Weight of k in World Consumption (log w_{kt})	0.337*** (0.012)	0.337*** (0.012)	0.315*** (0.014)	0.310*** (0.015)
Price of Exported good k (log Pr_{ikt})	-1.115*** (0.008)	-1.108*** (0.008)	-0.802*** (0.0501)	-0.878*** (0.535)
Distance (log d_{ij})	-1.17*** (0.020)	-0.968*** (0.234)	-0.988*** (0.027)	-0.790*** (0.031)
Common Border (b_{ij})	-	0.852*** (0.068)	-	0.727*** (0.081)
Common Language (L_{ij})	-	0.332*** (0.072)	-	0.359*** (0.092)
Pairs in Colonial Relationship (COL_{ij})	-	-0.583*** (0.093)	-	-0.093 (0.126)
Exporter/Importer is Landlocked (LND_{ij})	-	0.174*** (0.034)	-	0.015*** (0.042)
Constant	-4.593*** (0.498)	-4.830*** (0.544)	-4.389*** (0.584)	-5.667*** (0.0623)
Instrument for Price: Exporter Labour Productivity	No	No	Yes	Yes
Number of Observations	32505	32505	32505	32505
R2	0.95	0.95	-	-
Durbin-Wu-Hausman Endogeneity test (OLS vs IV): $\chi^2(1)$ [b]	-	-	279.52***	342.49***
Heteroscedasticity test: $\chi^2(1)$ [c]	202.74***	189.83***	368.65***	376.17***
F	1788.97***	1072.15***	1359.23***	761.31***

a) White standard Errors are reported in parentheses. b) The null hypothesis for the Durbin-Wu-Hausman test is that OLS yields consistent estimates c) Breusch-Pagan / Cook-Weisberg test for heteroskedasticity: uses the fitted values of Log of exports in explaining the estimated squared residuals. ***) significant at 1%; **) significant at 5%; *) significant at 10%

Table 2.2: Gravity Equation: GLS and LSDV Estimation

The Dependent Variable is log of Exports (log EX_{ijkt}) $^{a)}$	IV-GLS	IV-LSDV I	IV-LSDV II	IV-LSDV III
Exporter GDP (log GDP_{it})	0.247*** (0.021)	0.008 (0.146)	0.001 (0.146)	-0.012 (0.114)
Importer GDP (log GDP_{jt})	0.599** (0.028)	0.613*** (0.107)	0.865** (0.117)	0.932* (0.153)
Weight of k in World Consumption (log w_{kt})	0.258*** (0.021)	0.322*** (0.029)	0.334*** (0.031)	0.237*** (0.030)
Price of Exported good k (log $\Pr_{ikt}$)	-1.052*** (0.069)	-0.782* (0.562)	-0.765* (0.616)	-0.807 (0.602)
Distance (log d_{ij})	-0.854*** (0.047)	-	-	-
Common Border (b_{ij})	0.739*** (0.133)	-	-	-
Common Language (L_{ij})	0.247* (0.139)	-	-	-
Pairs in Colonial Relationship (COL_{ij})	0.270 (0.139)	-	-	-
Exporter/Importer is Landlocked (LND_{ij})	0.126* (0.067)	-	-	-
Constant	-2.648*** (0.934)	-	-	-
Number of Observations	31823	31823	31823	31823
Number of groups	17889	17889	17889	17889
R2	0.965	0.959	0.962	0.973
Breusch-Pagan LM test (Random vs pooled OLS): $\chi^2(1)$	24717.83***			
Hausman (Fixed vs Random Effects): $\chi^2(4)$	526.80***	-	-	-
Wald Tests:				
Exporter Effect	-	267.36***	14.99***	10.63***
Importer Effect	-	75.11***	9.87***	11.03***
Time Effect	-	5.26***	5.50***	9.26***
Bilateral Effect	-	-	19.00***	29.47***
Commodity Effect	-	-	-	135.59***
time-invariant effects	-	259.96***	86.97***	148.74***

a) White standard Errors are reported in parentheses. ***) significant at 1%; **) significant at 5%; *) significant at 10%.

Table 3.3 illustrates Egger's Two-Step approach where the bilateral Fixed Effects obtained from the first-step LSDV estimation are initially regressed on distance alone (Reg-I), then on both distance and the rest of the time-invariant regressors in a second regression (Reg-II).

Comparing the results of the second-step regression in Table 2.3 to those yielding from the 2SLS estimation of the extended model's specification in column 4 of Table 2.1, the coefficient on distance is again significant and different than 1, suggesting a non-linear relationship between transportation costs and distance and signalling the presence of other variables influencing transportation costs between countries. The common border dummy is no longer significant and colonial relations seem to exhibit significant positive influence over exports. As in Table 3.1, landlocked-ness does not seem to discourage exports in this sample, having a positive significant estimator. Finally, it is worth noting that the R^2 increased by only 11% when all four dummies were added in regression II, the fact that highlights the importance of distance in explaining transportation costs and affecting trade relative to the other time-invariant bilateral factors.

Table 2.3: Gravity Equation: The Two-Step Approach

First Step: Fixed Effects; Dependent Variable is Exports		**Second Step: OLS; Dependent Variable is Bilateral Fixed-Effects**		
Explanatory Variables		Explanatory Variables	Reg-I	Reg-II
Exporter GDP (log GDP_{it})	-0.012 (0.114)	Distance (log d_{ij})	-1.236*** (0.014)	-1.188*** (0.017)
Importer GDP (log GDP_{jt})	0.932* (0.153)	Common Border (b_{ij})	-	0.838 (0.046)
Weight of k in World Consumption (log w_{kt})	0.237*** (0.030)	Common Language (L_{ij})	-	0.199*** (0.390)
Price of Exported good k (log $\Pr_{ikt}$)	-0.807 (0.602)	Pairs in Coloniol Relationship (COL_{ij})	-	0.138** (0.056)
		Exporter/Importer is Landlocked (LND_{ij})	-	0.516*** (0.023)
		Constant	11.643*** (0.101)	9.689*** (0.129)
R-Squared	0.973	R-Squared	0.435	0.545
Wald Tests:				
Exporter Effect: F(14, 31496)	10.63***			
Importer Effect: F(14, 31496)	11.03***			
Time Effect: F(4, 31496)	9.26***			
Bilateral Effect: F(176, 31496)	29.47***			
Sector Effect: F(112, 31496)	135.59***			
No time invariant effects	148.74***			

a) White standard Errors are reported in parentheses. ***) significant at 1%; **) significant at 5%; *) significant at 10%.

2.4 Conclusion

It has long been established that gravity equations naturally emerge whenever specialisation in production is assumed. This chapter has shown that modified neoclassical H-O assumptions can equally produce a gravity equation that is prone to give specific inferences relating to the explanatory power of the factors influencing North-South inter-industry trade. When the extreme case of no specialisation in production (a special case of Evenett and Keller's imperfect specialization assumption) is coupled with Deardorff's (1998) trade pattern determination in a multi-country/multi-product, H-O and perfectly competitive world that is additionally FPE-free, a gravity equation is developed, predicting that exports from South to North countries are essentially triggered by importing (North) countries' GDP rather than by that of the exporters. In addition, the model provides a theoretical back up on the effect of technological developments – embedded in commodity prices- and consumer preferences on trade, constituting major stimuli for South-North export flows.

Empirical results from Fixed Effects panel estimation validate the model's predictions and emphasize the role of distance in explaining transportation costs. Distance, however, should not be included in the gravity equation as the sole representative of transportation costs as it exhibits a nonlinear impact on the volume of exports with its estimated coefficient being strictly different than one. General consumer preferences for particular commodities are shown to be a robust determinant of related export flows even when commodity-specific effects are controlled for. Exporter country GDP and prices (instrumented by exporting countries' technological level) are, however, proved to be less significant when unobserved exporter and commodity-specific effects are included in the model. This finding underlines the overwhelming influence of the importer GDP and its absorption capacity of foreign goods on the determination of the export intensity from South to North countries as opposed to the exporter's size and/or productivity.

Chapter 3

The Effect of Port Inefficiency on Maritime Transportation Costs & Trade: The Case of the Maghreb & EU-15 Countries

3.0 Introduction

In the broad trade literature, distance was the common factor used to proxy transportation costs in a gravity equation. A normally estimated negative coefficient signals the inverse effect geographical distance has on trade intensity[11]. With globalization on the crescendo, several economists questioned the importance of distance in hindering trade. Disdier and Head (2004) show evidence that technological change and trade liberalizations has not reformed the world economy in that the effect on trade of spatial separations has not declined. Leamer and Levinshon (1995) also concluded that, contrary to common expectations, the impact of distance on the patterns of trade is not decreasing over time. They concluded that that the "dispersion of economic mass is the answer, not a shrinking globe". On the same lines of analysis, Anderson and van Wincoop (2003) provided a theoretical justification for the inclusion of a remoteness variable termed the "multilateral resistance index" that is prone to account for this dispersion in economic mass. More recently, Brun, Carrère, Guillaumont and de Melo (2005) showed that the "death of distance" is limited to bilateral trade among developed countries while the trade elasticities of distance or transportation costs are still significantly high in low income countries.

[11] Examples are: Bergstrand (1985), Egger (2000), Cheng and Wall (2005).

On the empirical findings regarding transportation costs in gravity models, Amjadi and Yeats (1995) give evidence that the trade-hindering effect of transport costs outweighs that of custom duties. Similarly, Limao and Venables (2000) stress the importance of transportation costs in determining the volume of trade between two partners. They demonstrate that a 10% reduction in transportation costs decreases trade volumes by more than 20%. As they were able to show in their study and among the factors explaining transportation costs, infrastructure prevails as a major determinant especially in the case of landlocked countries in Sub-Saharan Africa. Fink, Mattoo and Neagu (2002, henceforth FMN) launch the first study on the determinants of maritime transportation charges and emphasise the role of non-competitive and private policies. In their paper, FMN focus on the liner segment of the shipping market where private anti-competitive policies (maritime conferences) alongside restrictive trade procedures imposed by governments (cargo reservation schemes) hinder the fall in the price of transport that is induced by technological improvement in the form of increased containerisation (Hummels 1999).

In a recent paper, Clark, Dollar and Micco (2004, henceforth CDM) focus on another important determinant of maritime shipping costs: port efficiency. Using data on maritime charges of imports entering the United States' major sea ports, they conclude that "bad ports are equivalent to being 60% farther away from markets for the average country". With port efficiency being a chief determinant of transport costs, they link differences in efficiency levels across ports to factors like the presence of organized crime (corruption), restrictive regulations and the country's general infrastructure.

A survey on port infrastructure quality reported by The World Economic Forum's 2003-2004 Global Competitiveness Report indicates that Tunisia, Morocco and Algeria occupy the 37^{th}, 51^{st} and 72^{nd} rank, respectively, among a sample of 102 developed and developing countries included in the study. With the Port Infrastructure Quality index ranging between 1 and 7 (1 indicating underdeveloped sea ports) both Tunisia and Morocco scored 4.5 and 3.7, respectively, whereas Algeria lagged behind with a score of 3. Generally, the three countries stand in a better position vis-à-vis the common bad performers: countries of Latin America, the Caribbean and West Africa. However they can be considered to be in the same league as the Central and Eastern European countries (CEEC) where the latter group's scores range between 3.2 and 5.3 (Table 3.1)[12].

A notable difference between the two areas (Maghreb vs CEEC) is the heavy dependence on maritime transportation for shipment of goods from the Maghreb countries to the European coast. This is due to two main reasons: the fact that they are separated by the Mediterranean sea where maritime transport journeys are fairly short, which greatly depresses the possibility of road transport[13] and the large weight of mineral and petroleum products (tanker bulk) in the composition of Maghreb countries' exports to the EU15 (72% of Algeria's total exports to the EU15 is tanker bulk) that can only be carried by tramps across the Mediterranean[14].

A EUROSTAT publication, Statistics in Focus, outlines the significance of Petroleum products in the EU's total sea-imports: In 2002[15], they represented 42% of the total volume of Extra-EU imports by maritime transport. In another issue of that same publication, the EU-15's imports from all 12 CEEC countries were tabulated by mode of transport. Excluding Cyprus and Malta from the sample[16], the average share of maritime transport in all CEECs is calculated to be equal to 38.94%, much lower than the Maghreb's average maritime share of total exports to the EU of 80%. The average share of road transport for the CEECs is around 36.8%.

When ad-valorem transportation costs are compared to tariff duties between the three Maghreb countries and the EU-15 for the year 2003 and for commodities aggregated at the 6-digit level of the HS-96 classification, it is observed that for the majority of the manufactured products imported by members of the EU-15, ad-valorem transportation costs prevail over tariffs which are, in most cases, levelled down to zero as a result of the active bilateral Cooperative and Euro-Mediterranean Association Agreements (Figures 3.1, 3.2 and 3.3) [17].

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[12] Cyprus was not included in the survey.

[13] Road transport constituted only 3.87% of EU's external trade volume (in tonnes) with all Euro-Med countries. That rate is expected to be lower for Maghreb countries alone.

[14] Tramp carriers usually handle the shipment of Bulk traffic which encompasses both liquid (crude oil and oil related products) and dry (iron, ore, grain, coal, bauxite and phosphate) non-containerized raw material.

[15] The latest available data from Eurostat's Statistics in Focus publication goes back to year 2002.

[16] In order to avoid the "island bias".

[17] Ad-Valorem transportation costs are calculated by deducting 1 from the cif/fob ratio. Both cif and fob values are taken from the United Nations COMTRADE Database. They include costs of freight and insurance. Ad-valorem tariffs are calculated as the sum of applied ad-valorem tariffs and

Figure 3.1: Ad-Valorem Freight and Tariff Rates in 2003 (Algeria-EU15)

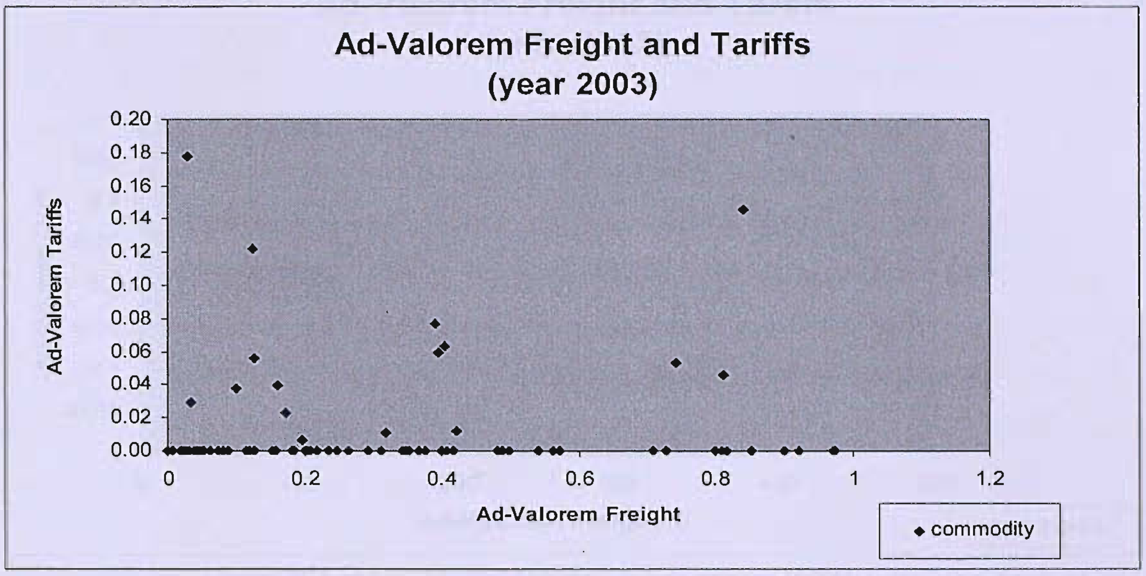
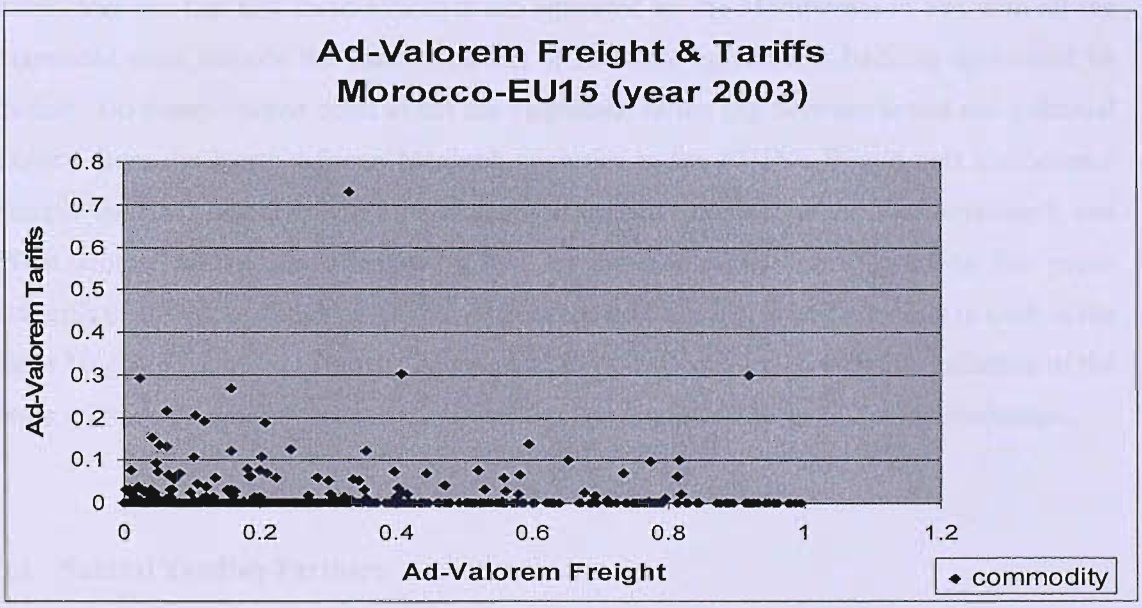


Figure 3.2: Ad-Valorem Freight and Tariff Rates in 2003 (Algeria-EU15)



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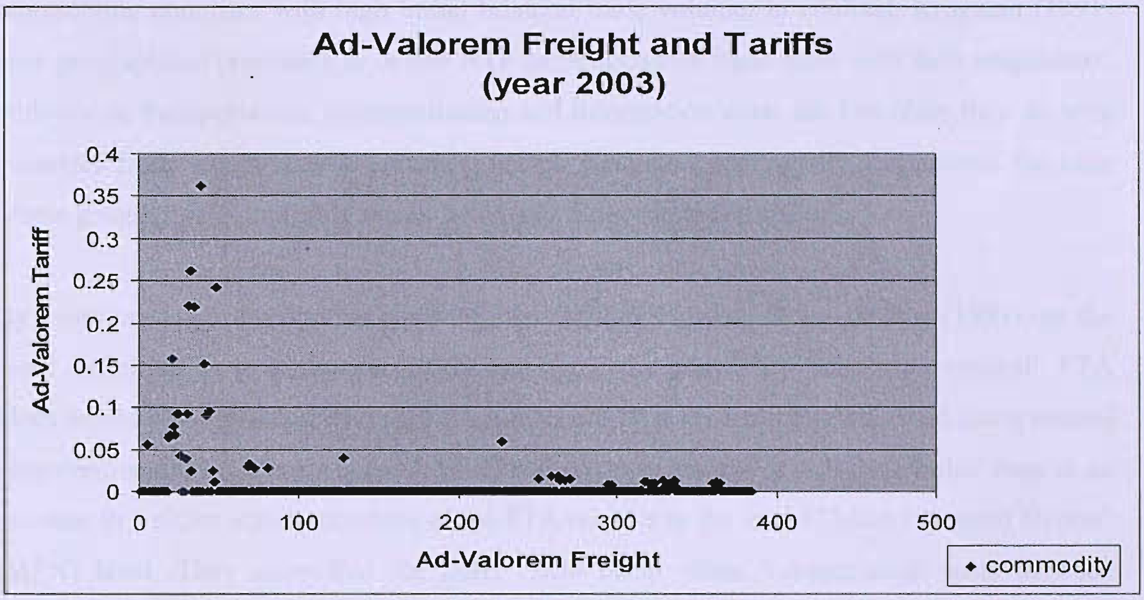
the ad-valorem equivalent of specific tariffs. Data for both types of tariffs were obtained from the MACMAP database. Albeit the database stocks only recently collected data (2004), a great benefit resides in the fact that MACMAP breaks through the limitations discussed in Anderson and Van Wincoop (2003) regarding the unavailability of ad-valorem equivalents for specific tariffs (levied particularly on agricultural products), a problem commonly faced if the TRAINS database was alternatively used and offers a reliable tariff-freight comparison instrument.

Figure 3.3: Ad-Valorem Freight and Tariff Rates in 2003 (Tunisia-EU15)



This fact raises questions with regards to the importance of the role transportation costs play in determining bilateral trade between each of the Maghreb countries and the EU-15. How much does the fact that these countries are separated by the Mediterranean Sea with all the associated costs impede the materialization of the trade agreements building up around its basin?; Do transportation costs affect the magnitude of the gap between actual and potential exports from the North African Maghreb countries to the EU15?; Would port inefficiency hamper the tariff liberalizing efforts targeting increased trade across the Mediterranean?; and What sectors are mostly affected by bad maritime infrastructure? Questions this paper attempts to answer by focusing on the costs instigated from inefficient sea-ports in each of the three Maghreb countries (Tunisia, Algeria and Morocco) and on the negative influence of the latter on trade integration between the Northern and Southern shores of the Mediterranean.

