GRAVITY MODEL, BORDER EFFECTS AND HOME MARKET EFFECT: AN OWNERSHIP-BASIS APPROACH

A Thesis Submitted to the College of Graduate Studies

and Research in Partial Fulfilment of the

Requirements for the Degree of Doctor of Philosophy

in the Department of Agricultural Economics

University of Saskatchewan

Saskatoon

By

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October 2005

Your file Votre référence
ISBN: 978-0-494-22124-2
Our file Notre référence
ISBN: 978-0-494-22124-2

UNIVERSITY OF SASKATCHEWAN

College of Graduate Studies and Research

SUMMARY OF DISSERTATION

Submitted in partial fulfillment

of the requirements for the

DEGREE OF DOCTOR OF PHILOSOPHY

by

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GRAVITY MODEL, BORDER EFFECTS AND HOME MARKET EFFECT: AN OWNERSHIP-BASIS APPROACH

International commerce is performed via cross-border trade and via transactions of foreign affiliates of multinational enterprises (MNEs). Throughout all the theoretical frameworks used in the literature to derive the gravity equation, the location-basis criterion in defining international transactions is adopted. The location-basis criterion dismisses the implications associated with the transactions of foreign affiliates of MNEs in the theoretical derivation of the gravity equation. As a result, conceptual and computational defects accompany the conventional measurement of the border effects as a reflection of the magnitude of the international economic integration. Adopting the ownership-basis criterion in defining international transaction, this paper retrieves the gravity equation from a framework that encompasses the transactions of foreign affiliates of MNEs and allows for the non-engagement in any form of international commerce. The ownership-basis gravity equation is applied for the OECD countries reporting the inward activities of the foreign affiliates of MNEs. The empirical results show significant overestimation in the magnitudes of border effects when using the conventional gravity equation. The results also suggest that more opportunities await to be exploited through FDI liberalization.

The ownership-basis gravity equation allows us to build measures of effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce relative to barriers in intranational commerce. These effective measures encompass the direct transactional effects of the barriers and the indirect effects of the barriers on the configuration of international commerce. The empirical application examines the effects of Canada-U.S. free trade agreement (CUSFTA) in the aggregate manufacturing industry from the U.S. perspective. The effects of CUSFTA are examined by probing for the occurrence of structural breaks in growth rates of these measures between the post-CUSFTA period and the pre-CUSFTA period. The results highlight the trade creation effect of CUSFTA between the U.S and Canada and show no significant effect of CUSFTA on the transactions of foreign affiliates of MNEs between the U.S and Canada. The results also demonstrate that CUSFTA has indeed promoted further economic integration between the U.S. and Canada. With supplementary results showing non-significant effects of CUSFTA on the international transaction between the U.S. and the outsiders, the outcomes are suggestive in terms of positive welfare implications of CUSFTA for the U.S. in the manufacturing industry.

The final exploitation of the ownership-basis theoretical framework is to study the implications on the home market effect phenomenon. Our study shows that the home market effect occurs for two different criteria: location-basis and ownership-basis. The location-basis home market effect implies that an increase in relative market size of a given economic entity induces more than one for one increase in the share of total production *within* this economic entity. The ownership-basis home market effect implies that an increase in relative market size of a given economic entity induces more than one for one increase in the share of total production by firms owned by this economic entity. Our study also investigates the various effects of cross-border trade barriers and FDI barriers on the magnitude of the location-basis home market effect and the ownership-basis home market effect.

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ABSTRACT

International commerce is performed via cross-border trade and via transactions of foreign affiliates of multinational enterprises (MNEs). Throughout all the theoretical frameworks used in the literature to derive the gravity equation, the location-basis criterion in defining international transactions is adopted. The location-basis criterion dismisses the implications associated with the transactions of foreign affiliates of MNEs in the theoretical derivation of the gravity equation. As a result, conceptual and computational defects accompany the conventional measurement of the border effects as a reflection of the magnitude of the international economic integration. Adopting the ownership-basis criterion in defining international transaction, this paper retrieves the gravity equation from a framework that encompasses the transactions of foreign affiliates of MNEs and allows for the non-engagement in any form of international commerce. The ownership-basis gravity equation is applied for the OECD countries reporting the inward activities of the foreign affiliates of MNEs. The empirical results show significant overestimation in the magnitudes of border effects when using the conventional gravity equation. The results also suggest that more opportunities await to be exploited through FDI liberalization.