3.1 Natural Trading Partners

The Natural Trading Partner (NTP) theory advocates that free trade agreements (FTAs) between Natural Trading Partners are more likely to create trade among the FTA members and less likely to divert trade away from non-members, leading to an increase in welfare in member countries. In the related literature, three main definitions for the concept of Natural Trading Partners have so far been forwarded: Wonnacott and Lutz (1989) were the first to introduce the term followed by Summers (1991) defining Natural Trading Partners as representing countries with high initial bilateral trade volume. In contrast, Krugman (1991) uses geographical proximity to define NTP since countries trade more with their neighbours, with whom transportation, communication and information costs are low, than they do with countries from which they are further distant. Krugman additionally emphasizes the case where geographical proximity meant belonging to the same continent.

By incorporating transportation costs into their model, Frankel, Stein and Wei (1995) use the same definition as in Krugman (1991) but signal the possibility that "super-natural" FTA blocs would emerge. Super-natural FTA blocks are FTA blocks that are formed along natural intra-continental lines but where liberalization of trade leads to a reduction rather than to an increase in welfare across members of the FTA relative to the initial "Most Favoured Nation" (MFN) level. They show that the latter could occur when transportation costs between continents are as low as 10 or 20% even if they are well above intra-continental ones.

In a recent paper, Krishna (2003) refutes the latter definitions of NTP by studying the effect of distance on welfare changes resulting from tariff reductions by the United States vis-à-vis 24 different countries over the period 1965-1995: He finds a statistically insignificant correlation between welfare estimates and distance but points out "that outcomes may simply be highly sensitive to context". Schiff (1999) shows that Summers' definition of NTP is not justified: He gives the reason that the volume of trade is itself shaped by trade policy from which the NTP criterion must be independent. Schiff redefines NTPs as countries whose trade complements each other: a member country imports what a prospective member exports.

Kandogan (2005) studies whether any of the three previously cited definitions applies to the countries of the Euro-Mediterranean region and finds support for the negative effect of distance, as a determinant for "naturalness", on general trade increase. He also finds a significant positive effect of distance on inter-industry trade diversion. In this chapter, another determinant of transportation costs relating to export country's port inefficiency is added and its effect is later studied on increased trade that is brought about by the signature of the Euro-Med Agreement between the Maghreb countries and the members of the EU-15 or as a result of trade diversion away from third countries. In addition, the chapter studies the effect of seaport level inefficiency costs on the process of hindering actual trade from reaching its expected potential.

3.2 Methodology

Given the weight of maritime transported goods in the total volume of exported products from the three Maghreb countries to the EU-15 and drawing on CDM's (2004) results with regards to the role of port inefficiency in total transport costs, Chapter 3 will start by studying the impact of port efficiency on the Maghreb countries' freight charges to the EU. For this purpose and in section 3.3, I initially define some of the factors that could exert influence on maritime transportation costs, and then use a reduced form price equation to estimate the effect each factor (port inefficiency in particular) has on the determination of freight charges, closely following the method of analysis as in the FMN and CDM studies. Since there is no direct measurement of port efficiency at port level, I use three different country-aggregated proxies for port efficiency and study the determinants of port efficiency at country-level. In section 3.4, a set of three country-specific, seaport-related, maritime transportation indices is constructed, and then included in a gravity model to examine the effect of country-specific maritime transportation costs on potential trade with the EU-15.

In section 3.5, I calculate post Euro-Med trade creation effects by adopting Kandogan's (2004, 2005) method in computing the change in normalized time-varying bilateral errors from a gravity equation estimated over two periods of time (1992-1996 and 1997-2001), respectively preceding and succeeding the signature of the agreement in 1997. In this section, the effect of maritime transportation costs Trade potential between the latter two groups is subsequently computed, and compared to actual recorded trade to quantify the effect the presence of a separating sea and all the associated costs have on impeding trade and hindering it from reaching its normal expected level between the two groups. I then classify commodities into the five main first-level ISIC categories (Manufacturing, Agriculture, Electricity and Gas, Mining and Fishing) and study the effect of Maghreb country-specific, port-related maritime transportation costs on the export volume of each category's commodities one-at-a-time.

3.3 Determinants of Maritime Transportation Costs

3.3.1 The Price Equation

Closely following CDM (2004) and FMN (2000), I aim in this section to measure the effect of port inefficiency level, among other variables, on the cost of transporting products from the southern to the northern coast of the Mediterranean basin. The reduced form price equation used in this section closely follows the lines of analysis presented in both the FMN and CDM papers. In the latter two studies, the dollar price of shipping product k from port i (located in Country I) to port j (located in country J) was equated to the marginal cost for this service multiplied by shipping companies' markup term, both of which were expressed in function of factors relating to the countries of origin (I) and destiny (J) and to the type of product (k). In this context, one needs to highlight an important fact underlined in the FMN paper which could modify the specification of the price equation. FMN note that "tramp shipping is generally believed to be a fairly competitive market, mostly free from restrictions" such as those encountered in the liner market, like price-fixing and cooperative working agreements[18]. For this reason and given the previously mentioned fact that the majority of Maghreb countries' (especially in the case of Algeria and Tunisia) exports to the EU-15 is constituted of mineral and fuel material and with the relatively shorter nautical distance separating the Maghreb and the EU countries, liners are not considered to be the most frequently used shipping carriers. Therefore and in this particular case, shipping prices are assumed to merely equal their marginal costs as competitive tramp services are more prevalent.

Importing countries publish the value of imports taking into account carriage, insurance and freight (cif), while exporting countries report their value free on board (fob) counting only the

[18] Liner shipping is the maritime transport of commodities by regular lines that circulate, beforehand, their calls in diverse harbours. Tramp shipping denotes maritime transport that is carried out irregularly, relying on momentary demand. Tramp shipping is not subject to conference agreements, a confined characteristic of liner shipping, and rarely involves cooperative price agreements. Data on cooperative agreements taken from the FMN study indicates that Moroccan and Tunisian liner services are not engaged in cooperative working agreements with other US liners, a reason to believe that this may also be the case with regards to the regular lines and the less organized tramps operating in the Med. Furthermore, in its April 2002 report on the maritime transport of goods between the countries lying on the Western part of the northern and southern shores of the Med sea, the Research Centre for Western Mediterranean Transport (CETMO) underlines the fact that since

cost of imported commodities. Denoting the fob price of a certain good k that is shipped from country I to country J and the unit cost of shipping good k from I to J by P_{IJk} and T_{IJk} respectively, I define C_{IJk}, the (cif/fob) ad-valorem transportation cost factor as

$$C_{IJk} = (cif / fob)_{IJk} = (P_{IJk} + T_{IJk}) / P_{IJk} \tag{3.1}$$

Equating the unit cost of shipment to its marginal cost, I get

$$T_{IJk} = (C_{IJk} - 1) \times P_{IJk} = MC(I, J, k) \tag{3.2}$$

Where $MC(I, J, k)$ is considered to be determined by characteristics relating to the country of export (I), the country of import (J), the type of product (k) and to the length of journey between the two countries. Expressed in logarithm, the estimated price equation will have the following form

$$t_{IJk} = mc(I, J, k) \tag{3.3}$$

Where lower case letters refer to the natural logs of the respective variables. t_{IJk} is divided by maritime traffic in port i to reflect economies of scale and maritime charges at the Maghreb port level. no Closely following FMN and CDM in the specification of the marginal cost equation and adding a subscript for time, I get

$$\begin{aligned} (t_{IJkt} / traf_{it}) &= \beta_1 wv_{IJkt} + \beta_2 \text{cnt}_{it} + \beta_3 \text{Imb}_{IJkt} + \beta_4 \text{PE}_{I} + \beta_5 \text{Infra}_{Jt} + \beta_6 d_{ij} + \beta_7 d_{jJ} + \beta_8 d_{Ji} + \varepsilon_{iJkt} \\ \varepsilon_{iJkt} &= \gamma_1 \varphi_I + \gamma_2 \alpha_J + \gamma_3 \delta_{IJ} + \gamma_4 \eta_i + \gamma_5 \lambda_k + \gamma_6 \psi_t + v_{iJkt} \end{aligned} \tag{3.4}$$

Where

wv_{IJkt}: Value per weight (unit value) of commodity k, transported from I to J at time t, expressed in logarithm.

1995, maritime transport with all three Maghreb countries has been completely liberalized from all sorts of price fixing agreements between regular lines.

cnt_{It}: Fraction of total products shipped from I in containers at time t (containerization rate), expressed in logarithm.

Imb_{IJkt}: Trade imbalance in product k between I and J at time t. It is measured as J's exports minus J's imports divided by total trade between both countries, expressed in logarithm.

PE_{I}: Maghreb country I's aggregate ports' efficiency

Infra_{Jt}: General infrastructure of country J at time t

d_{ij}: Nautical distance of the shortest navigable route between port i in I and J's major port, expressed in logarithm[19][20]

d_{Ii}: Terrestrial distance between Maghreb capital I and port i, expressed in logarithm.

d_{jJ}: Terrestrial distance between EU-15 port j and Capital of J, expressed in logarithm

α_J: Dummy variable for EU-15 country J

φ_I: Dummy variable for Maghreb country I

η_i: Dummy variable for Maghreb port of loading i

δ_{IJ}: Dummy variable for country pairs I and J

λ_k: Dummy variable for product k

ψ_t: Dummy variable for year t.

The dummy variable (α_J) captures the existence of potential differences in general port efficiency across EU-15 countries. The second dummy (λ_k) proxies for unobservable product-specific effects: it controls for differences in marginal costs across products that may be related to the physical properties of the shipped goods, such as weight or size. The dummy variables, φ_I and η_i, are included in the regression to captures country and port-specific heterogeneity across the Maghreb countries. The year dummy (ψ_t) is a time specific effect accounting for changes in marginal costs over the period stretching from 1997 till 2001. The

[19] In some cases, longer routes which circumvent currents, avoidance of ice or other dangers to navigation are used.

value per weight term (wv_{IJkt}) enters the equation as a proxy for the insurance component in the maritime transport cost. The containerisation rate variable (cnt_{It}) denotes the technological effect that reflects the reduction in shipment charges brought about by the use of containers. Containers usually facilitate the inter-modal transport of goods and hence reduce the charges incurred in the delivery process.

The distance variables (d_{ij}, d_{Ii}, d_{jJ}) measure the nautical distance separating ports i and j, the shortest driving distance between the capital of I and the port of loading i, and the shortest driving distance between country J's main port and its capital, respectively. The directional imbalance in trade, characterised by the variable (Imb_{IJkt}) captures the increase in the price of transport resulting from carriers hauling empty container units on their way back to Maghreb ports.

β_1 is expected to have a positive sign since the higher the value per weight for a certain product, the higher is the associated insurance fee and, hence, the higher are the transport charges required to transport it to another country.

The sign of β_2, however, is anticipated to be negative since higher containerization rates imply technological improvement in the handling of cargo at ports, the fact that ultimately reduces transportation costs. The coefficient on all distance variables (β_6, β_7 and β_8) should normally be positive. The coefficient on the trade imbalance variable, β_3, should ordinarily be positive where greater trade imbalances lead to higher transportation charges.

3.3.2 Data Description[21]

Data for the maritime transport of products between the Maghreb countries and those of the EU-15 is strictly available for the period 1997-2001. Due to the unavailability of product specific shipping rates from Maghreb to EU-15 ports, transportation costs are proxied by

[20] Since data on bilateral port relations is not available, I look at maritime traffic in the port of unloading to determine the importance degree of that seaport in the general maritime trade industry in the importing country.

cif/fob transport cost ratios for 2-digit products classified according to the Nomenclature Uniforme des Marchandises pour les Statistiques de Transport (NSTR). This is a fairly old classification (last revised in 1967) that is exclusively adopted in the EU for collection of transport data. NSTR has three levels of disaggregation (1st level: 10 chapters, 2nd level: 52 groups and 3rd level: 176 headings). The third and most detailed level is not very significant for analysis that takes into account recent trade evolutions, hence, only products at the second level of NSTR classification will be considered in the study[22].

One hurdle was in the value of NSTR-classified seaborne imports from Maghreb to EU-15 as they are only reported by the latter countries, which implies that cif/fob ratios can only be computed by relating each product to its corresponding equivalent/s in another product classification that is more commonly used in trade studies and that additionally has available trade values recorded at both the ports of loading and unloading. Given that NSTR is an abridged version of the SITC classification[23], equivalence liaisons are established between the two in order to approximate transport costs for the 52 product groups. NSTR has only one correspondence and it is established with respect to the Combined Nomenclature (CN) Classification. Hence, NSTR products are first related to their CN counterparts that are later linked to their SITC equivalents.

cif/fob ratios estimate aggregate country-to-country transport costs. In order to have a proxy for Maghreb port-to-EU country maritime transport charges, I divide cif/fob ratios with total outward tonnage from each Maghreb port since increased vessel traffic in any one port implies reduced cargo handling charges and improves efficiency as a result of economies of scale that would most likely prevail at the sea-port level.

Common problems associated with the use of cif/fob transport cost data are the inconsistency in the reporting of export and import data between trade partners and the inaccuracy in the determination of destination countries when it comes to reporting outflows. An example of the latter is, if A exports good k to B for further processing and B exports k after processing to C, then good k will be reported by countries A and B as (exports from A to B) and

[21] Appendix 3.1 gives a description of the data used in this chapter.

[22] Yeats (1978) shows that COMTRADE cif/fob data variations are more related to true shipping costs in generally aggregated data.

[23] According to a United Nations' publication, "the Harmonization of Statistical Classifications, Report of Meeting of an Expert Group"

(exports from B to C), respectively, while it will be reported by C as (imports from A to C). One would not find country A reporting exports of good k to C.

For these reasons, I dropped all observations where missing data, from one of the partner countries, are spotted. Observations yielding cif/fob ratios that are less than 1 are also removed from the study since they imply negative transportation costs. Similarly, cif/fob ratios higher than 2 are dropped since they refer to transportation costs exceeding the value of the goods being shipped. The study is restricted to analysing the observations falling in the range of 1-2 where ad-valorem transportation costs are between 0% and 100%[24].

Unit value data was obtained by taking the ratio of sea-transported commodities' exports' value over volume, both of which were generously supplied by Mr. Evangelos Pongas from the Transport Division in Eurostat. This variable is available per product and per exporter-importer pair[25].

The rate of containerization at Maghreb seaport level is not completely available for all the years in the 1997-2001 period. In the case where the use of large containers is not present for a certain year, I assume non-existence of any containerization activity for the years that precede that date[26]. Noteworthy to mention that the port of Rades is responsible for most of the Tunisian container transport (63% of the total).

Data for nautical distance was obtained by measuring the shortest navigation distance (in nautical miles) between the considered Maghreb port of loading and the EU country's major port.

There is no available direct measure for port efficiency that could be used for a cross-port/cross-country analysis in the Med region. For this purpose, I use three different proxies

[24] Hummels and Lugovsky (2003) define these observations as lying in the "reasonable range". They note, however, that the value of 1.1 is excluded from this range as IMF's Direction of Trade Statistics imputes a freight rate of 10% to all country pairs for which paired data is not available. None of the ci/fob observations, included in this study, was exactly equal to 1.1.

[25] Email communication with Mr. Evangelos Pongas confirmed that official data on maritime transport between the Maghreb countries and the EU can only be provided by EUROSTAT via their MEDSTAT/MED-TRANS program which was implemented in 1997.

[26] Since the investment in containerization infrastructure is generally considered very costly (CETMO's report on the maritime transport of goods in the West Mediterranean) and thus, it is only carried out when containerization is needed.

for this variable: The first two proxies rely on data related to the infrastructure of Maghreb seaports which is, in turn, linked to the general seaport efficiency level and the third is log of GDP/Capita. These are:

1- CDM's (2004) Port Efficiency variable (henceforth, Proxy I) calculated as the logarithm of the square of the total number of the largest seaports by country, normalised by the product between the country's population and area.

2- CDM's (2004) Infrastructure Index (henceforth, Proxy II), calculated by taking the simple average of three normalised indices accounting for the country's level of communications (telephones) and its transport system (paved roads, railroads and airports).

3- Maghreb country GDP per capita (henceforth, Proxy III), expressed in logarithm.

3.3.3 Estimation Results

Table 3.1 shows the Least Square Dummy Variable (LSDV) estimation results of the transportation cost equation using the three different proxies for port inefficiency. The Hausman and Taylor test rejects the null hypothesis of consistent Random Effects estimates and so a Fixed Effects model is preferred, hence the use of LSDV estimates.

R^2 is fairly high for all three regressions[27]. The exporter specific variables (i.e containerization rate and port efficiency) are both significant and in the correct sign. A 1% improvement in port efficiency leads to a 4.7% and 2% reduction in the total journey's transportation costs when Proxy I or III is used respectively. When Proxy II is used, one point amelioration on the Maghreb port efficiency index cuts down maritime transportation costs by around 4.8%. All distance variables have been dropped from the three regressions as they are time-invariant.

Trade imbalances between Maghreb and EU15 members do not seem to have an independent effect on transportation costs as its explanatory power is embedded in the country pair bilateral dummies whose coefficients were significant at the 1% level. The coefficients on the

[27] It is, however, reduced by half (0.46) when Least Square estimates are employed and country/port/commodity/time heterogeneous effects are omitted

importer country's infrastructure (Infra_{Jt}) and the exported commodity's per weight value (wv_{IJkt}) are roughly constant in second and third columns, have the expected signs and are significant at the 10% level. Amelioration in the importer country's general infrastructure by one point is predicted to decrease total transportation costs by around 1.7% regardless of the proxy used.

Table 3.1: Transport Price Equation

Dependent Variable is: (cif/fob) transportation costs normalized by Maghreb port-specific volume of loaded exports [a)]

Variable	LSDV Estimates I	LSDV Estimates II	LSDV Estimates III
Containerization Rate (cnt_{it})	5.214 (4.412)	-0.974*** (0.047)	-0.974*** (0.047)
Value per Weight (wv_{IJkt})	0.088* (0.053)	0.088* (0.053)	0.088* (0.053)
Trade Imbalance (Imb_{IJkt})	0.112 (0.140)	0.111 (0.141)	-0.113 (0.140)
Import Country Infrastructure (Infra_{Jt})	-0.017* (0.011)	-0.017* (0.012)	-0.017* (0.010)
Maghreb Port Efficiency:			
Proxy I	-4.650* (2.549)	-	-
Proxy II	-	-0.048* (0.034)	-
Proxy III	-	-	-2.043*** (0.604)
Number of Observations	5,511	5,511	5,511
R^2	0.840	0.840	0.840
	p-values	p-values	p-values
Hausman-Taylor Test	0.000***	0.000***	0.000***
Heteroscedasticity [c)]	0.000***	0.000***	0.000***
F	0.000***	0.000***	0.000***
Wald Tests:			
Time Effects	5.18**	8.31***	6.51***
Exporter Country Effects	0.00	22.89***	34.77***
Exporter Port Effects	405.5***	428.84***	430.80***
Importer Country Effects	32.19***	32.27***	32.34***
Bilateral Effects	54.56***	57.83***	57.78***
Commodity Effects	0.58	0.57	0.52

a) Coefficient estimates in the table are rounded to the nearest thousandth and robust standard errors are reported between parentheses b) t-statistic is Heteroscedasticity robust (White, 1980) c) Breusch-Pagan / Cook-Weisberg test for Heteroscedasticity: uses the fitted values of the dependent variable in explaining the estimated squared residuals.***) significant at the 1% **) significant at the 5%; *) significant at the 10%

3.4 Maritime Transportation Costs and Trade

3.4.1 The Maritime Index in the Gravity Equation

This section is devoted for studying the impact on trade of port inefficiency via its effect on maritime transportations in the Maghreb countries. To this end and closely following the work done by CDM (2004), a set of three country-specific indices are composed and later included in a gravity equation to study their explanatory power vis-à-vis the level of trade. These indices are defined by exporter-specific parameters (exporter-specific effects, containerization rates and port inefficiency) explaining bilateral transportation costs.

The method forwarded by CDM (2004) in computing these three indices is the following. Three sets of residuals are collected, each obtained by estimating equation (3.4) using a separate proxy for port efficiency. The two Maghreb country-specific components (containerization rate and port efficiency) in the predicted maritime costs are then added to exporter-specific country and port dummies, which will finally yield the country-specific, maritime transportation cost index (TCI^{n}_{Ikt}) for each aggregate port efficiency proxy n (n= I, II or III), computed by taking the simple average of all observations recorded per country for each commodity and year:

$$TCI^{n}_{Ikt} = \frac{1}{N_I}\sum_{all}\left[(t_{IJkt}/trqf_{it}) - (\hat{\beta}_1 ww_{IJkt} + \hat{\beta}_3 \mathrm{Imb}_{IJkt} + \hat{\beta}_5 \mathrm{Infra}_{Jt} + \hat{\beta}_6 d_{Ij} + \hat{\beta}_7 d_{Ii} + \hat{\beta}_8 d_{jJ} + \gamma_2\hat{\alpha}_J + \gamma_3\hat{\delta}_{IJ} + \gamma_5\hat{\lambda}_k + \gamma_6\hat{\psi}_t + \gamma_7\hat{\varepsilon}_{ij})\right] \quad (3.5)$$

$\forall$ n= I, II, III

Where N_I is the number of observations from country I per commodity k and time t. TCI^{n}_{Ikt} is independent of any bilateral factor relating to the maritime journey of transporting a good between the two countries. It represents the costs incurred in the port of loading in the exporting country only. I include these indices, each at a time, in the gravity equation using the specification derived in Chapter 2 of the thesis. I consider a panel extending longitudinally from 1997 till 2001

$$Exp_{IJkt} = \beta_1 GDP_{It} + \beta_2 GDP_{Jt} + \beta_3 pr_{Ikt} + \beta_4 cons_{kt} + \beta_5 d_{IJ} + \beta_6 TCI^{n}_{Ikt} + \varepsilon_{IJkt} \quad (3.6)$$

$$\varepsilon_{IJkt} = \gamma_1\varphi_I + \gamma_2\alpha_J + \gamma_3\delta_{IJ} + \gamma_4\lambda_k + \gamma_5\psi_t + \nu_{IJkt} \qquad \forall \text{ n=I, II, III}$$

Exp_{IJkt} is the log of export volumes from I to J. GDP_{It} and GDP_{Jt} are real incomes of exporter country I and importer country J, respectively, at time t. they are both expressed in logarithm. $cons_{kt}$ denotes the weight of commodity k in the world's total consumption at time t; it is expressed in logarithm. pr_{Ikt} corresponds to log of the price, exporters in I receive for commodity k at time t. d_{IJ} is the great circle distance between I and J and it is also expressed in logarithm. β_6 is expected to have a negative sign along with β_5 and β_3. All the other regressors are trade enhancing and, thus, their coefficients are expected to be positive.

3.4.2 Estimation Results

Table 3.2 depicts the estimated gravity equation having the specification derived in Chapter II of the thesis and to which was added the exporter-specific maritime transportation cost variable TCI^n_{Ikt} for each n=I, II and III pertaining to the exporting countries' aggregate port efficiency proxies I, II and III, respectively.

The Hausman and Taylor test does not reject the null and so Instrumental Variable (IV) Generalized Least Squares (GLS) estimates are employed as the price variable suffers from endogeneity. The instrument used is the labour productivity in each of the three exporting countries. These residuals act as proxies for the effect of the supply side and exporter's level of technology/productivity on price determination. It is noticeable from column 3 of Table 3.2 that exporter and importer's GDP as well as the weight of the exported commodity in World consumption $(cons_{kt})$ are insignificant and this might be due to colinearity effects with the GDP/Capita variable that is included in the exporter-specific transportation cost variable (TCI^3_{Ikt}).

The coefficients on all three exporter-specific maritime transportation costs have a negative sign, are significant but with different magnitudes. From column 1, one can deduce that a 1% increase in exporter specific maritime transportation index would yield a 0.19% decrease in the total volume of export. From column 1, if two countries are 1% further away, then Maghreb countries' exports to the EU15 countries will decrease by 1.8%.

Table 3.2: Maghreb-EU15 Gravity Equation including Maghreb Port Costs

Dependent Variable: Volume of Exports from I to J $^{a)}$	IV-GLS I	IV-GLS II	IV-GLS III
Exporter GDP (GDP_{It})	0.597*** (0,159)	0.613*** (0.142)	0.100 (0.297)
Importer GDP (GDP_{Jt})	0.802*** (0.043)	2.293** (1.225)	1.270 (1.114)
Commodity Weight in World Consumption ($cons_{kt}$)	-0.042 (0.218)	0.321* (0.183)	-0.190 (0.226)
Price of Exported Commodity k (pr_{Ikt})	-0.693* (0.438)	-1.714*** (0.421)	-1.204** (0.663)
Distance (d_{IJ})	-1.822*** (0.279)	-4.424* (2.920)	-1.732 (0.494)
Maghreb Country-Specific Port Related Transportation Costs:			
TC^1_{Ikt}	-0.186* (0.125)	-	-
TC^2_{Ikt}	-	-0.182*** (0.067)	-
TC^3_{Ikt}	-	-	-0.002*** (0.0004)
Number of Observations	5,511	5,511	5,511
Overall R^2	0.65	0.68	0.70
Wald Tests:	p-values	p-values	p-values
Time Effects	0.0133**	0.000***	0.000***
Exporter Country Effects	0.687	0.000***	0.000***
Importer Country Effects	0.2297	0.219	0.002***
Bilateral Effects	0.0149**	0.000***	0.933***
Commodity Effects	0.000***	0.000***	0.000***

a) Estimated coefficients are rounded to the nearest thousandth and Standard errors are reported between parentheses. b) Breusch-Pagan / Cook-Weisberg test for heteroskedasticity: uses the fitted values of Log Exports in explaining the estimated squared residuals. ***) significant at 1% **) significant at 5%; *) significant at 10%

3.5 Trade Effects

3.5.1 Methodology

Trade creation indicates an increase in trade among members of a trading bloc in the good of each country's comparative advantage: The Vinerian (1950) definition of trade creation establishes that countries of a Partial Trade Agreement (PTA) lower their tariffs vis-à-vis each other, and hence, shift their sourcing from high-cost domestic producers to lower-cost and more efficient producers in member countries. This eventually leads to an increase in welfare. Increased trade between Maghreb and EU15 countries can also emerge as a result of trade diversion as EU15 trade with third parties is displaced in favour of Maghreb countries following the Euro-Med Agreements. In order to detect trade creation effects, a dummy for pairs in a trade agreement was commonly added to the estimation of the gravity equation. If the coefficient on the PTA dummy was to be positive, then a common conclusion would be that the agreement is trade creating and, hence, welfare improving.

Polak (1996) and Matyas (1997) criticize the use of those dummy variables as they yield inaccurate inferences as the gravity model would be misspecified. Kandogan (2004) adopts another method to calculate trade creation effects and that is by estimating a gravity equation over two separate periods; the first precedes the signature of the PTA and the second covers the years following the signature of the agreement. The resulting time-varying bilateral errors are, then, divided by the GDP of the importer country to study welfare implications. Kandogan (2004) averages these ratios over the number of years in these two periods and regards the changes in those average ratios as determining the size of trade creation effects. In this chapter, equation (3.6) is estimated, excluding the distance variable from the right hand side of the regression, for the two periods: 1992-1996 and 1997-2001 and later examine the changes in the annual deviations from normal export levels (the changes in the time-varying bilateral errors) relative to the importing country's GDP post the Euro-Med Association Agreements[28]. Average change is not computed, as in Kandogan (2004), since interest lies in the scale of "annual" trade creation in each commodity and for each pair of export-import countries in the 1997-2001.

[28] The Euro-Med Association Agreements were ratified and put into force in 1996, 1998 and 2001 for Morocco, Tunisia and Algeria, respectively. Agreement talks with all three countries, however, began much earlier (in the year 1996) which justifies the use of 1996-1997 year threshold as indicating the start of Euro-Med effects.

Kandogan (2005) looks at the effect of distance on trade creation between countries of the entire Euro-Mediterranean region and finds no significant effect of transportation costs (proxied by distance) on trade creation, while significant effects were depicted for trade diversion. Furthermore, when he studies the effect of distance on inter-industry trade creation alone, he gets a positive and significant coefficient for distance, the fact that contradicts with normal expectations. I regress "increased trade" effects on distance and the export country-specific maritime transportation cost index (TCI^{n}_{Ikt}) [29]:

$$Tr.Incr_{IJkt} = \beta_1 d_{IJ} + \beta_2 TC^{n}_{Ikt} + \varepsilon_{IJkt} \qquad \forall \text{ n=I, II, III} \qquad (3.7)$$

$$\varepsilon_{IJkt} = \gamma_1 \varphi_I + \gamma_2 \alpha_J + \gamma_3 \delta_{IJ} + \gamma_4 \lambda_k + \gamma_5 \psi_t + \nu_{IJkt}$$

Where both β_1 and β_2 are anticipated to have a negative sign.

3.5.2 Estimation Results

Table 3.3 depicts the estimation results for Maghreb-EU15 exports regressed over the two periods: 1992-1996 and 1997-2001. The Hausman and Taylor test rejects the null for the 1992-1996 but does not reject it for the period 1997-2001. Hence, IV-LSDV estimates are employed.

The coefficients on both exporter's GDP and commodity's weight in world consumption are not significant in the first period but become so in the second period. This is due to the fact that both exporter and commodity-specific effects are very significant in the first period (and not so in the second period), hence, capturing the effect of the latter variables on trade.

The residuals yielding from the above regressions are divided by importing country's GDP to exclude any influence, specific properties pertaining to the importing country might have, in explaining deviations from normal trade. The change in annual ratios, representing post Euro-

[29] Correlation coefficients were computed for each of the country-specific indices and distance. All correlation coefficients were minimal.

Table 3.3: Maghreb-EU15 Standard Gravity Equation for (1992-1996) & (1997-2001)

Dependent Variable: Volume of Exports from I to J [a]				
	IV-LSDV Estimates (1992-1996) [b]	Stnd. Error	IV-GLS Estimates (1997-2001) [c]	Stnd. Error
Exporter GDP (GDP_{It})	-0.157	0.553	0.701***	0.400
Importer GDP (GDP_{Jt})	0.873**	0.477	0.774***	0.127
Commodity Weight in World Consumption ($cons_{kt}$)	0.071	0.144	0.283***	0.125
Price of Exported Commodity k (pr_{Jkt})	-1.377***	0.587	-2.488***	0.250
Number of Observations	7,902		10,970	
R^2	0.73		0.60	
	p-values		p-values	
Hausman-Taylor Test	0.000***		1.000	
Heteroskedasticity [c]	0.000***		-	
F	0.000***		0.000***	
Wald Tests:				
Time Effects	0.000***		0.5286	
Exporter Country Effects	0.000***		0.8098	
Importer Country Effects	0.000***		0.000***	
Bilateral Effects	0.000***		0.5617	
Commodity Effects	0.000***		0.000***	

a) Estimated coefficients are rounded to the nearest thousandth b) White (1980) standard errors are reported between parentheses. c) Pagan and Hall's (1983) test of Heteroskedasticity for instrumental variables (IV) estimation c) the Distance variable was not included in the regression in order to study its effect on post Euro-Med Signature trade creation. ***) significant at 1% **) significant at 5%; *) significant at 10%

Med increased-trade effects are regressed over distance and exporting country-specific transportation costs.

Table 3.4 results indicate that export country's sea-port inefficiency acts more like a barrier to "naturalness" then does distance, since the coefficients on the distance variable were not significant in the first two regressions and barely so in the third. Furthermore, the export country's seaport-related maritime transportation cost index had a very small but significant negative effect even with the inclusion of significant bilateral effects: a 10% increase in general Maghreb countries' seaport inefficiency leads to a 3.27e-16%, 1.66e-14% and 2.63e-13% decrease in potential trade increase. This, in fact, signals that, contrary to Kandogan's

(2005) results, transportation costs can play a role, however small, in hindering trade integration. This translates through the channel of inefficient seaports in the Maghreb exporting country rather than through the distance separating the two countries.

Table 3.4: Effects of Port-Related Maritime Transportation Costs on Increased Trade

Dependent Variable: (1992-1996)/(1997-2001) Increased Trade Effects [a]			
	LSDV Estimates I	LSDV Estimates II	LSDV Estimates III
Distance (d_{IJ})	-1.72e-13 (1.71e-12)	8.69e-13 (1.73e-12)	-2.19e12* (1.49e-12)
Maghreb Country-Specific Port Related Transportation Costs:			
TC^1_{Ikt}	-3.27e-15** (1.51e-15)	-	-
TC^2_{Ikt}	-	-1.66e-13*** (5.62e-14)	-
TC^3_{Ikt}	-	-	-2.63e-13*** (0.95e-13)
Number of Observations	3,321	3,321	3,321
R^2	0.3608	0.3629	0.3609
	p-value	p-value	p-value
Hausman-Taylor Test	0.000***	0.000***	0.000***
Heteroscedasticity [b]	0.000***	0.000***	0.000***
Wald Tests:			
Time Effects	0.000***	0.000***	0.000***
Exporter Country Effects	0.000***	0.000***	0.000***
Importer Country Effects	0.000***	0.000***	0.000***
Bilateral Effects	0.1345	0.000***	0.000***
Commodity Effects	0.000***	0.000***	0.000***

a) White (1980) standard errors are reported between parentheses. b) Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity: uses the fitted values of increased trade in explaining the estimated squared residuals. ***) significant at 1% **) significant at 5%; *) significant at 10%

3.6 Potential-to-Actual Exports Ratio

3.6.1 Methodology

Several studies have been conducted to compute potential-to-actual trade ratios between the EU-15 and other groups of counties, mainly that of Central and Eastern Europe (CEECs) in order to assess the integration process fostered by the Europe Agreements (EAs) that were initiated by the EU with 10 out of 12 CEECs studied in this paper prior to their official accession in 2004[30]. In the literature on trade potential, two methodologies have been adopted to calculate Potential/Actual trade ratio: 1) *The Out-of-Sample* approach which consists of extracting the parameters of an estimated gravity equation on intra-EU bilateral trade flows and predicting trade potential with other groups of countries like the CEECs or the Mediterranean countries. Papers who followed this approach to assess the EU-CEEC trade potential are: Wang and Winters (1991), Hamilton and Winters (1992), Baldwin (1994), Bertolini and Montanari (2002) and Ferragina, Giovannetti and Pastore (2005). The only study that uses this approach and is conducted for the EU-Mediterranean countries is that of Ferragina, Giovannetti and Pastore (2005). 2) The *In-Sample* approach interprets the residuals of the estimated equation as indicating whether actual trade is below or above its potential level: they are assumed to represent the difference between potential and actual trade. This method was used in Brenton and Kendall (1994) and De Benedectis and Vicarelli (2005) for the EU-CEEC potential trade and Al-Atrash and Yousef (2000) and Miniesy, Nugent and Yousef (2004) for the EU-Mediterranean potential trade[31].

Egger (2002) outlines the fact that the *In-Sample* approach is econometrically unfounded as only mis-specified regressions and inconsistent parameters yield large systematic errors and, consequently, large differences between observed and in-sample predictions. Furthermore, Ferragina, Giovannetti and Pastore (2005) is the only study that combined panel estimation with the *Out-of-Sample* method to predict trade potential for the Mediterranean region with the EU. However, they use intra-EU bilateral trade flow as benchmark to evaluate potential integration of the EU with the Mediterranean countries imposing identical elasticities of trade determinants as those observed in the case of intra-EU trade.

In this chapter, It is considered that the elasticities of trade with respect of its different determinants should be compared to those examined in the CEEC-EU trade since country pairs in this relation exhibit South-North characteristics like in the case of the Maghreb-EU trade. In addition, potential-to-actual export ratios are computed for each commodity traded by every pair of countries in every year of the 1997-2001 period. Potential-to-actual export

[30] The 12 CEECs countries are: Poland, Hungry, Czech Republic, Latvia, Estonia, Lithuania, Cyprus, Malta, Slovakia, Bulgaria, Romania and Slovenia.

[31] Ferragina, Giovannetti and Pastore (2005) report a detailed survey of the literature on trade potential between the CEE, the Med region and the EU15.

ratios are then regressed on distance and exporter-specific maritime transportation costs to assess the impact of bad sea-ports on trade and on hindering it from reaching its potential.

$$\left(\frac{Potential}{Actual}\right)_{IJkt} = \beta_1 d_{IJ} + \beta_2 TC^{n}_{Ikt} + \varepsilon_{IJkt} \qquad \forall \text{ n=I, II, III} \qquad (3.8)$$

$$\varepsilon_{IJkt} = \gamma_1 \varphi_I + \gamma_2 \alpha_J + \gamma_3 \delta_{IJ} + \gamma_4 \lambda_k + \gamma_5 \psi_t + v_{IJkt}$$

Where both $\hat{\beta}_1$ and $\hat{\beta}_2$ are anticipated to have a negative sign.

3.6.2 Estimation Results

Table 3.5 depicts the regression results of equation 3.6, performed on exports originating from the 12 Central and Eastern European Countries (CEECs) and from the three Maghreb countries and flowing to the EU15 in 1997-2001. IV-LSDV results for the CEEC-EU15 regression yield significant coefficients on all variables. Comparing exporter's GDP coefficients in both regressions, it is evident that Maghreb countries' GDP has a larger influence on the determination of trade than does that of the CEECs. A 10% increase in GDP in the Maghreb countries leads to a 7% increase in trade. This stresses the need for Maghreb countries to invest in efficient infrastructure that will facilitate trade transactions, and increase exports.

When regressed over exporter-specific transportation costs, potential-to-actual export ratios between Maghreb and EU15 also proved to be sensitive to Maghreb inefficient seaports: Lower potential-to-actual export ratios are associated with low levels of exporter-specific transportation costs. Depending on the proxy used, a 10% rise in seaport inefficiency-led exporter transportation costs is associated with a corresponding 0.04% when Proxy I and II are employed and to a 0.004% increase when Proxy III is used (Table 3.6).

Table 3.5: CEEC-EU15 & Maghreb-EU15 Gravity Equation for (1997-2001)

Dependent Variable: Volume of Exports from I to J [a)]

	CEEC-EU15 IV-LSDV Estimates [b)]	Standard Error	Maghreb-EU15 IV-GLS Estimates	Standard Error
Exporter GDP (GDP_{It})	0.159**	0.075	0.701***	0.204
Importer GDP (GDP_{Jt})	0.774***	0.130	0.774***	0.127
Commodity Weight in World Cons. $(cons_{kt})$	0.179**	0.0915	0.283**	0.125
Price of Exported Commodity k (pr_{Ikt})	-2.383***	0.471	-2.488***	0.250
Distance (d_{IJ})	-	-	-1.236**	0.568
Number of Observations	50,382		10,970	
R^2	0.976		0.956	
	p-value		p-value	
Hausman-Taylor Test	0.000***		1.000	
Heteroscedasticity [c)]	0.000***		-	
Wald Tests:				
Time Effects	0.006***		0.000***	
Exporter Country Effects	0.000***		0.000***	
Importer Country Effects	0.000***		0.000***	
Bilateral Effects	0.000***		0.000***	
Commodity Effects	0.000***		0.000***	

a) Estimated coefficients are rounded to the nearest thousandth b) White (1980) standard errors are reported between parentheses. c) Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity: uses the fitted values of Log Exports to explain estimated squared residuals.***) significant at 1%**) significant at 5%*) significant at 10%

Table 3.6: Effect of Maghreb Port-Related Maritime Transportation Costs on Actual-Potential Exports

Dependent Variable: Potential-to-Actual Maghreb-EU15 Export Ratio [a]			
	LSDV Estimates I	LSDV Estimates II	LSDV Estimates III
TC^1_{Ikt}	0.0384*** (0.0067)	-	-
TC^2_{Ikt}	-	0.0447** (0.026)	-
TC^3_{Ikt}	-	-	0.0004*** (0.00007)
Number of Observations	5,499	5,499	5,499
R^2	0.8327	0.8325	0.8327
	p-value	p-value	p-value
Hausman-Taylor Test	0.0032***	0.0037***	0.0021***
Wald Tests:			
Time Effects	0.004***	0.004***	0.005***
Exporter Country Effects	0.000***	0.158	0.553
Importer Country Effects	0.000***	0.000***	0.000***
Bilateral Effects	0.000***	0.000***	0.000***
Commodity Effects	0.000***	0.000***	0.000***

a) t-statistic is Heteroskedasticity robust (White, 1980). b) Breusch-Pagan / Cook-Weisberg test for heteroskedasticity: uses the fitted values of Log Exports in explaining the estimated squared residuals. ***) significant at 1% **) significant at 5%; *) significant at 10%

A by-sector analysis draws important inferences on the effects of bad seaports in hindering Maghreb exports from reaching their potential in both the Manufacturing and Agricultural sectors. From Table 3.7, the impact of exporter-specific transportation costs on potential-to-actual export ratios is more pronounced in the latter two sectors (coefficients are significant at the 1% level). A 10% increase in exporter-specific transportation costs drives potential-to-actual export ratio in the manufacturing sector by 0.48% when Proxy I is used. Hence, the dismantling of tariff barriers, as a direct consequence of the Euro-Med agreements, is insufficient for promoting more South-North exports to the EU15 if it is not accompanied by policies aiming at reducing inefficiency at seaports. Moreover, the yet protected agricultural sector is more sensitive to bad infrastructure as a 10% rise in exporter-specific transportation costs is associated with a 0.92% rise in potential-to-actual export ratio, almost double the effect in the manufacturing sector.

Table 3.7: By Sector Effect of Maghreb Port-Related Maritime Transportation Costs on Trade Diversion

Dependent Variable: By- Sector Potential-to-Actual Maghreb-EU15 Export Ratio [a)]						
	GLS Estimates I		GLS Estimates II		GLD Estimates III	
	TC^1_{Ikt}	d_{IJ}	TC^2_{Ikt}	d_{IJ}	TC^3_{Ikt}	d_{IJ}
Agriculture	0.0921*** (0.015)	-0.9834 (0.0757)	0.0226*** (0.0086)	0.2184*** (0.0086)	0.0098*** (0.0017)	0.2173*** (0.0586)
Electricity & Gas	0.0043 (0.9563)	-0.1517 (0.2213)	-0.0017 (0.0424)	0.3754* (0.0424)	0.0051 (0.0108)	0.3754* (0.2223)
Fishing	0.0812** (0.0378)	0.5056*** (0.1434)	0.0557** (0.0219)	0.6646*** (0.1042)	-0.0004 (0.0042)	0.4977*** (0.1474)
Manufacturing	0.0483*** (0.0029)	0.2112*** (0.0120)	0.0104*** (0.0017)	0.2123*** (0.0123)	0.0034*** (0.0003)	0.2116*** (0.0122)
Mining	-0.0030 (0.0378)	-1.6229*** (0.2700)	0.0013 (0.0203)	0.4226*** (0.1423)	0.0005 (0.0044)	0.4436*** (0.1426)

a) Standard errors are reported between parentheses ***) significant at 1% **) significant at 5%; *) significant at 10%

3.7 Conclusion

Recent literature on transportation costs and their impact on trade integration highlight the important role of general infrastructure and inefficient seaports in increasing the non-tariff barriers to trade. Following the signature of the Euro-Med Association Agreements between the EU and the Maghreb countries, an area of interest is the role of transportation costs in hindering the materialisation of the trade liberalizing efforts.