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ACKNOWLEDGEMENTS

I would like to thank my supervisor, Dr. Hartley Furtan, for setting the exemplar of a successful academic researcher. I appreciate his guidance, encouragement and friendship throughout the four years at the University of Saskatchewan.

I would like to thank my advisory committee: Dr. Joel Bruneau, Dr. Richard Gray, Dr. Keith Head and Dr. James Vercammen for their discussions, insights and help, crucial for the completion of my dissertation.

I would like to thank my external examiner, Dr. Derek Brewin, for his discussions and comments.

Sincere gratitude to Dr. Mark Partridge for his empirical advises throughout the latter stages of the thesis and in providing the access to empirical programs that are needed for the completion of my dissertation.

I would like to thank Dr. Rose Olfert for her friendship, help and insights.

I would like to thank my colleagues: Ryan Cardwell, Faycal Haggui and Daniela Mihal for their friendship and endless support in some of the critical phases.

I would like to thank all the faculty staff and graduate students of the department of agricultural economics at the University of Saskatchewan for providing an atmosphere characterized with friendship and support.

I would like to thank my relatives in Québec for their support and encouragement.

Finally, a sincere gratitude to my parents: Laoun and Nazehli and for my brother, Christian and my sister, Carole for their support and endless love.

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CHAPTER I
INTRODUCTION

1.1 Problem Statement

One of the principle aspects of globalization connecting the world economies is foreign direct investment (FDI). FDI has extended the economic boundaries of countries beyond their national borders. The operational aspect of FDI is represented through the activities of foreign affiliates of multinational enterprises (MNEs). The dramatic growth of FDI and activities of foreign affiliates of MNEs have compelling implications on the theoretical formulation and empirical analysis of international commerce. International commerce in goods and services can be channeled via cross-border trade but also via transactions of foreign affiliates of MNEs.

The work horse of the empirics in international trade is the gravity equation. The conventional form of the gravity equation explains bilateral trade flows between countries with the economic size of the country of production and country of consumption, distance separating them, and a factor capturing the non-distance barriers. The latter consists of other non-policy trade barriers and policy trade barriers. The gravity equation has been used as a tool to assess the economic barriers between countries (i.e. magnitude of economic integration between countries) and to analyze the effects of the regional integration agreements (RIAs). The economic barriers between countries assessed through the gravity equation is coined the "border effects" in the pioneering paper of McCallum (1995).

The approach used in the literature to assess the magnitude of the border effects and to investigate the effects of RIAs is a location-basis approach. The location-basis approach records the transaction as being international based on the location (residence) of the economic agents. The location-basis approach does not encompass the operational aspect of FDI that is expressed through the activities of foreign affiliates of MNEs. This fact recalls for the alternative ownership-basis approach that encompasses a broader set of transactions. The ownership-basis approach records the transactions as being international based on the nationality/ownership of the economic agents. In this sense, the ownership-basis approach highlights the operational aspect of FDI. The ownership-basis approach is not considered yet in the gravity literature.

The mere representation of international transactions through cross-border trade when analyzing international economic integration and effects of RIAs is dubious. Consider the following hypothetical example illustrating the consequences of dismissing the activities of foreign affiliates of MNEs on the measurement of the international economic integration. Consider a world consisting of two countries and one sector: the cake sector producing differentiated varieties of cake. Assume that these two countries are remote enough so that all international transactions are conducted via the intangible transfer of cake recipe (i.e. transfer of knowledge) and local production of cakes by foreign affiliates of MNEs[1]. The transfer of cake recipe is unrecorded in cross-border trade in goods. A location-basis approach can mistakenly refer to an extreme case of non-economic-integration between these two countries when solely regarding the recorded cross-border trade in goods, *ceteris paribus*. This fact suggests that revisiting the concept, measurement process and interpretation of border effects by adopting the ownership-basis approach is a compelling avenue of economic research.

Analyzing the effects of RIAs is not complete without considering the broader set of transactions through the ownership-basis approach. This fact is depicted through the following illustration. Consider RIA that leads to an increase in cross-border trade. The increase in cross border trade is the result of trade liberalization but also of the potential reallocation of production of foreign affiliates of MNEs to domestic firms. In this case, the mere representation of international transactions through cross-border trade leads to an overestimation of the positive effects of RIA.