The aim of this chapter is to quantify Maghreb countries-specific transportation costs stemming from bad infrastructure and inefficient operations at the seaport level. Empirical results reveal that, even when distance is controlled for, exporter-specific transportation costs inversely affect exports to the EU15. They, further, slow down increased trade effects induced by the Euro-Med Agreements and hinder potential trade from reaching its potential level when CEEC-EU15 exports are taken as benchmark. Finally, the impact of exporter-specific transportation costs on trade is more pronounced in the protected agricultural sector as well as the more trade liberalized manufacturing one.

Chapter 4

FDI, Migration and Trade: An Empirical Study

4.0 Introduction

The links between trade and migration, migration and FDI and between FDI and trade formed a wide area of research and study. Standard trade models predict a substitutability pattern between migration and trade and between FDI and trade given that perfect factor mobility (Capital or Labor), and hence, Factor Price Equalization (FPE) across countries reduces comparative advantage and the need for trade. This has been discussed at great length in both the theoretical (Mundell, 1957) and the empirical literature (Layard et al, 1992). These predictions were mainly behind the expansionary implementation of Free Trade Areas (FTA), which targeted, among other, the need to "export goods not people" (President Salinas speech on the creation of NAFTA). FTAs were also accompanied by strict and selective migration policies put in place in order to limit the quantity and improve the quality of migrant flows (Faini, 2004). Docquier and Marfouk (2004) point out that the second objective has only been reached with the number of highly-skilled immigrants increasing by 70% between 1990 and 2000. This, however, was accompanied by a 28% increase in low-skilled migrants during that same period.

In reaction to the new immigration policies, sending countries have voiced their concern with regards to the brain drain resulting from the loss of the most skilled of their workers: the catalysts for inward FDI. This fact triggered further research on the dynamic effects of migration and their likely benefits to the sending country in the long run. In fact, growing literature on migrant networks and their role in facilitating bilateral transactions through their reduction of information costs and the removal of cultural barriers predict that trade and migration can be complements and particularly in heterogeneous goods (Gould, 1994, Rauch and Casella, 2003, Rauch and Trindade, 2002).

However, Lopez and Schiff (1998) studied the impact of trade liberalization on migration and showed that they are complements when migration is of the unskilled type and substitutes when migration is skilled. An empirical study on migration from Southern to Northern Europe conducted by Faini and Venturini (1993) produces similar results. This finding was primarily linked to the existence of high migration costs as trade liberalization raises wages in the labour abundant country which allows more unskilled labour to emigrate provided that they will be less constrained by their ability to pay for migration. However, from a politico-economic perspective, Bilal, Grether & De Melo (2003) argued that the opening of trade and its effect on the improvement of the terms of trade in the skilled labour-intensive opposing inflows of unskilled migrants with poor capital, yielding a substitutability relationship between unskilled migration and trade. In addition to the networking literature, the prominent study of Markusen (1983) theoretically shows that by assuming technological differences across countries along with free trade in commodities and immobility of one factor of production, migration and trade can well be complements.

It has also been argued that both skilled and un-skilled migrants could remove investment-related uncertainty, mitigate the match costs between potential investors and home partners and facilitate the set up process of a production facility, rendering FDI and migration complements rather than substitutes. Complementarity, in this context, is defined as migration flows in one direction encouraging FDI flows in the opposite direction. Also on the relation between FDI and migration, Aroca Gonzalez and Maloney (2002) study the effect of FDI on US-Mexico migration and provide evidence of a contemporaneous substitutability relationship between the two. More recently, Kugler and Rapoport (2005) phase in the dynamic implications of Migration on FDI and conclude to a relationship of contemporaneous substitutability and dynamic complementarity between skilled migrants and FDI.

As for the well documented relationship between FDI and trade, it is of two types: a complementary relationship emanates when FDI is of the vertical type or when the purpose of FDI is to seek greater efficiency through the fragmentation of the production process. A substitution relationship otherwise emerges when FDI is of the horizontal type. Blonigen

(1999) found evidence for both a substitution and complementarity relationship between US FDI inflows to Japan and Japanese exports to the US in the automobile parts industry.

In his study on the effect of trade on migration, Faini (2004) noted that since the three factors- FDI, trade and migration – tend to feed on one another, it is crucial for them to be examined in one integrated framework. This has also been backed up by econometric concerns as failing to control for trade when looking at the relation between migration and FDI may well yield omitted variable bias in the regression's estimates.

This chapter intends to study the impact of migration on FDI after controlling for the volume of exports and imports in the FDI source country. How would the "substitutability or complementarity" relationship between migration and FDI be affected by the skill composition of migrants when the effect of "labour export" that is embedded in the export of goods is controlled for? How does the significance and the magnitude of the partial effect of the different migrant groups on FDI changes when the trade components (exports and imports) are incorporated into the model? To answer these questions, this study follows an empirical strategy consisting of first employing plain OLS estimation for both the whole sample and the for sub-sample of strictly positive FDI flows in order to differentiate between the partial effects of the different determinants on the extensive margin (when FDI is positive) as opposed to their concurrent effect on both the extensive and intensive margins (the whole sample). Tobit estimation is secondly employed to deal with censoring or measurement error in the reporting of FDI flows: the censor is alternatively considered to equal zero or the value of the lowest positive FDI flow. Lastly, a Heckit (or Type 3 Tobit) estimation technique is employed to deal with both the censoring of the dependent variable and with the sample selection bias resulting from the endogeneity of the capital investment decision.

The remainder of the chapter is organized as follows: Section 4.1 illustrates the working model developed by Kugler and Rapoport (2005), Section 4.2 discusses the data used in the analysis and tackles endogeneity and sample selection issues, Section 4.3 presents the methodology and the different estimation techniques (OLS, Tobit and Heckman Selection) employed in the study, Section 4.4 depicts the empirical results and finally Section 4.5 concludes.

4.1 The Theoretical Framework

In order to look to at the dynamic and contemporaneous effects of the three categories of migrants on FDI flows in the presence of trade, a regression is estimated based on the specification developed in Kugler and Rapoport (2005) and is extend with measures for export and import flows. They consider a model with a small open economy where capital is perfectly mobile across countries. Labour, on the other hand, is not perfectly mobile internationally and is constrained by migration costs and foreign immigration policies. The small economy is also assumed to be "developing" in that wages are higher in the migration-receiving countries due to a continual technological advantage, the fact that positively influences outward-migration. The production function is assumed to be Cobb-Douglas with constant returns to scale:

$$Y_t = A(H_t)K_t^{1-\alpha}L_t^{\alpha}$$

where $L_t = (N_t - M_t^U - M_t^S)H_t$ represents the efficient stock of labour at time t net of skilled, M_t^S, and unskilled, M_t^U, migrants. Following Lucas (1988), total factor productivity, A, depends on H_t which is the average level of human capital. First order conditions:

$$r_t = (1-\alpha)A(H_t)k_t^{-\alpha}$$
$$w_t = \alpha A(H_t)k_t^{1-\alpha}$$

Coupled with the assumption that domestic interest rates are higher than the international ones by the magnitude of the domestic risk premium yield an equilibrium capital stock equation given by:

$$K_t = \left[\frac{(1-\alpha)A_t L_t^{\alpha}}{r^* + \pi_t}\right]^{\frac{1}{\alpha}}$$

where r^* is the international interest rate and π_t is the risk premium that may jointly be determined by variables such as corruption, economic, financial and political instability.

Based on adaptive and rational expectations, Kugler and Rapoport (2005) develop a set of Lemmas predicting the different contemporaneous and substitutability relations linking the three types of migration and FDI. Given their additional assumption regarding the endogeneity of the skill composition of labour (being related to emigration levels and the proportion of skilled individuals in the economy), they predict contemporaneous substitutability and dynamic complementarity between FDI and skilled migration when expectations are adaptive. However, the signs of the correlation between unskilled migration, both lagged and current, and FDI are ambiguous. When expectations are rational, however, the model predicts dynamic complementarity for both skilled and unskilled. Nevertheless, the contemporaneous links between both categories and FDI are ambiguous under these assumptions.

4.2 Data description

Bilateral data on immigration stocks by host country, place of birth and education level for 1990 and 2000 are taken from a database constructed by Docquier and Marfouk (2004). The database originally comprised emigration rates from 170 and 190 both developing and industrial countries in 1990 and 2000, respectively. Emigrants are classified by their highest educational attainment- primary, secondary or tertiary- henceforth representing the migrants' main skill categories. When migrants are classified as either skilled or unskilled, then the grouping is done as follows: skilled consisting of migrants with tertiary education and unskilled comprising migrants with primary or secondary education.

Bilateral data for FDI flows are taken from Razin et al. (2002) and are deflated by the unit value of manufactured goods' exports (MUV). Bilateral FDI is available for 12 source countries and 45 host countries[32]. Other controls, also taken from Razin et al, consist of (1) specific host and source country characteristics such as GDP/Capita in 1990, FDI-host country's real GDP, its financial, economic, political and corruption risk ratings in 1990, its ethnic fractionalization index in 1990, its average tax in 1990 and host-country mean debt equity ratio (2) bilateral variables such as FDI flows in 1990, geographical distance, common language, common border, colonial relationship and a proxy for time zone differences. Other source (s), host (h) unobserved heterogeneities are controlled for by including host and source-specific dummies.

The source for trade data is the United Nations COMTRADE database. 1-digit disaggregated commodity trade flows are included in the study. Trade flow measures are reported for 1990 and over the 1990-2000 period. The two variables are included in OLS, Tobit and Heckman's flow equation estimation, while only the former variable is incorporated in Heckman's selection equation as it influences the choice for subsequent FDI flows between the two trading partners.

4.3 Empirical Challenges

4.3.1 Endogeneity Issues

Looking first at the direction of the causality link between factor flows, previous studies (Groznik, 2003 and Chong-UK, 2006) found evidence that factors cluster in that labour leads capital when capital is defined as FDI. This fact has been backed up by the literature on migrant networks and their role in mitigating the costs associated with investments in their home country. Hence, it would seem proper that migration is included in the right-hand-side of the specification as it is considered more exogenous. Fears of possible endogeneity in the migration variable that could originate from the influence of increased FDI on labour market variables in the presence of migration constraints are dealt with by including the relevant proxies such as FDI-host country's real GDP and GDP per Capita.

Moreover, since trade in commodities involves an implicit trade in factors, omitting the trade variable from the specification would not only lead to omitted variable bias but also to unaccounted for endogeneity bias in the migration variable. Hence, accounting for the volume of trade in the specification is integral to properly estimate the partial effect of trade in goods and migration on investment.

[32] The Razin et al. database comprised data on FDI inflows to Taiwan from the 23 FDI exporters in the sample. It was, however, excluded from the study since COMTRADE reports all

As it has been well documented, trade and FDI are predicted to be complements, especially when FDI is of "vertical" nature: Aggregate financial and commercial openness are closely related since they are explained by similar gravity determinants (Portes and Rey, 2005; Aizenman and Noy, 2005). It was also shown that causality linkages between trade and FDI significantly run both ways (Aviat and Coeurdacier, 2004). Relying on Geweke's (1982) methodology in disentangling temporal from simultaneous (or instantaneous) causality, Aizenman and Noy (2005) show that most of the linear feedback between gross FDI and commodity flows is explained by Granger-causality from FDI to Trade (50%) and from Trade to FDI (31%). The rest is due to simultaneous correlations. In order to, therefore, deal with the endogeneity-driven bias in the trade variable, a host of macroeconomic controls that serve as common determinants for both trade and FDI are included in the FDI specification. These comprise: GDP, per-capita GDP, financial, economic, political and corruption risk ratings, and other controls discussed in section 4.2[33].

Lastly, I specify a differences-in-differences specification for FDI by taking the log of the change of FDI stocks between 1990 and 2000. This helps in mitigating any remaining bias stemming from omitted or unobserved time-constant, country-specific or country-pair heterogeneity.

4.3.2 Sample Selection

Razin et al. (2005) examine the sample selection bias brought about by the estimation of the FDI equation when the non-randomness of the zero flows are not appropriately dealt with. They jointly estimate the maximum likelihood of the flow and selection equation using Heckman and find evidence for the non-randomness hypothesis. More precisely, they prove that the choice to invest or not to invest is linked to fixed set-up costs in the host country. They further show that failing to account for these fixed costs may lead to erroneous interpretations of the results (this has been illustrated through the effect of the source-host differences in the educational level, which significantly impacts FDI on its extensive margin but shows no significant influence on the intensive margin or the volume of FDI within an FDI-trading pair).

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inbound and outbound trade to Taiwan as being part of Chinese trade.

[33] See appendix 4.1 for a full list of explanatory variables.

Indeed, a descriptive analysis of the data on FDI flows shows that from a sample of 180 potential FDI-trading pairs only 450 (12 source and 45 host countries) are observed (Razin et al., 2002). Furthermore, it was shown that most source countries export to only one host country and that the higher the per-capita GDP in a host country, the larger is the number of FDI-exporting partners.

The sample selection bias in the trade variable has been examined in Helpman, Melitz and Rubenstein (2006). They show that among 158 countries with available trade data yielding a possible 24,806 positive export relationships, only 11,146 of these relationships have non-zero export flows. Moreover, they show that the speedy growth of world trade is mostly due to a trade expansion on the intensive margin rather than to a formation of new exporters to a particular destination. They argue that common gravity estimations suffer (1) from a downward bias emanating from the sample selection in the trade variable when zero trade flows are excluded from the estimation and (2) from an upward bias resulting from the endogenous number of firms choosing to export to foreign markets. The latter bias stems from the fact that firms are heterogeneous in their nature and respond differently to trade barriers and, hence, make different export decisions. For the firm, the choice to export or not to export (its selection into export markets) is determined by its zero profit condition. Therefore, the effect of trade frictions on trade maybe confounded with their indirect effect on the proportion of exporting firms, creating the upward bias (the distance variable in a gravity equation maybe correlated with unobservables relegated to the error term). In this study, both types of biases do not pose econometric concern since it is not aimed at explaining trade rather the objective is to control for the trade variable in the process of better explaining FDI.

4.4 Empirical Methodology

In order to examine whether the linkages predicted in Kugler and Rapoport (2005) between migration and FDI are robust when trade is controlled for, the model is estimated under three alternative econometric procedures. As a first benchmark scenario, the data is pooled and the equation is estimated using OLS. The equation has the following specification:

$$\ln \Delta Y_{j,i,t} = \beta_0 + \beta_1 \ln \Delta prim\_mgr_{i,j,t} + \beta_2 \ln \Delta \sec\_mgr_{i,j,t} + \beta_3 \ln \Delta ter\_mgr_{i,j,t}$$
$$+ \beta_4 \ln prim\_mgr_{i,j,t-1} + \beta_5 \ln \sec\_mgr_{i,j,t-1} + \beta_6 \ln ter\_mgr_{i,j,t-1} + \beta_7 \ln \Delta exp_{i,j,t} + \beta_8 \ln \Delta imp_{i,j,t}$$
$$+ \beta_9 \ln exp_{i,j,t-1} + \beta_{10} \ln imp_{i,j,t-1} + \beta_{11} A'_{i,t-1} + \beta_{12} B'_{j,t-1} + \beta_{13} C'_{i,j,t} + \beta_{14} D'_{i,j} + \varepsilon_{i,j,t}$$
(4.1)

where $\Delta Y_{i,j,t}$ is the flow of FDI from country j to i between 1990 and 2000; $\Delta prim\_mgr_{i,j,t}$ ($prim\_mgr_{i,j,t-1}$), $\Delta \sec\_mgr_{i,j,t}$ ($\sec\_mgr_{i,j,t}$) and $\Delta ter\_mgr_{i,j,t-1}$ ($ter\_mgr_{i,j,t-1}$) are the flows (stocks) of migrants with primary, secondary and tertiary education from i to j between 1990 and 2000 (in 1990), respectively; $\Delta exp_{i,j,t}$ and $\Delta imp_{i,j,t}$ represent the flow of exports of i to j and imports of i from j between 1990 and 2000; $exp_{i,j,t-1}$ and $imp_{i,j,t-1}$ denoted the volume of exports and imports from i to j in 1990; $A_{i,t-1}$ represents the vector of exporter-specific controls in 1990; $B_{j,t-1}$ is the vector of importer- specific controls in 1990 ; $C_{i,j,t-1}$ corresponds to the vector of bilateral-specific control variables in 1990; and $D'_{i,j}$ stand for the time-invariant bilateral-specific variables (distance, colonial relationship, common border, common language).

In this case, possible measurement errors (resulting from censoring) and fixed set-up costs are ignored and zeros are assigned to missing observations in FDI flows. The same estimation is conducted, when only positive FDI flows are considered. The latter would help determining those variables with significant impact on FDI's intensive margin. The results of the latter two estimations are reported with and without the trade components to monitor changes in the variables' coefficients. Lastly, the same procedure is repeated, but now considering migrants to be classified as either skilled or unskilled. This technique combines both primary and secondary educated migrants into one category and treats them as being unskilled. The estimated equation has the following specification:

$$\ln \Delta Y_{j,i,t} = \beta_0 + \beta_1 \ln \Delta unskilled\_mgr_{i,j,t} + \beta_2 \ln \Delta skilled\_mgr_{i,j,t} + \beta_3 \ln unskilled\_mgr_{i,j,t-1} + \beta_4 \ln skilled\_mgr_{i,j,t-1}$$
$$+ \beta_5 \ln \Delta exp_{i,j,t} + \beta_6 \ln \Delta imp_{i,j,t} + \beta_7 \ln exp_{i,j,t-1} + \beta_8 \ln imp_{i,j,t-1} + \beta_9 A'_{i,t-1} + \beta_{10} B'_{j,t-1} + \beta_{11} C'_{i,j,t} + \varepsilon_{i,j,t} \quad (4.2)$$

where $\Delta unskilled\_mgr_{i,j,t}$ $(unskilled\_mgr_{i,j,t-1})$ and $\Delta skilled\_mgr_{i,j,t}$ $(skilled\_mgr_{i,j,t-1})$ denote the flow (stock) of unskilled and skilled migrants from country i to country j between 1990 and 2000 (in 1990), respectively.

As a second benchmark and based on measurement error, observations below a certain threshold are recorded as zero flows. Tobit estimation is hence employed with the censor (threshold) being at zero or, alternatively, at the lowest positive FDI flow value. If Y^*_{jit} denotes desired FDI flows from j to i at time t, then the truncation of the sample distribution is expressed as follows:

$$\ln\Delta Y^*_{j,i,t} = \beta_0 + \beta_1 \ln\Delta prim\_mgr_{i,j,t} + \beta_2 \ln\Delta \sec\_mgr_{i,j,t} + \beta_3 \Delta \ln ter\_mgr_{i,j,t} + \beta_4 \ln prim\_mgr_{i,j,t-1}$$
$$+\beta_5 \ln\sec\_mgr_{i,j,t-1} + \beta_6 \ln ter\_mgr_{i,j,t-1} + \beta_7 \ln\Delta exp_{i,j,t} + \beta_8 \ln\Delta imp_{i,j,t} + \beta_9 \ln exp_{i,j,t-1}$$
$$+\beta_{10} \ln imp_{i,j,t-1} + \beta_{11} A'_{i,t-1} + \beta_{12} B'_{j,t-1} + \beta_{13} C'_{i,j,t-1} + \beta_{14} D'_{i,j} + \beta_{15}\varepsilon_{i,j,t}$$

$Y^*_{j,i,t}$ may well be negative[34].. However, the data only reports the latent variable $Y^*_{j,i,t}$ when it is positive (with the censor being equal to zero):

$$\Delta Y_{j,i,t} = \max(0, \Delta Y^*_{j,i,t})$$

or when it exceeds a minimum positive threshold:

$$\Delta Y_{j,i,t} = \max(\theta, \Delta Y^*_{j,i,t}) \quad \text{where} \quad \theta > 0$$

By using Tobit, however, sample selection bias would not be controlled for and the possibility that FDI-partners are non-random would consequently be ruled out. Results are reported for both the case when trade is controlled for and for the case when it is not included in the regression. I also repeat the estimation for migrants classified as skilled or unskilled.

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[34] $Y^*_{i,j,t-1}$ may well be negative as changes in the productivity of capital may cause FDI to flow in the opposite direction.

Finally, the need to further correct for lumpy set-up costs that are behind the root cause of sample selection in the dependent variable are phased in and FDI is estimated via a two-step Heckman Correction Model (Heckman, 1976, 1979). The form of the sample selection problem is presented by two equations: the outcome (or the flow) equation which explains the intensity of FDI flows, and the selection equation (or the decision equation) which explains the factors affecting the decision to invest or not to invest. This technique solves for both measurement errors and the existence of set-up costs. The binary variable, $D_{i,j,t}$, is considered as denoting the decision of entrepreneurs in country i to invest in j in the year 1990. $D_{i,j,t}$ takes the value of 1 when the flow of FDI over the 1990-2000 period, $\Delta Y_{j,i,t}$, is strictly positive and zero otherwise:

$$D_{j,i,t} = \begin{cases} 1 & \text{if } \Delta Y_{j,i,t} > 0 \\ 0 & \text{otherwise} \end{cases}$$

The second step involves estimating equation (1) extended with the inverse mills ratio that is produced from the first step Probit regression of $D_{i,j,t}$ on a subset of the explanatory variables from equation (1) in addition to the exclusion restriction variable, $D_{j,i,t-1}$, which represents a dummy for positive FDI flows over the 1980-1990 period. To the extent that the presence of positive FDI flows reduce set-up costs for subsequent FDI flows in that information and familiarity with the host market had already been established, this dummy could act as a good exclusion restriction for the selection equation. An overlapping set of variables are used to explain both the intensive and extensive FDI margins. The first-step Probit regression is hence presented as follows:

$$\begin{aligned} \Pr(D_{j,i,t}) = {} & \alpha_0 + \alpha_1 \ln \Delta prim\_mgr_{i,j,t} + \alpha_2 \ln \Delta \sec\_mgr_{i,j,t} + \alpha_3 \ln \Delta ter\_mgr_{i,j,t} + \alpha_4 \ln prim\_mgr_{i,j,t-1} \\ & + \alpha_5 \ln \sec\_mgr_{i,j,t-1} + \alpha_6 \ln \Delta ter\_mgr_{i,j,t-1} + \alpha_7 \ln \Delta exp_{i,j,t} + \alpha_8 \ln \Delta imp_{i,j,t} + \alpha_9 \ln exp_{i,j,t-1} \\ & + \alpha_{10} \ln imp_{i,j,t-1} + \alpha_{11} A'_{i,t-1} + \alpha_{12} B'_{j,t-1} + \alpha_{13} C'_{i,j,t-1} + \alpha_{14} D'_{i,j} + \upsilon_{i,j,t} \end{aligned} \qquad (4.3)$$

Maximum likelihood estimation is applied to the selection equation where an inverse mills ratio variable is generated and later included in the second step regression that is estimated by OLS and specified as follows:

$$
\begin{aligned}
\ln\Delta Y_{j,i,t} &= \gamma_0 + \gamma_1 \ln\Delta prim\_mgr_{i,j,t} + \gamma_2 \ln\Delta \sec\_mgr_{i,j,t} + \gamma_3 \ln\Delta ter\_mgr_{i,j,t} + \gamma_4 \ln prim\_mgr_{i,j,t-1} \\
&+ \gamma_5 \ln \sec\_mgr_{i,j,t-1} + \gamma_6 \Delta ter\_mgr_{i,j,t-1} + \gamma_7 \ln\Delta exp_{i,j,t} + \gamma_8 \ln\Delta imp_{i,j,t} + \gamma_9 \ln exp_{i,j,t-1} \\
&+ \gamma_{10} \ln imp_{i,j,t-1} + \gamma_{11} A'_{i,t-1} + \gamma_{12} B'_{j,t-1} + \gamma_{13} C'_{i,j,t-1} + \gamma_{14} D'_{i,j} + \gamma_{15} InvMills + \varepsilon_{i,j,t}
\end{aligned} \tag{4.4}
$$

4.5 Empirical Results

The results of the OLS estimation of equation (4.1) are presented in Tables 4.1 and 4.2. Most noticeable and consistent across Table 4.1 is the absence of both a negative contemporaneous relationship between the flow of tertiary migrants over the 1990-2000 period and FDI, and of a positive dynamic relationship between the stock of secondary migrants on one hand and FDI on the other. In fact, column 1 of Table 4.1 does not show evidence of any networking effect that migrants from the different categories might have in positively promoting for FDI inflows to their source countries. Also in columns 1 and 2, there is no evidence of a negative contemporaneous relationship between the flow of tertiary (or skilled) migrants and the inflows of FDI from the migrants' host country like the FDI-Migration model would predict when expectations are adaptive.

Adding the two trade components (exports and imports) to the regressions carried out on the full sample slightly improves on the initial regression in that the sign of the coefficient on the flow of primary migrants becomes negative at the 5% significance level. Furthermore, the coefficient on both the export and import flows over the 1990-2000 period in both the full sample regression (columns 2) and the sub-sample regression (column 4) of Table 4.1 are positive and significant giving support to the notion that increased trade reduces uncertainty and information costs which normally act as deterrents to foreign investment. Commodity imports of the FDI host country from the FDI sending country becomes significant when looking at the sub-sample of positive FDI flows.

However, the intensity of FDI over the 1990-2000 period - illustrated in columns 3 and 4 of Table 4.1 when only positive values of FDI are considered - is shown to be positively dynamically affected by the stock of both primary and tertiary migrants in the year 1990 as the theoretical model would predict when trade is not accounted for. Furthermore, both the flows of primary and secondary migrants over the 1990-2000 are also shown to substitute for contemporaneous FDI. An interesting observation is when controlling for the components of trade in the sub-sample as the coefficient on commodity import flows in the year 1990 becomes positively significant emphasizing the presence of a complementary relation between trade and FDI.

F-tests proved that only three types of interaction variables are jointly significant, those joining the stocks of the three different classes of migrants in 1990 with each of the corruption, political and fractionalization risk indices in 1990. Although they are small in magnitude, the related parameters are proven to have a robust, negative, and significant coefficient almost across the four regressions. The latter implies that increased political, corruption and fractionalization risk reduces the positive networking impact of existing stocks of migrants on FDI flows to their home country.

The OLS estimation carried out on the skilled/unskilled classification of migrants yields similar results with regards to the effect of the flow of the skilled category over the 1990-2000 period on FDI: it stayed positive and significant.

Most interestingly, the inclusion of the trade variable generates results that are in line with the predictions of the trade-free theoretical model: The regression carried on the sub-sample (column 4 of Table 4.2), for instance, suggests a negative relationship between contemporaneous migration and FDI on one hand and a positive, complementary relationship between both stocks of skilled and unskilled migrants in 1990 and FDI, on the other. Results indicate that a 1% increase in the stocks of skilled migrants leads to just about 1.3% increase in FDI flows to the migrants' source country.

Table 4.1: OLS Estimation (Migrants classified as Primary/Secondary/Tertiary Education)

Dependent Variable: FDI (prices adjusted - in logs)				
	Full Sample [1]		Sub-Sample [2]	
	Without Exports/Imports [3] [4]	With Exports/Imports [3]	Without Exports/Imports [3] [4]	With Exports/Imports [3]
$\Delta prim\_mgr_{i,j,t}$ (log)	0.161*** (0.047)	-0.076** (0.030)	-0.077** (0.032)	-0.076** (0.032)
$\Delta sec\_mgr_{i,j,t}$ (log)	-0.312*** (0.074)	-0.242*** (0.058)	-0.200*** (0.051)	-0.242*** (0.059)
$\Delta ter\_mgr_{i,j,t}$ (log)	0.355*** (0.056)	0.498*** (0.071)	0.462*** (0.050)	0.498*** (0.053)
$prim\_mgr_{i,j,t}$ (log)	-0.601*** (0.037)	0.392*** (0.026)	0.265*** (0.026)	0.392*** (0.026)
$sec\_mgr_{i,j,t}$ (log)	-0.014*** (0.064)	-0.328*** (0.044)	-0.245*** (0.040)	-0.328*** (0.048)
$ter\_mgr_{i,j,t}$ (log)	0.0356 (0.054)	0.203*** (0.045)	0.231*** (0.036)	0.203** (0.047)
$\Delta exp_{i,j,t}$ (log)	-	0.036*** (0.009)	-	0.036*** (0.009)
$\Delta imp_{i,j,t}$ (log)	-	0.034*** (0.008)	-	0.034*** (0.008)
$exp_{i,j,t-1}$ (log)	-	0.004 (0.005)	-	0.004 (0.004)
$imp_{i,j,t-1}$ (log)	-	0.007 (0.004)	-	0.007** (0.003)
Ethnic_frac90 *log(primary_90)	-2.78e-08*** (1.06e-08)	-1.37e-08 (1.53e-08)	-4.53e-8*** (1.22e-08)	-1.37e-08 (1.14e-08)
Ethnic_frac90 *log(secondary_90)	-7.10e-08*** (2.95e-08)	1.34r-07*** (3.98e-08)	-8.51e-08*** (3.23e-08)	-1.34e-07*** (3.02e-8)
Ethnic_frac90 *log(tertiary_90)	-5.25e-08*** (1.37e-08)	-9.23e-08*** (2.22e-08)	-6.53e-08*** (1.68e-08)	-9.23e-08*** (1.75e-08)
Political_Index90 *log(primary_90)	-2.66e-07*** (5.64e-08)	-4.307e-07*** (7.88e-08)	-3.15e-07*** (7.17e-08)	-4.30e-07*** (6.95e-08)
Political_Index90 *log(secondary_90)	-2.86e-07*** (5.64e-07)	4.21e-07 (9.99e-08)	-2.53e-07** (1.02e-07)	4.30e-07 (8.80e-08)
Political_Index90 *log(tertiary_90)	-4.79e-08** (1.95e-08)	-1.06e-07*** (3.08e-08)	-1.51e-07*** (3.29e-08)	-1.06e-07*** (2.12e-08)
Corruption_index90 *log(primary_90)	-7.21e-07*** (3.42e-07)	-2.48e-06*** (5.51e-07)	-3.15e-06*** (5.51e-07)	-2.48e-06*** (3.70e-07)
Corruption_index90 *log(secondary_90)	-5.43e-06*** (1.45e-06)	8.44e-06*** (1.81e-06)	-5.43e-06*** (1.84e-06)	-8.44e-06 (1.60e-06)
Corruption_index90 *log(tertiary_90)	-5.08e-06*** (1.03e-06)	-8.00e-06*** (1.40e-06)	-5.76e-06*** (1.27e-06)	-9.00e-06*** (1.40-e-06)
Host Dummies	Yes	Yes	Yes	Yes
Source Dummies	Yes	Yes	Yes	Yes
Observations	3819	4454	2636	3230
R2	0.79	0.79	0.70	0.79

1) All sample included, 2) Country pairs with no positive FDI flows are excluded from the sample, 3)White standard errors are reported in parentheses, 4)h-s primary/tertiary educated pop. differences were dropped from the regression due to colinearity.*) significant at 10%,**) significant at 5%,***) significant at 1%

Table 4.2: OLS Estimation (Migrants classified as being skilled/unskilled)

Dependent Variable: FDI (prices adjusted - in logs)	Full Sample [1]		Sub-Sample [2]	
	Without Exports/Imports [3] [4]	With Exports/Imports [3]	Without Exports/Imports [3] [4]	With Exports/Imports [3]
$\Delta unskilled\_mgr_{i,j,t}$ (log)	-0.068 (0.053)	-0.159*** (0.061)	-0.068 (0.052)	-0.204*** (0.052)
$\Delta skilled\_mgr_{i,j,t}$ (log)	0.346*** (0.050)	0.556*** (0.055)	0.346*** (0.049)	0.504*** (0.058)
$unskilled\_mgr_{i,j,t}$ (log)	0.231** (0.103)	-0.129* (0.117)	0.231** (0.103)	0.772*** (0.098)
$skilled\_mgr_{i,j,t}$ (log)	-0.795*** (0.118)	0.249* (0.136)	-0.795*** (0.118)	1.294*** (0.101)
$\Delta exp_{i,j,t}$ (log)	-	0.035*** (0.009)	-	0.001 (0.008)
$\Delta imp_{i,j,t}$ (log)	-	0.025*** (0.009)	-	0.011 (0.007)
$exp_{i,j,t-1}$ (log)	-	0.002 (0.006)	-	0.009** (0.004)
$imp_{i,j,t-1}$ (log)	-	-0.011* (0.006)	-	0.018*** (0.003)
Ethnic Fractionalization90 *log(Unskilled 90)	-1.37e-08*** (1.53e-08)	-3.26e-08*** (1.11e-08)	-3.94e-09 (1.17e-08)	-4.53e-09 (9.39e-08)
Ethnic Fractionalization90 *log(Unskilled 90)	-1.34e-07*** (3.98e-08)	-7.16e-08*** (1.39e-08)	-1.01e-07*** (1.48e-08)	-1.10e-07*** (1.51e-08)
Political Risk 90 *log(Unskilled 90)	-4.30e-07*** (7.88e-08)	-1.78e-07*** (5.71e-08)	-4.48e-07*** (6.24e-08)	-4.26e-07*** (6.42e-08)
Political Risk 90 *log(Unskilled 90)	-4.21e-07*** (9.99e-08)	-4.24e-08*** (1.92e-08)	-3.47e-08* (1.81e-08)	-3.65e-07*** (8.56e-08)
Corruption Risk 90 *log(Unskilled 90)	-2.48e-06*** (5.51e-07)	-8.46e-07** (3.44e-07)	-1.01e-06*** (3.27e-07)	-2.58e-06*** (3.06e-07)
Corruption Risk 90 *log(Skilled 90)	-8.00e-06*** (2.40e-06)	-3.35e-06*** (1.03e-06)	-8.31e-06*** (1.13e-06)	-8.29-06*** (1.15e-06)
Host Country Dummies	Yes	Yes	Yes	Yes
Source Country Dummies	Yes	Yes	Yes	Yes
Observations	3819	4454	2636	3230
R2	0.87	0.86	0.76	0.86

1) All sample included, 2) Country pairs with no positive FDI flows are excluded from the sample, 3) White standard errors are reported in parentheses, 4) h-s skilled/unskilled population differences were dropped due to collinearity *) significant at 10%, **) significant at 5%, ***) significant at 1%

Tables 4.3 and 4.4 depict the Tobit estimation results of equations (4.1) and (4.2) respectively. The first two columns of Table 4.3 present regression results when the censor is placed at zero, suggesting that negative FDI flows that are below the zero threshold have been reported as being equal to zero. When the trade components are excluded from the regression in column 1, merely two relationships are congruent to what should be expected from the model but as the flows of exports and imports in 1990 and over the 1990-2000 period are added, the coefficients of all but one migration variable (the coefficient on the flow of tertiary migrants) become consistent with the theory and at the same time significantly different from zero. Among these is the coefficient on the stock of secondary migrants which becomes both positive and significant reflecting an improvement over the OLS estimation results in Table 4.1. When the censor is placed at the lowest positive FDI value[35], results are less appealing – particularly when trade is controlled for – as the coefficients on the stocks of both secondary and tertiary migrants lose significance.

The Tobit estimation carried out on the skilled/unskilled classification of migrants deliver results that are in harmony with the predictions of the model, especially when it comes to the inclusion of the trade variables in the left censored regression with logged FDI observations exceeding the value of 0.1373322 (column 4 of Table 4.4). Export flows in 1990 are significant this time and positively impact FDI implying that a strong export base in 1990 acts as a stimulant for FDI, and more particularly the vertical type which is facilitated by freer trade between partners. Interaction variables continue to be negative and significant almost across the table with larger magnitudes when trade is excluded from the regression.

Econometrically, Tobit estimation suffers from some notable limitations that could be dealt with by the use of a Heckman Selection Correction model in its place. First, In Tobit estimation, the same set of variables explains both the probability that a particular observation is censored and the value of the dependent variable. Second, it does not allow for a separate empirical explanation of why the censored observation happens to be censored.

[35] In this case equal to 0.1373322

Table 4.3: Tobit Estimation (Migrants classified as having Primary/Secondary/Tertiary Education)

Dependent Variable: FDI (prices adjusted - in logs)				
	Censor at Zero		Censor @ Lowest Positive FDI Value 1)	
	Without Exports/Imports	With Exports/Imports 2)	Without Exports/Imports	With Exports/Imports 2)
$\Delta prim\_mgr_{i,j,t}$ (log)	0.161***	-0.076***	0.157***	-0.078***
	(0.043)	(0.030)	(0.043)	(0.030)
$\Delta sec\_mgr_{i,j,t}$ (log)	-0.312***	-0.242***	-0.306***	-0.239***
	(0.069)	(0.057)	(0.070)	(0.057)
$\Delta ter\_mgr_{i,j,t}$ (log)	0.355***	0.498***	0.351***	0.493***
	(0.055)	(0.057)	(0.009)	(0.057)
$prim\_mgr_{i,j,t}$ (log)	-0.014	0.392***	-0.018	0.391***
	(0.038)	(0.025)	(0.039)	(0.025)
$sec\_mgr_{i,j,t}$ (log)	-0.076***	0.328***	-0.070***	-0.325***
	(0.059)	(0.043)	(0.059)	(0.043)
$ter\_mgr_{i,j,t}$ (log)	0.0356**	0.203***	0.355***	0.201
	(0.047)	(0.045)	(0.047)	(0.045)
$\Delta exp_{i,j,t}$ (log)	-	0.036***	-	0.037***
		(0.008)		(0.008)
$\Delta imp_{i,j,t}$ (log)	-	0.034***	-	0.034***
		(0.008)		(0.008)
$exp_{i,j,t-1}$ (log)	-	0.004	-	0.004
		(0.005)		(0.005)
$imp_{i,j,t-1}$ (log)		0.007*	-	0.007*
		(0.004)		(0.004)
Ethnic_frac90	-2.78e-08**	-1.37e-08	-3.27e-08***	-1.39e-08
*log(primary_90)	(1.44e-08)	(1.51E-08)	(1.55e-08)	(1.51e-8)
Ethnic_frac90	-7.10e-08**	1.34e-07***	-1.85e-07***	-1.36e-07***
*log(secondary_90)	(3.71e-08)	(3.94)	(3.60e-08)	(3.95e-08)
Ethnic_frac90	-5.25e-08***	-9.23e-08***	-9.74e-08***	-9.31e-08***
*log(tertiary_90)	(2.05e-08)	(2.20e-08)	(1.88e-08)	(2.20e-08)
Political_Index90	-4.79e-08*	-4.30e-07***	-5.09e-07***	-4.33e-07***
*log(primary_90)	(2.90e-08)	(7.81e-08)	(7.02e-08)	(7.82e-08)
Political_Index90	-2.86e-07***	-4.21e-07***	-4.25e-07***	-4.24e-07***
*log(secondary_90)	(9.65e-08)	(9.89e-08)	(9.64e-08)	(9.9e-08)
Political_Index90	-5.25e-08***	-1.06e-07***	-5.09e-07***	-1.07e-07***
*log(tertiary_90)	(2.05e-08)	(3.05e-08)	(7.02e-08)	3.06e-08
Corruption_index90	-7.21e-07	-2.48e-06***	-2.15e-06**	-2.49e-06***
*log(primary_90)	(5.23e-07)	(5.45e-07)	(1.01e-06)	(5.47e-07)
Corruption_index90	-5.43e-06***	-8.00e-06***	-7.50e-06***	-8.47e-06***
*log(secondary_90)	(1.75e-06)	(1.38e-06)	(1.80e-06)	(1.80e-06)
Corruption_index90	-5.08e-06***	-0.050***	-9.46e-06**	-8.04e-06***
*log(tertiary_90)	(1.33e-06)	(0.008)	(1.25e-06)	(1.39e-06)
Host Dummies	Yes	Yes	Yes	Yes
Source Dummies	Yes	No	Yes	Yes
Observations	3819	4454	3819	4454

Censor equal to the log value of the lowest positive FDI flow (= 0.137), 2) h-s skilled/unskilled population differences dropped due to collinearity *) significant at 10%, **) significant at 5%, ***) significant at 1%

Table 4.4: Tobit Estimation (Migrants classified as being skilled/unskilled)

Dependent Variable: FDI (prices adjusted - in logs)				
	Censor at Zero		Censor @ Lowest Positive FDI Value [1)]	
	Without Exports/Imports	With Exports/Imports [2)]	Without Exports/Imports	With Exports/Imports [2)]
$\Delta unskilled\_mgr_{i,j,t}$ (log)	-0.111** (0.048)	-0.322*** (0.489)	-0.004 (0.045)	-0.323*** (0.049)
$\Delta skilled\_mgr_{i,j,t}$ (log)	0.483*** (0.051)	0.623*** (0.049)	0.252*** (0.047)	0.619*** (0.049)
$unskilled\_mgr_{i,j,t}$ (log)	-0.120 (0.114)	0.333*** (0.095)	0.395*** (0.096)	0.336*** (0.095)
$skilled\_mgr_{i,j,t}$ (log)	0.462*** (0.045)	0.162*** (0.039)	0.146*** (0.042)	0.160*** (0.039)
$\Delta exp_{i,j,t}$ (log)	-	0.031*** (0.008)	-	0.032*** (0.008)
$\Delta imp_{i,j,t}$ (log)	-	0.028*** (0.008)	-	0.028*** (0.008)
$exp_{i,j,t-1}$ (log)	-	0.011** (0.005)	-	0.011** (0.005)
$imp_{i,j,t-1}$ (log)	-	0.002 (0.003)	-	0.002 (0.003)
Ethnic Fractionalization90 *log(Unskilled 90)	-3.28e-08** (1.42e-08)	-1.83e-08 (1.48e-08)	0.003 (0.007)	-1.85e-08*** (1.48e-08)
Ethnic Fractionalization90 *log(Unskilled 90)	-6.61e-08*** (2.03e-08)	-1.12e-07*** (2.16e-08)	-0.001 (0.008)	-1.13e-07*** (2.16e-08)
Political Risk 90 *log(Unskilled 90)	-2.18e-07*** (7.46e-08)	-3.20e-07*** (7.67e-08)	-0.032*** (0.006)	-3.22e-07*** (7.69e-08)
Political Risk 90 *log(Unskilled 90)	-2.24e-07** (9.68e-08)	-1.14e-07*** (3.00e-08)	0.226 (0.049)	-1.15e-07*** (3.00e-08)
Corruption Risk 90 *log(Unskilled 90)	-8.41e-07 (5.18e-07)	-3.21e-07*** (7.67e-08)	0.006 (0.344)	-2.79e-06*** (5.38e-07)
Corruption Risk 90 *log(Skilled 90)	-4.20e-06*** (1.33e-06)	-5.63e-06*** (1.36e-06)	-0.002* (0.001)	-5.67e-06*** (1.37e-06)
Host Country Dummies	Yes	Yes	Yes	Yes
Source Country Dummies	Yes	Yes	Yes	Yes
Observations	3819	4454	3819	4454

1) Censor is equal to the log of value of the lowest positive FDI flow (= 0.1373322), 2) h-s skilled/unskilled population differences were dropped due to collinearity *) significant at 10%, **) significant at 5%, ***) significant at 1%

The Heckman Selection Model addresses these restrictions by allowing for different sets of variables to separately explain the value of the dependent variable, represented here by the intensity of FDI flows, and the probability of censoring or the choice to engage in positive FDI flows, hence overcoming the above mentioned shortcomings. In this chapter, I employ an overlapping set of variables to explain both the intensiveness and extensiveness of FDI flows, adding however one exclusion restriction represented by the dummy variable, $D_{i,j,t-1}$, for the existence of positive FDI over the 1980-1990 period.