[1] International transaction in intangibles can be conducted through licensing of domestic producers in the foreign country rather than internalization of the production process within the firm boundary. This alternative is not considered in this example.

Finally, the location-basis approach is also adopted in the home market effect literature. The home market effect describes the phenomenon where an increase in market size of one country leads to a more than one for one increase in the production *within* that country (Krugman, 1980; Helpman and Krugman, 1985). The ownership-basis home market effect is not considered yet in the literature. The ownership-basis home market effect describes the situation where an increase in market size of one country leads to a more than one for one increase in the production by firms owned by that country. Some observations compels for the investigation of the ownership-basis home market effect. Consider the North American car industry. While a fraction of North American car industry is located in Canada, the majority of North American car industry is owned by U.S. firms. Studying the ownership-basis home market effect is motivated by the implications on the gross national product (GNP) expressed through the repatriation of profits by foreign affiliates of MNEs.

1.2 Objectives of the Study

The main theoretical objective of this study is to derive the gravity equation from a comprehensive theoretical setup that renders homage to *both* channels of international commerce: cross border trade and transactions of foreign affiliates of MNEs. The amended gravity equation will be coined the ownership-basis gravity equation. The ownership-basis gravity equation and the ownership-basis theoretical setup pave the way to achieve the following additional objectives:

- To extend the method of measuring the border effects by encompassing a broader set of transactions through the ownership-basis distinctions;

- To illustrate the conceptual and computational implications on the border effects measured through the conventional gravity equation;

- To build theoretical indices reflecting current barriers associated with cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce;

- To exploit the ownership-basis theoretical setup in order to inspect whether the home market effect manifests itself at the location-basis as well as at the ownership-basis.

Once the ownership-basis theoretical framework is developed and the ownership-basis gravity equation is derived, this study has the following empirical objectives:

- To empirically estimate the border effect through the ownership-basis gravity equation for the Organization for Economic Cooperation and Development (OECD) countries in the manufacturing sector;

- To contrast the estimates of the border effects obtained from the ownership-basis gravity equation to the estimates of the border effects obtained from the conventional gravity equation;

- To empirically probe the evolvement of the indices of the current barriers associated with cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce in order examine the effects of the Canada-U.S. free trade agreement (CUSFTA).

1.3 Methodology

There are two requirements that dictate the selection of the basic theoretical setup. The first requirement is that the basic theoretical setup should allow for intra-industrial trade and intra-industrial FDI and hence, intra-industrial international commerce. The reason for the first requirement is that the empirical applications are conducted for subsets of OECD countries where international trade, transactions of foreign affiliates of MNEs and aggregate international commerce are characterized by intra-industrial aspect. Therefore, a theoretical setup derived from the new trade theory based on imperfect competition and increasing return to scale (IRS) is convenient in this case. The neoclassical comparative cost advantage theory is thought to characterize more international commerce between industrialized countries and developing countries. The second requirement is that the basic theoretical setup should allow for a mixed equilibrium with some firms opting to export, some firms opting to undertake FDI and some firms opting not to be engaged in any form of international commerce.

In order to meet these two requirements, the theoretical framework in this study draws on the basic theoretical setup of Helpman, Melitz and Yeaple (2004) characterized by multi-sector multi-country general equilibrium, Dixit and Stiglitz (1977) monopolistic competition with constant elasticity of substitution (CES) preferences across varieties. In this basic theoretical setup, the mixed equilibrium is obtained by allowing heterogeneity across firms through their productivity attribute. The decisions of firms on whether to export, undertake FDI and not to be engaged in any form of international commerce are determined through the proximity-concentration trade-off hypothesis. The proximity-concentration trade-off hypothesis states that firms decide whether to serve a foreign market via cross-border trade or FDI by weighing the benefits of jumping the cross-border trade barriers and reaping economy of scale at the corporate level against the additional fixed cost incurred when establishing production facilities abroad.

We perceive the border effects as being determined by the weighted average of the cross-border trade barriers, operational FDI barriers and the implicit prohibitive barriers associated with the non-engagement in any form of international commerce. Therefore, in deriving the ownership-basis gravity equation, one of the critical tasks is to develop these weights. The ownership-basis theoretical setup will be also utilized to build the conventional gravity equation. Doing so highlights the implications on the measurement of the border effects through the conventional gravity equation. This study also attempts to derive the ownership basis gravity equation from a theoretical setup where heterogeneity across firms is depicted by a fixed cost attribute.