Tables 4.5 and 4.6 convey the results of the Heckman Sample Selection estimation of equations (4.3) and (4.4). The first two columns of Table 4.5 show the results for the outcome and selection equation, respectively, when trade is not controlled for. The Likelihood Ratio test for independent equations is carried on both regressions of Table 4.5. Results reveal that both ρ 's are significantly different from zero at the 1% significance level, hence, leading to the rejection of the hypothesis that there is no correlation between the two error terms from the investment decision and the investment intensity equations. This gives further credibility to the relevance of the Heckman selection model and provides evidence to the existence of fixed set-up costs for FDI. Moreover, considering that above-average set up costs come as a result of relatively high productivity levels in the FDI receiving country (like in Razin et. al, 2005), a negative ρ would be in concordance with the notion that below-average likelihood of non-zero exports of FDI (due to relatively high setup costs) is associated with above-average inflows of FDI (due to an above average productivity of capital).

The ρ in both regressions of Table 4.5 are close to 1 signalling the suitability of a Heckman Two Step procedure over Heckman ML estimation in handling the estimation better[36]. Furthermore, the estimated coefficient on the the Inverse Mills Ratio confirms the presence of sample selection bias as it is significant in both regressions at the 1% level. The negative coefficient on the inverse mills ratio unveils the presence of unobserved variables increasing the probability of a lower than average score on the dependent variable.

In column 1 of Table 4.5, estimation results reveal no evidence for both the complementarity and substitutability relations that are to be expected from the model respectively between the

[36] Based on a comment made by Dr. David Greenberg, Sociology Department, New York University on STATA listserver.

stock and flow of tertiary educated migrants on one hand and FDI on the other. The selection equation in column 2, however, proposes that the stock of tertiary educated migrants positively influences the decision to invest in the Migrants' source countries. The coefficients on both the stocks of primary and secondary migrants in 1990, however, seem to have counter-expected, negative and significant coefficients. Columns 3 and 4 of Table 4.5 show the Heckman Selection Estimation results when the trade components are included in both the outcome and selection equations. Controlling for trade renders the parameters on both the flow of tertiary educated migrants and the stock of secondary educated migrants in line with the model's predictions. The results for the selection equation with regards to the stock of primary and secondary educated stocks of migrants do not change in the sense that both have negative coefficients that are significantly different from zero. Import flows over the 1990-2000 period and in 1990 are proven to have a positive and significant effect on the intensive margin (the outcome equation) and no significant effect on the extensive margin (the selection equation). A 1% increase in export flows over the 1990-2000 from FDI host to source is expected to lead to a 0.03% increase in FDI flows in the opposite direction.

The last table most prominently reveals the benefits of controlling for both trade and fixed costs (sample selection issues) when migrants are classified as either skilled or unskilled. Both ρ and the coefficient on the Inverse Mills Ratio are negative and significant at the 1% level, confirming the interdependence between the residuals of the decision and outcome equations. The substitutability relationship between the flow of skilled migrants and the 1990-2000 flow of FDI finally materializes in column 3 as a positive and significant coefficient emerges in the flow equation. A 1% increase in the flow of skilled migrants in one direction is expected to yield around a 1.6% reduction in the intensity of FDI in the opposite direction. Additionally, both the stocks of skilled and unskilled migrants assume the role of catalysts for prospective FDI flows.

Table 4.5: Heckman Estimation (Migrants classified as with primary/secondary/tertiary education) [1)]

Dependent Variable: FDI (prices adjusted - in logs)

	Without Exports/Imports		**With Exports/Imports**	
	Flow Equation	Selection Equation	Flow Equation	Selection Equation
$\Delta prim\_mgr_{i,j,t}$ (log)	0.178*** (0.052)	-	0.161* (0.070)	-
$\Delta sec\_mgr_{i,j,t}$ (log)	-0.341*** (0.097)	-	-0.410*** (0.129)	-
$\Delta ter\_mgr_{i,j,t}$ (log)	0.286*** (0.076)	-	-0.797*** (0.185)	-
$prim\_mgr_{i,j,t}$ (log)	0.618*** (0.142)	-0.518* (0.294)	0.614*** (0.142)	-0.334* (0.194)
$sec\_mgr_{i,j,t}$ (log)	-0.631*** (0.229)	-1.230** (0.523)	0.560*** (0.087)	-0.325** (0.157)
$ter\_mgr_{i,j,t}$ (log)	0.065 (0.176)	1.852*** (0.348)	-0.183 (0.111)	0.671*** (0.262)
$\Delta exp_{i,j,t}$ (log)	-	-	0.012 (0.018)	-
$\Delta imp_{i,j,t}$ (log)	-	-	0.034** (0.017)	-
$exp_{i,j,t-1}$ (log)	-	-	0.094** (0.038)	0.073 (0.056)
$imp_{i,j,t-1}$ (log)	-	-	0.046 (0.036)	-0.012 (0.051)
Ethnic_frac90 *log(primary_90)	-0.002*** (0.0007)	0.008*** (0.002)	-2.94e-08** (1.54e-08)	-8.93e-07*** (2.81e-07)
Ethnic_frac90 *log(secondary_90)	0.001 (0.001)	-0.010*** (0.003)	1.78e-07 (3.62e-08)	-4.21e-06*** (6.81e-07)
Ethnic_frac90 *log(tertiary_90)	-0.0001*** (0.001)	-0.0001*** (0.002)	-1.05e-07*** (1.89e-08)	-5.68e-07*** (2.24e-07)
Political_Index90 *log(primary_90)	-0.012*** (0.003)	0.015*** (0.005)	-4.96e-07*** (7.05e-08)	-3.68e-06*** (2.28e-06)
Political_Index90 *log(secondary_90)	0.002 (0.004)	0.011*** (0.009)	-4.34e-07*** (9.78e-08)	-7.95e-06*** (1.71e-06)
Political_Index90 *log(tertiary_90)	0.010*** (0.003)	-0.018*** (0.006)	-1.37e-07*** (5.02e-08)	-4.09e-06*** (9.06e-07)
Corruption_index90 *log(primary_90)	0.059** (0.024)	-0.188*** (0.063)	-3.09e-06*** (1.02e-06)	-0.0001*** (0.00002)
Corruption_index90 *log(secondary_90)	0.199** (0.043)	-0.016*** (0.104)	7.85e-06*** (1.82e-06)	-0.0001*** (0.00002)
Corruption_index90 *log(tertiary_90)	-0.214*** (0.036)	0.132* (0.070)	-9.10e-06*** (1.26e-06)	0.00007*** (0.00001)
Positive FDI flow in 1980-1990 (=1 if Yes)	-	0.435*** (0.069)	-	0.106*** (0.001)
Host Country Dummies	Yes	No	Yes	No
Source Country Dummies	Yes	Yes	Yes	Yes
Inverse Mills Ratio	-0.670***	(0.090)	-0.632***	(0.092)
Rho	-0.819***	(0.078)	-0.780***	(0.073)

1) The exclusion restrictions used for the selection equation is the dummy for positive FDI flows in 1980 *) significant at 10%, **) significant at 5%, ***) significant at 1%

Table 4.6: Heckman Estimation (Migrants classified as being skilled/unskilled) [1)]

Dependent Variable: FDI (prices adjusted - in logs)	Without Exports/Imports		With Exports/Imports	
	Flow Equation	Selection Equation	Flow Equation	Selection Equation
$\Delta unskilled\_mgr_{i,j,t}$ (log)	0.0003 (0.069)	-	0.107 (0.365)	-
$\Delta skilled\_mgr_{i,j,t}$ (log)	0.389*** (0.075)	-	-1.609*** (0.370)	-
$unskilled\_mgr_{i,j,t-1}$ (log)	0.317* (0.182)	3.595*** (0.664)	1.142*** (0.269)	-1.871 (1.605)
$skilled\_mgr_{i,j,t-1}$ (log)	0.124 (0.159)	-1.636*** (0.548)	1.125*** (0.210)	2.040*** (0.430)
$\Delta exp_{i,j,t}$ (log)	-	-	0.070*** (0.024)	-
$\Delta imp_{i,j,t}$ (log)	-	-	0.017 (0.023)	-
$exp_{i,j,t-1}$ (log)	-	-	0.133*** (0.052)	0.098*** (0.002)
$imp_{i,j,t-1}$ (log)	-	-	0.023 (0.050)	0.096*** (0.032)
Ethnic Fractionalization90 *log(Unskilled 90)	0.002* (0.001)	-0.011*** (0.004)	-0.005*** (0.001)	-0.005*** (0.002)
Ethnic Fractionalization90 *log(Unskilled 90)	-0.002** (0.0009)	0.010*** (0.003)	-0.004*** (0.001)	-0.006*** (0.002)
Political Risk 90 *log(Unskilled 90)	-0.009*** (0.003)	-0.012*** (0.011)	-0.017*** (0.004)	-0.033*** (0.005)
Political Risk 90 *log(Unskilled 90)	-0.006** (0.003)	-0.011 (0.009)	-0.011*** (0.003)	-0.023*** (0.005)
Corruption Risk 90 *log(Unskilled 90)	0.108*** (0.034)	-0.773*** (0.137)	-0.193*** (0.044)	-0.309*** (0.060)
Corruption Risk 90 *log(Skilled 90)	-0.089*** (0.029)	0.772*** (0.119)	-0.176*** (0.037)	-0.199*** (0.062)
Positive FDI flow in 1980-1990 (=1 if Yes)	-	0.422*** (0.093)	-	0.447*** (0.087)
Host Country Dummies	Yes	No	Yes	No
Source Country Dummies	Yes	Yes	Yes	Yes
Inverse Mills Ratio	-0.998*** (0.103)		-0.956*** (0.093)	
Rho	-1*** (0.095)		-0.931*** (0.078)	

1) The exclusion restrictions used for the selection equation is the dummy for positive FDI flows in 1980 *) significant at 10%, **) significant at 5%, ***) significant at 1%

The way to interpret the coefficients on the variables appearing in both the outcome and selection equation is unlike the interpretation of the coefficients on those variables that uniquely appear in the flow equation since the marginal effect of the former on the dependent variable in the outcome equation is affected by their presence in the first step Probit equation[37]. A 1% increase in the stocks of skilled and unskilled migrants implies a 1.02% subsequent increase in the flow of FDI. On the other hand, a 1% rise in the stock of skilled migrants will, however, result in 2.04% increase in the standard deviation of the predicted probability for positive FDI. The coefficients on both export and import flows are positively signed and statistically significant signalling the importance of trade in determining the selection of commodity trading partners into FDI trading ones.

Lastly, it is observed that the coefficients on the interaction variables are larger in magnitude compared to the ones in the previous tables, while still conforming to the concept that greater political, corruption and ethnic fractionalization rates reduces the positive networking impact of existing migrants. From columns 3, an increase by one point ethnic fractionalization in the FDI host country would yield to a decrease in the positive, networking effect of unskilled and skilled migrants on FDI flow intensity by 0.5% and 0.4% respectively. On the other hand that same negative externality would decrease the positive impact of migrants in influencing the decision of entrepreneurs from i to invest in j by 0.5% for unskilled migrants and 0.6% for the skilled ones.

4.6 Concluding Remarks

[37] The method to follow is that of Sigelman and Zeng (2000), where I compute the average of:

$$\frac{\partial E(Y / z^* > 0, x)}{\partial x_k} = \beta_k - \alpha_k \rho \sigma_u \delta(\alpha)$$

where Y is the dependent variable in the outcome equation, z^* is binary dependent variable in the selection equation, x_k is the k^{th} independent variable, β_k is the coefficient on x_k in the outcome equation, α_k is the coefficient on x_k in the selection equation, σ_u is the variance of the error from the outcome regression, and ρ is the correlation coefficient between the errors from the selection and outcome regressions. $\delta(\alpha)$ is function of α and is given by

$$\delta(\alpha) = \textit{inverse Mills ratio} * (\textit{inverse Mills ratio} + \textit{selection prediction}(\alpha))$$

Chapter 4 aims at determining the linkages between migration and FDI when trade in commodities is controlled for. It employs three estimation techniques – OLS, Tobit and Heckman Selection- to find the most appropriate method to explain FDI using both migration and trade variables while overcoming the econometric challenges in the way.

It was found that excluding the trade variables from the regression renders the migration-FDI relationship less adherent to the predictions of the model even though Kulger and Rapoport's (2005) model as such does not account for the trade components.

Results also show that Tobit and Heckman estimation methods are more suitable for underpinning the nature of the linkages between labour and capital flows as they respectively solve for censoring and endogenous selection in the reporting of the FDI data. Empirical findings detect the presence of a negative correlation between the likelihood to invest and the intensity of capital flows giving more credibility to Heckman estimation as a cure for the endogenous selection of country pairs into trading partners. Also, when Heckman Selection estimation is employed, Migration-FDI relationships converge to those predicted from the Kugler & Rapoport (2005) model. This become further pronounced when migrants are broadly classified as either skilled or unskilled.

Poor political and corruption indices as well as increased ethnic fractionalization dampen the positive effect of existing migrants. Their effect is more substantial when Heckman Selection estimation is used. Lastly, export and import flows in 1990 are shown to influence the choice to invest in the migrants' source countries as well as the flow intensity of exports over the 1990-2000 period signalling that the vertical type of FDI is more prevalent in the sample.

Chapter 5

Summary and Conclusion

This thesis has presented novel findings in three main International Trade areas that could be classified under the following three main headings: 1) the Theory and Predictions of Trade Gravity Models, 2) Maritime Transportation and Trade, and 3) The linkages between Factor Flows and Commodity Trade.

The Gravity model has been used extensively in International Trade studies in order to estimate or predict levels of commodity exchanges between countries. Believed to follow the same principles as Newton's Gravity Law of Gravitational Relativity whereby the physical attraction between two objects depends on their respective masses and the distance that separates them, the Gravity Model predicts that trade volumes between two countries is proportional to each of the countries' sizes, measured by GDP, and inversely related to the physical distance separating their capitals. No theoretical grounds were initially introduced on which to base the empirical success of the Trade Gravity Model. It has been proven that it works extremely well when applied to both developing and developed countries alike (Hummels and Levinshon). Anderson (1979) pioneered the first formal derivations of the model assuming products are differentiated based on their country-of-origin. Later, Helpman and Krugman (1985), Bergstrand (1990), Leamer (1992) and Eaton and Kortum (1997) produced a series of papers discussing the theoretical derivation of the Model using both monopolistic competition at the industry level and increasing returns to scale at the form level. A common result brought about by these assumptions is the perfect specialization in production and exports in and by each country. This outcome was necessary for a Gravity Model to emerge as the pattern of trade in a multi-country world was clearly defined.

Chapter 2 responds to the several critiques raised by Evenett and Keller (1998), Feenstra, Markusen and Rose (1998) and Haveman and Hummels (2004) where the need was voiced for a stylized Gravity Model that could accommodate the particular nature of the South-North type of trade. Chapter 2 develops a Gravity Model out of neoclassical Hecksher-Ohlin (H-O) assumptions of perfect competition and constant returns to scale at the local production level. It, however, posits that countries do not perfectly specialize in the production of their exportable commodity like a classical H-O model would predict as they are sufficiently similar in their relative factor endowments. Also, assumptions of Factor Price Equalization, cross-country equal technology and trade barrier-free world are relaxed. The pattern of trade and the determination of export specialization in this none-frictionless, multi-country, multi-product, multi-factor world are determined by countries' relative endowment and technological comparative advantage a La Deardorff (1982).

For simplicity purposes, the extreme case is considered when all goods are produced by all countries and that commodities are differentiated according to the Armington assumption of country-of-origin based differentiation. Every country will specialise in exporting the commodity which, on average, uses relatively more intensively those factors, present in relative abundance. Technological differences across countries and transportation costs are introduced into the model to cast away Factor Price Equalization (FPE) across countries.

There are three main findings reached in Chapter 2 and they mainly relate to the predictions of the Gravity Model when it is aimed at testing exports originating from South countries and heading to the developed North, particularly when production is not perfectly specialized. First, the model predicts that South-North exports are more dependent on the importing country's size than they are on that of the exporting country confirming previous empirical results on the estimation of Gravity Models applied to exports from developing to developed countries. Previous theoretical derivations of the model have so far predicted unitary elasticities of trade vis-à-vis the sizes of the two trading partners. The latter has been criticized in Feenstra, Markusen and Rose (1998) and in Haveman and Hummels (2004) as leading to erroneous predictions and contradicting with empirical results. This finding suggests that the intensity of South-North exports is more sensitive to the importing country's absorptive capacity for foreign produced commodities directly competing with home produced goods rather than then ability of the South exporter to produce more of his exportable speciality. Moreover, the model predicts that both elasticities are strictly less than one. Fixed Effects panel estimation results are in concordance with both predictions but yield an insignificant coefficient on the exporter's GDP indicating its weak influence on export volumes the variation of which in the export country is picked up by the exporter-specific effects.

The second finding of the chapter relates to the coefficient on the transportation cost variable which is equal to 1 like in the standard gravity and those that are derived from different sets of assumptions. When the specification of the obtained model is put though empirical testing using panel techniques, results reveal that export elasticity relative to distance is greater than one, signalling the non-linear relationship linking transportation costs and distance and phasing in the need to incorporate other trade discouraging barriers that negatively influence transportation costs in the Gravity Model.

Thirdly, the model provides the first theoretical back up for the influence of general consumer preferences and technological achievement in the exporting country on the size of South-North exports. From the empirical results, general consumer preferences seem to have a positive and robust effect on export flows. The price variable was instrumented by the exporting country's productivity level in order to better proxy the technological effect on exports. The coefficient on price variable lost significance as commodity-specific effects were entered into the Fixed Effects regression, accounting maybe for the explanatory power of technology.

The work on this chapter could be extended to include additional countries that display South-North trading relationships into the sample, which currently focuses on exports flowing to the EU15 members from their eastern and southern neighbours. In future work, the sample should be enlarged to include, for example, Latin and North American countries along with Middle East or North African (MENA) states. This would aim at generalizing the empirical findings of Chapter 2 and give more credibility to the model's prediction beyond the possible particularities of European trade. As results might be influenced by a stage of exporting effect that may be associated with the start of new trade arrangements for both the Maghreb and CEECs with the EU), data for longer periods should be explored. Furthermore, work extensions would only focus on testing the model's predictions by exclusively looking at products in the manufacturing sector as it is prone to reflect differentiated commodities traded between South-North countries. As in Helpman, Melitz and Rubenstein (2006), regressions should be repeated to test for possible sample selection in the Export volume variable as zero flows are none random and should be separately explained.

Chapter 3 looks into the determinants of bilateral maritime transportation costs between three Maghreb countries (Morocco, Tunisia and Algeria) and the members of the EU15. It aims at quantifying the influence of bad infrastructure at the seaport level in those three countries on the general volume of Maghreb-EU15 exports, on increased trade as a result of trade creation post Euro-Med or as result of trade diversion away from third countries. It also looks at the effect of maritime transportation costs in hindering actual exports from reaching their potential. Average trade with the EU15 represents over 70% of those countries' total trade with the world. However, Al-Atrash and Yousef (2000) and Miniesy, Nugent and Yousef (2004) show that Maghreb intra-regional trade and trade with the EU15 states is far from reaching its potential even after the signature of the Euro-Med Association Agreements aiming at rendering the Mediterranean basin a tariff-free zone.

Hence, motivated by the work performed by Fink, Mattoo and Neagu (2002) and that by Clark, Dollar and Micco (2004), Chapter 3 sets out to analyze the hindering effects of Maghreb-specific inefficiency at the seaport level on trade by first, looking at their explanatory power with respect to total maritime transportation charges, deriving a country-specific maritime transportation index that could be later used for studying their consecutive effect on increased trade with the EU15 or actual-potential export gap, when CEEC-EU15 trade is taken as a benchmark. It challenges empirical findings forwarded by Kandogan (2005) on the effect of transportation costs, in general, on the materialization of free trade agreements signed between partners. Kandogan (2005) proxies transportation costs by distance and disregards the costs incurred at the port of loading. He reaches the conclusion that distance negatively affects "naturalness" and that it may have a deterring role in discouraging "complementary" trading partners from engaging into mutually beneficial free trade agreements.

It has been shown in Chapter 2 that transportation costs should not be exclusively represented by distance as the coefficient on the distance variable is not unitary elastic as it could be expected from South-North Gravity Equation (2.34). Hence, the effect of distance on increased trade might not entirely capture the influence of transportation costs, specifically in the country sample under review where distances do not vary much across trading pairs. The maritime journey of goods and the costs involved are driven by the inefficient operations at the sea-port level, which phases in the need to account for those costs when studying the effect of transportation charges on trade effects in the Mediterranean. Chapter 3, hence, represents the first study analyzing port-related maritime transportation costs between the Maghreb and their most important trading partners: the countries of the EU15.

Chapter 3 reaches three important empirical findings: First, the effect of port inefficiency is shown to negatively impact total maritime charges, especially when other bilateral, exporter and importer-specific variables are controlled for. This effect is however mildly significant at the 10% level. A 1% (or 1 point) deterioration in the port efficiency index leads to a little more than a 4% increase in bilateral maritime transportation costs when both Clark, Dollar and Micco's (2004) port efficiency proxies are used. This impact is reduced to 2% when GDP per Capita is used to proxy port efficiency.

Second, when an exporter-specific maritime transportation cost index is produced for each of three Maghreb countries over the 1997-2001 period and included as determinant for bilateral transportation costs between along with distance, results show a negative and significant effect of Maghreb-specific maritime transportation costs on the intensity of South-North exports to the EU15. More precisely, a 1% increase in those costs leads to around 0.18% reduction in export intensity when Proxies I and II while that same increase would cause exports to decrease by only 0.002% when GDP per Capita is used to proxy port efficiency.

Third, port-related maritime transportation costs are proved to have a more significant impact of on increased trade than does distance even with the inclusion of time, exporter, importer, bilateral and commodity-specific effects. The elasticity, however small, is negatively signed and variations in both distance and that Maghreb-specific maritime index explain around 36% of the total variation in the increased trade effects. On other hand, these indices are shown to have a greater impact on trade diversion particularly when Proxies I and II for Maghreb port efficiency. Those indices, alone, explain around 83% of the variation in potential-to-actual Maghreb-EU15 export flows.

Finally, a by-sector analysis shows that the three sectors, Fishing, Agriculture and Manufacturing, are the most to be affected by inefficient infrastructure and operations at the seaport level. The impact is however smaller than that of distance which almost uniquely hinders actual exports from both, the Electricity & Gas and Mining sectors, from reaching their potential level when CEEC-EU15 trade is taken as a benchmark. An important implication, drawn from this empirical finding, stresses the need for those countries to focus on rendering their maritime hubs more competitive, in congruence with the free trade agreements being signed with their EU counterparts. The fact that port inefficiencies had a negative and significant impact on Mghreb-EU15 exports on the relatively liberalized manufacturing sector emphasizes the latter point.

Chapter 3 could be extended by looking at the effect of exporter-lead maritime transportation costs on the selection of country pairs into trading partners. This could be done by performing Heckman Sample Selection estimation on the gravity models used to determine trade effects and actual-potential export ratios.

The linkages between migration, investment and trade (MIT) have attracted a great deal of interest from economic researchers who have essentially centred their investigation on how these factors interact in pairs. Labour and capital movements are theoretically anticipated to flow in opposite directions as part of the efficient factor allocation between countries of different relative abundances in capital and labour. This type of argument was mainly behind the increasing worry that migrants, and particularly those with advanced education, could substitute for investment flows as a result of a reduction in the required human capital stock. Nonetheless, the growing "network" literature presents evidence to the contrary, highlighting the benefits migrants bring to their countries in terms of increased FDI flows from their host countries as they establish a network serving the needs of prospective investors in the form of increased information and stronger links for more efficient business transactions: distribution, procurement, laws and regulations...etc. It is through this mechanism that migration could be seen as complementing FDI. The links between FDI and trade are more easily predicted, given the type of FDI under examination. Vertical FDI is anticipated to increase bilateral trade between source and host countries due to the fragmentation of the production process. Bilateral trade is, however, anticipated to decrease when tariff-jumping horizontal FDI is prevalent.

Econometric concerns relating to omitted bias and endogeneity issues call for the need to look at the manner in which any two components of the MIT relationship interact when the remaining factor is controlled for. This fact has been outlined in two exclusive studies by Faini (2004) and Chong (2006) where a joint analysis of migration, FDI and trade was conducted in a single setting: Faini (2004) was more intuitive in his analysis whereas Chong (2006) looked at partial correlations between the three components.

To compare the results obtained when Migration, FDI and Trade are analyzed in one setting, Chapter 4 adopts the model developed by Kugler and Rapoport (2005) as a benchmark. The model considers a small and developing economy experiencing perfect mobility of capital but imperfect mobility of labour due to the presence of migration constraints. The model predicts a relationship of dynamic complementarity and of contemporaneous substitutability between skilled migration and FDI when expectations are adaptive. When expectations are rational, however, a dynamic positive relationship is expected between both skilled and unskilled migration, on one side, and FDI on the other.

Using the specification in Kugler and Rapoport (2005), and phasing in commodity export and import flows, I apply three different estimation techniques to study the effect of skilled and unskilled migration on FDI flows while controlling for trade. The benchmark being simple OLS estimation which ignores FDI censoring and the existence of set-up costs, I compare the latter with the empirical results obtained via Tobit estimation that handles the occurrence of errors in the reporting of FDI flows and with those obtained from Heckman selection estimation that deals with the selection of country pairs with positive FDI.

From the empirical results, Chapter 4 leads to the following findings: First, the omission of the trade variables from the regression renders the migration-FDI linkages less adherent to the predictions of the model albeit the model per-se does not account for the trade components. Indeed, it was observed that, upon the inclusion of exports and imports, more variables gain significance while relationships become more congruent to what could be expected from the model. This could be due to the fact that failing to control for trade might result in the coefficient for migration picking up some of the influence of trade on FDI or getting negatively influenced (via the classical trade theory or when migration is of the skilled type) or positively affected (if migration is of the unskilled type) by trade.

Results also show that OLS estimation yields weak results in terms of their degree of adherence to the model's general findings whilst both censoring and endogenous selection are ignored. Hence, empirical findings may lead to erroneous inferences as to the relationship between migration flows and FDI flows. Tobit and Heckman techniques serve better the purposes of detecting the underlying pattern between labour and capital flows as they respectively solve for censoring or endogenous selection in the reporting of the FDI data. The presence of negative correlation between the likelihood to invest and the intensity of capital flows suggests that ignoring the endogenous selection of countries into FDI trading pairs would yield biased estimates even if leftward censoring is dealt with via Tobit estimation. As estimated relationships between migration and FDI are handled through Heckman Selection estimation, linkages converge to those predicted from the Kugler & Rapoport (2005) model. Therefore, Migration-FDI liaisons developed by the model, particulary when migrants are broadly classified as skilled/unskilled are preserved when trade is controlled for.

Lastly, export and import flows in 1990 are shown to be among the main determinants of the choice to invest in migrants' source countries as it helps overcoming FDI-host market-related information barriers. Results also show that increased exports over the 1990-2000 period is an indicator of more intense FDI flows, the fact that signals the dominance of the vertical type of FDI in the sample.

The main implication of Chapter 4's findings reflects on the way migration policies should be developed and that is by looking at the simultaneous and dynamic interactions between the three components in the Migration, Investment and Trade (MIT) relationship. These results give more credibility to Faini's (2004) critique on the process of policy shaping based on pair-wise analyses. In addition, the study introduces the proper empirical methods to overcome econometric challenges encountered in similar studies.

Prospective work on this subject is envisaged to tackle the effect of migration on FDI when trade in both commodities and services is incorporated into the regression. This would serve the interest of finding out how FDI could be affected by the outsourcing of individuals delivering a particular service in the FDI source country and their specific impact on both the decision to engage in FDI export and on its intensity in their home country. Another area of potential research might involve WTO's newly introduced Mode 4, which is a sub-category of trade in services and which comprises those individuals who temporarily migrate to engage in job activities that take advantage of their specialized skills. Also, extended work would look at the alternative grouping of migrants into the broader categories of those who are skilled or unskilled whereby unskilled migrants encompass only those individuals who have primary education whereas individuals with either secondary or tertiary education would be considered as falling under the skilled category. This grouping method would be of particular interest when North-South FDI is studied as it may better reflect the status of individuals considered as skilled in the developing South and their effect on inward FDI to their home country, particularly when the percentage of individuals with tertiary education is relatively low.

Appendices

Appendix 2.1: Summary Statistics

FDI and Migrants Composition by Education: Stocks and Flows				
VARIABLE	**MEAN**	**DEVIATION**	**MINIMUM**	**MAXIMUM**
EXP_{ij}	11.852	2.952393	6.216606	21.863
GDP_i	23.13238	1.377083	19.7174	25.40501
GDP_j	26.6986	1.110085	23.60267	28.35181
$Price_k$	4.7634225	1.820834	0.149313	11.26516
$cons\_weight_k$	4.7557382	1.75345	2.603399	10.0101
Labour $Prod_i$	5.506225	3.400213	0.459023	14.25432
$distance_{ij}$	4.864766	1.157693	0.100674	6.13316

Definitions: EXP_{ij} is the log of exports from *i* to *j*. GDP_i is the GDP in country *i*. GDP_j is the log of GDP in country *j*, $Price_k$ is the log of the price of *k* expressed in f.o.b terms. $cons\_weight_k$ is the weight of *k* in world consumption. Labour $Prod_i$ is the labour productivity in country *i*. $distance_{ij}$ is the great circle distance between *i* and *j*'s capitals.

Appendix 2.2: The Grubel-Lloyd Index for the Maghreb and CEEC countries

The Grubel-Lyod Index was computed for bilateral trade between the Maghreb and the EU-15 countries to detect whether trade between them can be categorized as North-South trade. The index normally ranges between 0 and 1 with larger values indicating a greater level of trade in products of the same industry. If every product, k, is either exported or imported between any two countries, then, the associated Grubel-Lloyd Index will have a 0 value. If however a country exports and imports all goods with its partner(s), then Grubel-Lloyd Index with would be equal to 1. The year 2003 is selected to calculate the index since it had the most recent available data. The level of product desegregation was set to be matching with the one used in Evenett and Keller's (1998) 4-digit SITC-Rev3 level. The adjusted index of intra-industry trade (Greenaway and Milner, 1983), GL^{ij}, is computed and defined as follows:

$$GL^{ij} = 1 - \left[\frac{\sum_k \left| \text{Exp}_k^{ij} - \text{Imp}_k^{ij} \right|}{\sum_k \left(\text{Exp}_k^{ij} + \text{Imp}_k^{ij} \right)} \right], \qquad 0 \le GL^{ij} \le 1$$

Results:

1- All the bilateral indices are positive. The Grubel-Lloyd index for the two couples (Algeria-Luxembourg) and (Tunisia-Luxembourg) is equal to zero since the Luxembourg does not import any product from both Algeria and Tunisia in 2003.

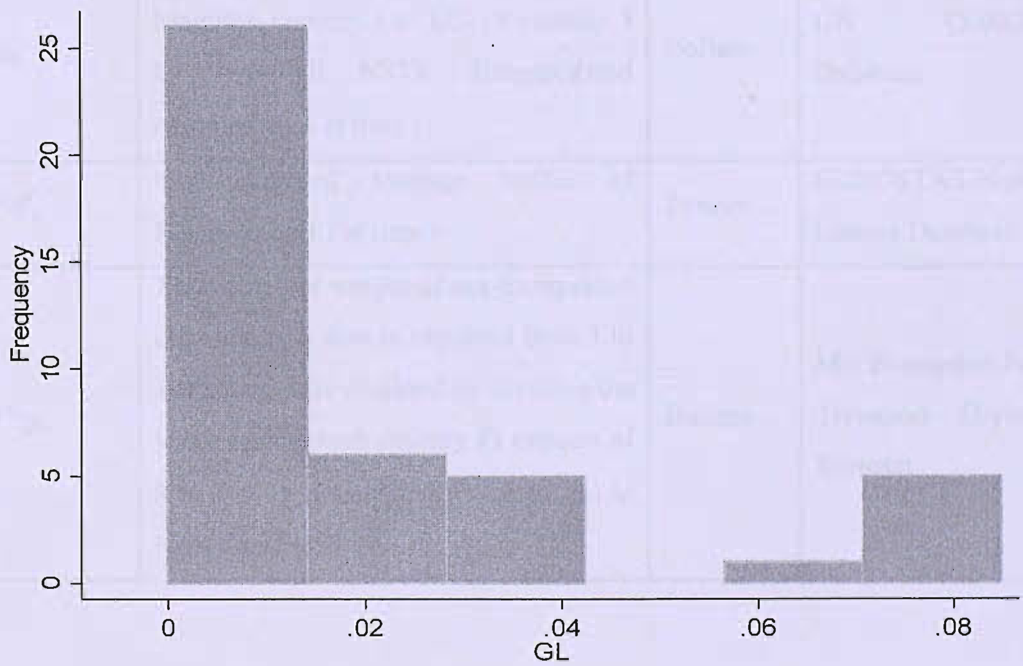
2- The distribution of the bilateral Grubel-Llyod indices is very skewed with around 86% of the observations lying below Evenett and Keller's critical value of 0.05 (more than 60% of the observations are below 0.01)

3- It was observed that only 6 out of the 43 (or 14% of the observations) bilateral Grubel-Llyod indices were greater than 0.05 and these relate to the following country couples:
   a- Morocco-Portugal
   b- Morocco-Spain
   c- Morocco-Italy
   d- Morocco- UK
   e- Tunisia- France
   f- Tunisia- Italy

Figure 1.1: Distribution of the Grubel-Lloyd Index for the Maghreb Countries (Table)

	Grubel-Llyod Index			
	Percentiles	Smallest		
1%	0	0		
5%	2.03e-06	0		
10%	.0000353	2.03e-06	Obs	43
25%	.0003746	2.38e-06	Sum of Wgt.	43
50%	.0024756		Mean	.0179195
		Largest	Std. Dev.	.0260569
75%	.0295671	.0727246		
90%	.0713334	.0768446	Variance	.000679
95%	.0768446	.0844259	Skewness	1.484483
99%	.08484	.08484	Kurtosis	3.922746

Figure 1.2: Frequency Distribution of Grubel-Lloyd Index for the Maghreb Countries (Graph)



Appendix 3.1: Data Description and Sources

Data Description			
Variable	**Description**	**Unit**	**Source(s)**
d_{ij}	The shortest sea route distance from the Maghreb port of export to the EU-15 member's port of Landfall. The port of landfall is considered to be EU-15 country J's largest port in 2001 where the volume share of sea-transported commodity traffic is largest.	Nautical Miles	wwww.world-register.org www.distances.com
d_{jJ}	Shortest driving distance between EU-15 seaport of landfall j to capital of destination J	Miles	www.geobytes.com
d_{Ii}	Shortest driving distance between Maghreb port i and the capital city	Miles	http://www.mapcrow.info/
t_{IJkt}	cif/fob transportation costs from Maghreb country I to EU-15 country J by two-digit NSTR disaggregated commodity k at time t.	Dollars	UN COMTRADE Database
$traf_{it}$	total outward tonnage traffic of Maghreb port i at time t.	Tonnes	EUROSTAT/New Cronos Database
wv_{IJkt}	The value per weight of sea-transported commodity k that is exported from I to J at time t. It is obtained by dividing the value of Maghreb country I's exports of k to J by k's weight. It is expressed in logarithm.	Dollars	Mr. Evangelos Pongas – Transport Division in Eurostat

Appendix 3.1 (continued)

cnt_{it}	Containerization rate (the percentage of cargo shipped in containers) in Maghreb port i at time t. It is expressed in logarithm.	Ratio	EUROSTAT/New Cronos Database
Imb_{IJkt}	Directional imbalance in trade volume between country I and country J in commodity k at time t. It is calculated by taking the ratio of the difference of Maghreb country I's exports and imports to/from J, to total bilateral trade in commodity k at time t, expressed in logarithm.	Tonnes	UN COMTRADE Database
$Infra_{Jt}$	Import country general infrastructure index: Corresponds to the simple average of four indices: main telephone lines per capita, kilometres of paved roads, kilometres of railroads and the number of paved airports (the last three indices are expressed per surface area)	Index	- CIA World Factbook (2004) - World Development Indicators (World Bank)
GDP_{It}	Real GDP of exporter country i. It is expressed in logarithm.	Dollars	World Development Indicators (World Bank)
GDP_{Jt}	Real GDP of importer country j. It is expressed in logarithm.	Dollars	World Development Indicators (World Bank)
pr_{IJkt}	Price of exported commodity k (from I to J) at time t, obtained by taking the ratio of value to volume of exports. It is expressed in logarithm.	Dollars	UN COMTRADE Database

Appendix 3.1 (continued)

$cons_{kt}$	Weight of commodity k in World's total consumption at time t. It is expressed in logarithm.	Ratio	UNIDO Industrial Demand-Supply Database
d_{IJ}	Great circle-distance between the capitals of countries I and J. It is expressed in logarithm.	Miles	Andrew Rose Database
Maghreb Port Efficiency Proxies:			
CDM proxy I	Ports normalized by country surface and population. It is computed by taking the logarithm of the ratio between the squared number of Maghreb country's major ports and the product between country surface and country population at time t.	Ratio	- Eurostat - CIA World Factbook (2004) - World Development Indicators (World Bank)
CDM proxy II	Corresponds to the simple average of four indices: main telephone lines per capita, kilometres of paved roads, kilometres of railroads and the number of paved airports (the last three of which are expressed per surface area)	Index	- CIA World Factbook (2004) - World Development Indicators (World Bank)
GDP/Capita	Real GDP per Capita. It is expressed in logarithm. expressed in logarithm	Dollars	- World Development Indicators (World Bank)

Appendix 3.2: Quality of Port Infrastructure

Country	Score	Rank
Maghreb Countries:		
Tunisia	4.5	37
Morocco	3.7	51
Algeria	3.0	72
CEECs:		
Estonia	5.3	19
Malta	5.1	23
Latvia	4.8	28
Slovenia	4.6	33
Lithuania	4.1	45
Romania	4.0	46
Poland	3.7	55
Bulgaria	3.7	56
Slovak Republic	3.5	57
Czech Republic	3.2	66
Hungary	2.5	80

*Port facilities and Inland Waterways in your Country are (1=Underdeveloped, 7=as developed as the world's best)

Source: The Global Competitiveness Report, 2003-2004.

Table 3.3: Summary Statistics

VARIABLE	MEAN	DEVIATION	MINIMUM	MAXIMUM
$trans_{IJ}$	3.41545	0.744285	-1.76617	8.5306295
$cont_i$	3.515589	1.703812	1.157434	7.109513
$value/weight_k$	7.090436	1.705777	1.907366	11.93057
Trade Imb_{IJ}	0.1516784	0.6764174	-0.9999958	0.9999992
$Infra_J$	0.6643292	0.2199407	0.112303	1.216157
Efficiency Proxy I	4.174088	.6960814	3.480366	5.617435
Efficiency Proxy II	4.174088	0.6960814	3.480366	5.617435
GDP/CAP_I	7.341663	0.2495612	7.057264	7.69601
EXP_{IJ}	9.891995	3.847508	0	21.63575
GDP_I	23.96508	0.3218462	23.53342	24.39728
GDP_J	27.10694	0.9906415	23.67723	28.35181
$Price_k$	8.636609	1.022156	7.056162	11.27585
$cons\_weight_k$	4.321904	1.005277	2.003879	8.989744
$distance_{IJ}$	5.872228	1.179187	1.609438	12.018593
$naut\_distance_{ij}$	6.934266	0.7685197	3.465736	8.165648

Definitions: $trans_{iJ}$ is the log of maritime transportation charges between port *i* and country *J*. $cont_i$ is the log of the containerization rate in port *i*. Trade Imb_{IJ} is the log of the trade imbalance between I and J. $Infra_J$ is the infrastructure index in *J*. Efficiency Proxy I is CDM's lof of the aggregate port efficiency variable. Efficiency Proxy II is CDM's infrastructure index. EXP_{ij} is the log of exports from *I* to *J*. GDP_i is the GDP in country *I*. GDP_j is the log of GDP in country *J*, GDP/CAP_i is the log of GDP per Capita in country *I*. $Price_k$ is the log of the price of *k* expressed in f.o.b terms. $cons\_weight_k$ is the weight of *k* in world consumption. Labour $Prod_i$ is the labour productivity in country *I*. $distance_{ij}$ is the great circle distance between *I* and *J*'s capitals. $naut\_distance_{ij}$ is the log of the shortest navigation distance.

Appendix 4.1: Data Description

$\Delta Y_{j,i,t}$	The flow of FDI between 1990 and 2000 from FDI-source country j to FDI-host country i, deflated by the MUV and expressed in logs
$\Delta prim\_mgr_{i,j,t}$	The flow of migrants with primary education from migration-source country i to migration-host country j between 1990 and 200, expressed in logs
$\Delta \sec\_mgr_{i,j,t}$	the flow of migrants with secondary education from migration-source country i to migration-host country j between 1990 and 2000, expressed in logs
$\Delta ter\_mgr_{i,j,t}$	The flow of migrants with tertiary education from migration-source country i to migration-host country j between 1990 and 2000, expressed in logs
$prim\_mgr_{i,j,t-1}$	The stock of migrants with primary education from migration-source country i to migration-host country j between in 1990, expressed in logs
$\sec\_mgr_{i,j,t-1}$	The stock of migrants with secondary education from migration-source country i to migration-host country j between in 1990, expressed in logs
$ter\_mgr_{i,j,t-1}$	The stock of migrants with tertiary education from migration-source country i to migration-host country j between in 1990, expressed in logs
$\Delta unskilled\_mgr_{i,j,t}$	The flow of unskilled migrants from migration-source country i to migration host country j between 1990 and 2000, expressed in logs. It is equal to the log sum of the primary and secondary educated migrant flows.
$\Delta skilled\_mgr_{i,j,t}$	The flow of skilled migrants from migration-source country i to migration host country j between 1990 and 2000, expressed in logs. It is equal to $\Delta ter\_mgr_{i,j,t}$

Appendix 4.1 (continued)

$unskilled\_mgr_{i,j,t-1}$	The stock of unskilled migrants from migration-source country i to migration host country j in 1990, expressed in logs. It is equal to the log sum of the primary and secondary educated migrant stocks.
$skilled\_mgr_{i,j,t-1}$	The stock of skilled migrants from migration-source country i to migration host country j in 1990, expressed in logs. It is equal to the log sum of the primary and secondary educated migrant stocks.
$\Delta exp_{i,j,t}$	The flow of commodity exports from migration-source country i to migration-host country j between 1990 and 2000, deflated by the export price index and expressed in logs
$\Delta imp_{i,j,t}$	The flow of commodity imports from migration-source country i to migration-host country j between 1990 and 2000, deflated by the import price index and expressed in logs
$exp_{i,j,t-1}$	The flow of commodity exports from migration-source country i to migration-host country j in 1990, deflated by the export price index and expressed in logs
$imp_{i,j,t-1}$	The flow of commodity imports from migration-source country i to migration-host country j in 1990, deflated by the import price index and expressed in logs
GDP_{it}	GDP of migration-source country in 1990 (deflated by the Manufacturing Export Unit Value Index)
GDP/Cap_{it}	GDP per Capita of migration-source country in 1990 (deflated by the Manufacturing Export Unit Value Index)
GDP/Cap_{jt}	GDP per Capita of migration-host country in 1990 (deflated by the Manufacturing Export Unit Value Index)
$\left(\frac{Pop_{prim}}{Pop_{total}}\right)_{i,t} - \left(\frac{Pop_{prim}}{Pop_{total}}\right)_{j,t}$	The difference in the proportion of primary level human capital to total human capital between migration-source and host countries in 1990, expressed in logs

Appendix 4.1 (continued)

$\left(\frac{Pop_{ter}}{Pop_{total}}\right)_{i,t}-\left(\frac{Pop_{ter}}{Pop_{total}}\right)_{j,t}$	The difference in the proportion of tertiary level human capital to total human capital between migration-source and host countries in 1990
$Political_{i,t}$	FDI-host country political risk rating in 1990
$Corruption_{i,t}$	FDI-host country corruption risk rating in 1990
$Financial_{i,t}$	FDI-host country financial risk rating in 1990
$Economic_{i,t}$	FDI-host country economic risk rating in 1990
$Ethnic_{i}$	FDI-host country ethnic fractionalization index (constant)
$(Debt / Equity)_{i,t}$	FDI-host country mean debt equity ratio in 1990
$distance_{ij}$	Great circle distance between FDI-host and source, expressed in logs
$colonial_{ij}$	Dummy for colonial relationship between FDI-host and source
$longitude_{ij}$	The Longitudinal distance between FDI partners, expressed in logs
$language_{ij}$	Dummy for common language between FDI partners
tax_{it}	Average tax in exporting country i in 1990, expressed in logs

Table 4.2: Summary Statistics

FDI and Migrants Composition by Education: Stocks and Flows				
VARIABLE	MEAN	DEVIATION	MINIMUM	MAXIMUM
ΔFDI	5.552341	2.119192	0.1373322	10.98373
FDI_{90}	1.847399	2.660103	0	10.27754
ΔM PRIM	0.232537	1.880197	-7.150702	10.69591
ΔM SEC	0.7634225	1.820834	-8.149313	11.26516
ΔM TER	0.7557382	1.75345	-7.603399	10.0101
M $PRIM_{90}$	5.506225	3.400213	0	14.25432
M SEC_{90}	5.102116	3.263089	0	13.53907
M TER_{90}	5.250778	3.363774	0	13.13872
ΔM unskilled	0.7461908	1.59513	-1.605898	11.0205
ΔM skilled	1.074669	1.52797	-2.448539	10.0101
M $unskilled_{90}$	6.143132	3.339276	0.6931472	14.65247
M $skilled_{90}$	5.250778	3.363774	0	13.13872
ΔEXP	18.08922	3.398825	6.368187	27.48447
ΔIMP	18.32549	3.563576	6.296262	27.57126
EXP_{90}	16.01249	3.24023	6.337823	24.91503
IMP_{90}	16.35095	3.378546	6.437378	26.25847
$Financial_{90}$	37.96248	7.960011	15.39	50
$Economic_{90}$	36.27695	5.869413	16.11	46.79
$Political_{90}$	71.81861	14.25368	39.80667	93.22334
$Corruption_{90}$	4.088139	1.276045	1.833333	6

Definitions: ΔFDI is the change in the log of FDI over the 1990-2000 period in the migrants' source country. FDI_{90} is the log of FDI flow in the year 1990. Δ M_e is the change over the 1990-2000 period of the log of the stock of migrants in FDI-sending country with *e* being educational attainment (henceforth, *e* = PRI, SEC and TER for primary, secondary and tertiary respectively), and M e_{90} is the log of the stock of migrants in the FDI-sending country in 1990 with *e* being educational attainment. Δ M_s is the change over the 1990-2000 period in the log of the stock of migrants in FDI-sending country with *s* being the skill level (henceforth, *s* = unskilled and skilled), and M s_{90} is the log of the stock of migrants in the FDI-sending country in 1990 with *s* representing the skill level). $Financial_{90}$, $Economic_{90}$, $Political_{90}$ and $Corruption_{90}$ correspond to the financial , economic, political and corruption indices in the FDI-host country in 1990.

References

[1] Al-Atrash, H.M., and T. Yousef (2000). "Intra-Arab trade: is it Too Little?", IMF working papers, 00/10

[2] Amjadi, A and A, Yeats (1995). 'Have Transport Costs Contributed to the Relative Decline of Sub-Saharan African Exports ?' World Bank Working Paper Series No. 1559.

[3] Anderson, J. (1979). "A Theoretical Foundation for the Gravity Equation," *American Economic Review,* 106-116

[4] Anderson, J. and E. van Winkoop (2003). "Gravity with Gravitas: a Solution to Border Puzzle," *American Economic Review*, 93 (2003):170–92.

[5] Aizenman, Joshua & Noy, Ilan (2005). "FDI and Trade - Two Way Linkages?". UCSC Center for International Economics (SCCIE), Working Paper No. 05-09; UCSC Department of Economics Working Paper No. 598

[6] Aviat, A. & N. Coeurdacier (2004). "The Geography of Trade in Goods and Asset Holdings". DELTA, mimeo

[7] Baier, Scott L. and Bergstrand, Jeffrey H. (2001) "The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity." *Journal of International Economics*, 53(1), pp. 1-27

[8] Baldwin R. (1994). "Towards an Integrated Europe", CEPR, London

[9] Bergstrand, J. (1985) "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence," *Review of Economics and Statistics*, 474-481.

[10] Bergstrand, J. (1989) "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade," *Reiew. of Economics and Statistics*, 143-153

[11] Bergstrand, Jeffrey H, (1990)."The Heckscher-Ohlin-Samuelson Model, the Linder Hypothesis and the Determinants of Bilateral Intra-industry Trade," *Economic Journal*, Royal Economic Society, vol. 100(403), pages 1216-29, December.

[12] Bertolini, P., and M. Montanari. (2002). "Trade Integration Between the EU and the CEECs on the Eve of Enlargement: A Gravity Model". *Rivista di Politica Economica* 92, no. 3: 35–56.

[13] Bilal, Sanoussi, Grether, Jean-Marie and de Melo, Jaime (2003). "Attitudes Towards Immigration: A Trade-Theoretic Approach". *Review of International Economics*, Vol. 11, pp. 253-267

[14] Blonigen, Bruce A. (1999). "In Search of Substitution between Foreign Production and Exports". NBER Working Paper No. W7154

[15] Brenton, P. & Kendall, T. (1994). "Back to Earth with the Gravity Model: Further Estimates for the Eastern European Countries". Centre for European Policy Studies, Brussels.

[16] Brun, Jean-François & Carrère, Céline & Patrick Guillaumont & Jaime de Melo, 2005. "Has Distance Died? Evidence from a Panel Gravity Model," World Bank Economic Review, Oxford University Press, vol. 19(1), pages 99-120

[17] Cheng, Hui & Howard J. Wall (2005). "Controlling for heterogeneity in gravity models of trade and integration," Federal Reserve Bank of St. Louis, issue Jan, pages 49-63.

[18] Chong-Uk Kim, (2006). "Immigration, FDI, and International Trade," University of Oregon Economics Department Working Papers 2006-3, University of Oregon Economics Department.

[19] Clark, Ximena & David Dollar & Alejandro Micco, (2004). "Port Efficiency, Maritime Transport Costs and Bilateral Trade", NBER Working Papers 10353, National Bureau of Economic Research, Inc.

[20] Combes, Pierre-Philippe & Lafourcade, Miren & Mayer, Thierry (2005). "The Trade-Creating Effects of Business and Social Networks: Evidence from France," *Journal of International Economics*, Elsevier, vol. 66(1), pages 1-29, May

[21] Davis, Donald R. (1995). "Intra-Industry Trade: A Hecksher-Ohlin-Ricardo Approach," *Journal of International Economics*, 39(3/4), November, 201-226.

[22] Davis, Donald R. & David E. Weinstein, (2001). "An Account of Global Factor Trade", *American Economics Review*, vol. 91(5), pages 1423-1453.

[23] De Benedictis, Luca & Claudio Vicarelli (2005). "Trade Potentials in Gravity Panel Data Models", *Topics in Economic Analysis & Policy*, Berkeley Electronic Press, vol. 5(1), pages 1386-1386

[24] Deardorff, Alan V. (1982). "The General Validity of the Heckscher-Ohlin Theorem," *American Economic Review*, American Economic Association, vol. 72(4), pages 683-94, September.

[25] Deardorff, Alan V. (1984). "Testing Trade theories and Predicting Trade Flows" in R. Jones and P. Kenen, eds., *Handbook of International Economics*, Vol. 1. Amsterdam: Elsevier, pp. 467-517

[26] Deardorff, Alan V. & Dalia S. Hakura (1995). "Trade and Wages-What Are the Questions?" in Jagdish Bhagwati and Marvin H. Kosters, eds., Trade and Wages: Leveling Wages Down? Washington, D.C.: The AEI Press, pp. 76-107.

[27] Deardorff, A.V. (1998). "Determinants of Bilateral Trade: Does Gravity work in a Neoclassical World?", in: Jeffrey A. Frankel (ed.) The Regionalization of the World Economy, The University of Chicago Press, Chicago.

[28] Debaere, P. (1998). "Relative Factor Abundance and Trade," CEPR Discussion Papers, No. 4435.

[29] Disdier, Anne-Celia and Head, Keith Charles (2004). "The Puzzling Persistence of the Distance Effect on Bilateral Trade". Centro Studi Luca d'Agliano Working Paper No. 186Feenstra, R.C., J.R. Markusen and A.K. Rose, 2001, Using theGgravity Equation to Differentiate among Alternative Theories of Trade, *Canadian Journal of Economics* 34(2): 430-447

[30] Dixit, A.K. and J.E. Stiglitz (1977). "Monopolistic Competition and Optimum p Product Diversity", *American Economic Review* 67, 297-308.

[31] Docquier, Frederic & Rapoport, Hillel (2004). "Skilled Migration: The Perspective of Developing Countries". World Bank Policy Research Working Paper No. 3382

[32] Eaton, Jonathan & Samuel Kortum (1997). "Technology and Bilateral Trade," NBER Working Papers 6253, National Bureau of Economic Research, Inc.

[33] Egger, Peter (2000). "A Note on the Proper Specification of the Gravity Equation". *Economics Letters* 66(1):25–31

[34] Egger, Peter (2002). "An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials", *The World Economy*, Vol. 25, pp. 297-312.

[35] Egger P. & Pfaffermayr M. (2003), "The Proper Econometric Specification of the Gravity Equation: A Three-Way Model with Bilateral Interaction Effects", *Empirical Economics* 28 (3), pp. 571 – 580

[36] Egger, Peter (2004). "On the Problem of Endogenous Unobserved Effects in the Estimation of Gravity Models", *Journal of Economic Integration 19 (1)*, 182-191.

[37] Evenett, Simon J. & Wolfgang Keller, (1998). "On Theories Explaining the Success of the Gravity Equation," NBER Working Papers 6529, National Bureau of Economic Research, Inc.

[38] Faini, Riccardo & Venturini, Alessandra (1993). "Trade, Aid and Migrations: Some Basic Policy Issues," *European Economic Review*, Elsevier, vol. 37(2-3), pages 435-442, April

[39] Faini, Riccardo (2004). "Trade Liberalization in a Globalizing World", IZA Discussion Paper No. 1406; Centro Studi Luca d'Agliano Development Studies Working Papers 192

[40] Feenstra, R. C. (1998). "Integration of Trade and Disintegration of Production in the Global Economy," *Journal of Economic Perspectives*, 12(4), 31–50.

[41] Feenstra; Robert C., James R. Markusen and Andrew K. Rose (1998), "Understanding the Home Market Effect and the Gravity Equation: The Role of Differentiating Goods," NBER Working Paper no. 6804, November.

[42] Ferragina, Anna & Giovannetti, Giorgia & Pastore, Francesco (2005). "A Tale of Parallel Integration Processes. A Gravity Analysis of EU Trade with Mediterranean and Central and Eastern European Countries," IZA Discussion Papers 1829, Institute for the Study of Labor (IZA).

[43] Fink, C.A. Mattoo & I. Neagu (2002). "Trade in International Maritime Services: How Much Does Policy Matter?", Policy Research Working Paper 2522.

[44] Frankel, Jeffrey & Stein, Ernesto & Wei, Shang-jin (1995)."Trading blocs and the Americas: The natural, the unnatural, and the super-natural," *Journal of Development Economics*, Elsevier, vol. 47(1), pages 61-95, June

[45] Geweke, John (1982): "Measurement of Linear Dependence and Feedback Between Multiple Time Series." *Journal of the American Statistical Association*, 77(378), 304-313

[46] Gould, David M (1994). "Immigrant Links to the Home Country: Empirical Implications for U.S. Bilateral Trade Flows," *Review of Economics and Statistics*, 76, pp. 302 – 316.

[47] Greenaway, D., Milner, C. (1983): On the measurement of intra-industry trade, Economic Journal 93 (December), pp. 900-908

[48] Greenway, D., Hine, R., Milner, R. (1994): Adjustment and the measurement of marginal intra-industry trade, Weltwirtschaftliches Archiv, 130 (2), pp. 418-427.

[49] Groznik, P. (2003). "Immigration and International Financial Flows," Indiana University, Working Paper

[50] Grubel, H. G. and Lloyd, P.J. (1975). Intra Industry Trade. London: Macmillan

[51] Grubert, Harry & John Mutti (1991): Taxes, tariffs and transfer pricing in multinational corporate decision making, *Review of Economics and Statistics*, vol 73 (2), 285-293

[52] Hamilton, C.B. & A.L. Winters (1992), "Opening up International Trade with Eastern Europe", *Economic Policy*, 14, 77-116.

[53] Haveman, Jon & Hummels, David L. (2004), "Alternative Hypotheses and the Volume of Trade: Evidence on the Extent of Specialization", *Canadian Journal of Economics*, vol. 37, issue 1, pages 199-218

[54] Heckman, J. (1976). “The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models”, *The Annals of Economic and Social Measurement*, 5, 475-492

[55] Heckman, J. (1979). “Sample Selection Bias as a Specification Error”, *Econometrica*, Vol. 47, No. 1, 153-162

[56] Helmers and Pasteels (2005). “TradeSim (Third Version): A Gravity Model for the Calculation of Trade Potentials for Developing Countries and Economies in Transition”, Explanatory Notes, International Trade Center, Geneva

[57] Helpman (1987), “Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries,” *Journal of the Japanese and International Economies*, 6, March, 62-81.

[58] elpman and Krugman (1985). Market Structure and Foreign Trade, MIT Press.

[59] Hummels, D. (1999), ‘Towards A Geography of Trade Costs’, University of Chicago, Mimeo.

[60] Hummels, D. and Levinsohn, J. (1995) "Monopolistic Competition and International Trade: Reconsidering the Evidence". *Quarterly Journal of Economics*, vol. 110, pp. 799-836

[61] Hummels, D. & V. Lugovsky. (2003).‘‘Usable Data? Matched Partner Trade Statistics as a Measure of International Transportation Costs.’’ Purdue University, Department of Economics, West Lafayette, Ind.

[62] Kandogan, Yener (2004)."Trade Creation and Diversion Effects of Europe's Regional Liberalization Agreements". William Davidson Institute Working Paper No. 2001-07

[63] Kandogan, Yener (2005). “Evidence for the Natural Trade Partners Theory from the Euro-Mediterranean Region”, William Davidson Institute Working Paper No.2005-01

[64] Krishna, P. (2003). "Are Regional Trading Partners "Natural"?," Journal of Political Economy, University of Chicago Press, vol. 111(1), pages 202-231, February.

[65] Krugman, P. (1991). “The move to free trade zones,” in Symposium on Policy Implications of Trade and Currency Zones, sponsored by the Federal Reserve Bank of Kansas City.

[66] Kugler, Maurice & Rapoport, Hillel (2005) "Skilled Emigration, Business Networks and Foreign Direct Investment". CESifo Working Paper Series No. 1455

[67] Leamer, Edward (1992). "Testing Trade Theory," NBER Working Papers 3957, National Bureau of Economic Research, Inc.

[68] Leamer, E. and Levinsohn, J. (1995). “International Trade Theory: The Evidence,” in Grossman, G. and Rogoff,-K., eds. *Handbook of international economics*. Volume 3.

Handbooks in Economics, vol. 3. Amsterdam; New York and Oxford: Elsevier, North-Holland, pages 1339-94.

[69] Limao, Nuno and Venables, Anthony J., "Infrastructure, Geographical Disadvantage, and Transport Costs" (December 1999). World Bank Policy Research Working Paper No. 2257.

[70] Lipsey, Robert E. & N. Y. Weiss (1981): "Foreign Production and Exports in Manufacturing Industries," *Review of Economics and Statistics,* 63: 488–94

[71] López, Ramón & Maurice Schiff (1998). "Migration and the Skill composition of the Labor Force", The Impact of Trade Liberalization in LDCs," *Canadian Journal of Economics*, Canadian Economics Association, vol. 31(2), pages 318-336, May.

[72] Lucas R. (1990) , " Why doesn't Capital Flow from Rich to Poor?", *American Economic Review*, Vol. 80, No. 2, Papers and Proceedings of the Hundred and Second Annual Meeting of the American Economic Association, pp. 92-96

[73] Maloney, William F. and Gonzalez, Patricio Aroca (2005). "Migration, Trade, and Foreign Direct Investment in Mexic", World Bank Policy Research Working Paper No. 3601

[74] Markusen, James R (1983). "Factor Movements and Commodity Trade as Complements," *Journal of International Economics*, vol 14, pp. 341-356

[75] Matyas, L. (1998): "The Gravity Model: Some Econometric Considerations", *The World Economy*, 21, 397-401.

[76] Matyas L. (1997), "Proper Econometric Specification of the Gravity Model", *The World Economy*, 20 (3), pp. 363-369

[77] Miniesy, R.S., J.B. Nugent, and T.M. Yousef (2004). "Intra-regional Trade Integration in the Middle East: Past performance and Future Potential" in Hakimian, H., and J.B. Nugent (eds.) *Trade Policy and Economic Integration in the Middle East and North Africa: Economic boundaries in flux*. London: Routledge.

[78] Mundell, Robert A. (1957). "International Trade and Factor Mobility", *American Economic Review*, 47, 321-335.

[79] Nilsson, L. (2000). "Trade Integration and the EU Economic Membership Criteria", *European Journal of Political Economy*, 16, 807-827.

[80] Portes, Richard & Rey, Helene (2005). "The determinants of cross-border equity flows," *Journal of International Economics*, Elsevier, vol. 65(2), pages 269-296, March.

[81] Rapoport, Hillel & Docquier, Frederic (2004). "Skilled migration: the perspective of developing countries," World Bank Policy Research Working Paper Series No. 3382

[82] Rauch, James E. & Alessandra Casella (2003). "Overcoming Informational Barriers to International Resource Allocation: Prices and Ties", *Economic Journal*, Royal Economic Society, vol. 113(484), pages 21-42, January

[83] Rauch, James E. & Vitor Trindade, (2002). "Ethnic Chinese Networks In International Trade", *The Review of Economics and Statistics*, MIT Press, vol. 84(1), pages 116-130, February

[84] Razin, Assaf, Rubinstein, Yona and Sadka, Efraim, (2002). "Fixed Costs and FDI: The Conflicting Effects of Productivity Shocks". NBER Working Paper No. W10864

[85] Razin, Assaf & Rubinstein, Yona & Sadka, Efraim, 2005. "Which Countries Export FDI, and How Much?," CEPR Discussion Papers No 4204

[86] Schiff, Maurice (1999). "Will the Real Natural Trading Partner Please Stand Up?", World Bank Policy Research Working Paper No. 2161.

[87] Sigelman, Lee & Langche, Zeng (2000): "Analyzing Censured and Sample-Selected Data with Tobit and Heckit Models", *Political Analysis*, 8(2), 167-182

[88] Summers, L. (1991). "Regionalism and the world trading system," in *Symposium on Policy Implications of Trade and Currency Zones*, sponsored by the Federal Reserve Bank of Kansas City.

[89] Trefler, Daniel (1995). "The Case of the Missing Trade and Other Mysteries." *American Economic Review*, December, 85(5), pp. 1029-46.

[90] Viner, Jacob (1950). The Customs Union Issue, Carnegie Endowment for International Peace: New York.

[91] Wang, Zhen Kun, and L.Alan Winters (1991). "The Trading Potential of Eastern Europe," Centre for Economic Policy Research Discussion Paper No. 610, November, London, UK.

[92] Wonnacott, P. and M. Lutz. (1989). "Is There a Case for Free Trade Areas?" In Schott, J.J.(ed.) *Free Trade Areas and U.S. Trade Policy*, pp. 59-84. Washinton, D.C.: Inst. Int. Econ.

[93] Yeats, Alexander (1978). "On the Accuracy of Partner Country Trade Statistics," *Oxford Bulletin of Economics and Statistics*, 40(4):341–61