The ownership-basis theoretical setup is exploited to derive two equations intended to examine two different types of home market effect phenomenon. The first equation relates the share of production *within* the national border of a given country from global production to the relative market share of that country. Hence, the first equation intends to examine the occurrence of a "location-basis" home market effect phenomenon. The second equation relates production share of firms headquartered in a given country from global production to the relative market share of that country. Hence, the second equation intends to examine the occurrence of an "ownership-basis" home market effect phenomenon.

The empirical methodology to compute the border effects from the ownership-basis gravity equation follows the empirical methodology to compute the border effects from the conventional gravity equation. In a conventional gravity equation a border effects dummy variable is employed to distinguish intranational trade from international trade. The border effects dummy variable capture the disparity between international trade and intranational trade after controlling for the economic size of the country of production and country of consumption, distance separating them and other non-policy barriers. The implementation of the ownership-basis gravity equation to measure the border effects warrants the employment of two border effects' dummies. The first captures the effective cross-border trade barriers and the second captures the effective barriers facing the transactions of foreign affiliates of MNEs. The magnitude of the "ownership-basis" border effects is constructed by combining the coefficients of both border effects' dummy variables.

The empirical methodology in determining the effects of CUSFTA consists of examining the existence of structural break in the evolvement of the current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce. A pre-CUSFTA and post-CUSFTA sub-periods will be distinguished through the employment of a dummy variable. Contrasting the pre-CUSFTA period to the post CUSFTA period is essential to isolate the effects of CUSFTA. Eichengreen and Irwin (1995) report some illustrations where two RIA insiders exhibit significantly higher trade between them then with the RIA outsiders long before the implementation of RIA. These findings cast doubts on the conventional approach of employing RIA dummy variable in a post-RIA implementation period. In this case, ambiguity arises on whether the relatively higher trade between RIA insiders is indeed attributed to the implementation of RIA *per se*.

1.4 Organization of the Study

The remaining chapters of the dissertation are organized as follows. Chapter II reviews the literature on the gravity equation and border effects. Chapter II states the theories that explain the occurrence of FDI. Chapter II also covers the theoretical and empirical literature on regionalism and home market effect. Chapter III develops the theoretical model that retrieves the ownership-basis gravity equation and derives the theoretical indices capturing the current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce. Chapter III also analyzes the location-basis home market effect and ownership–basis home market effect phenomena using the ownership-basis theoretical setup. Chapter IV conducts an empirical application of the ownership-basis gravity equation to measure the border effects for a subset of OECD countries. Chapter IV discusses the deficiency associated with the conventional gravity equation when measuring the border effects. Chapter IV contrasts the empirical results obtained form ownership-basis gravity equation to the empirical results obtained from the conventional gravity equation. Chapter V exploits the theoretical indices of the current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce to examine the effects of CUSFTA on cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce. Chapter VI summarizes the main findings and concludes the dissertation.

CHAPTER II
LITERATURE REVIEW

2.1 Introduction

Probing the level of international economic integration has inspired a substantial amount of theoretical and empirical literature. One of the main approaches is to contrast the magnitude of intranational with international economic attributes (e.g. price, transaction). The resulting disparity depicts the departure from complete international economic integration.

The gravity equation constitutes one of the main tools in identifying the degree of international economic integration. Inspired by the law of gravity in physics, the conventional form of the gravity equation explains bilateral trade flows between countries with the economic size of the country of production and country of consumption, distance separating them, and a factor capturing the non-distance trade barriers. The latter consists of other non-policy trade barriers and policy trade barriers. McCallum (1995) terms the disparity between international trade and intranational trade after controlling for the economic size of the country of production and country of consumption and for the distance separating them by the "border effects".

This chapter reviews the literature on the conventional gravity equation and border effects. It lists the attempts to theoretically and empirically amend the conventional gravity equation and the measurement of the border effects. It also discusses the potential role of different forms of locational endogeneity in driving the results of the border effects. This chapter devotes particular attention to FDI as being a potential form of locational endogeneity. This chapter discusses the different types of FDI and the theories that explain their occurrence.

As one of the listed objectives of the dissertation consists of examining the effect of CUSFTA using the amended ownership-basis gravity equation, this chapter also reviews the theoretical literature on regionalism. In addition, it covers the empirical attempts to examine the effects of RIAs and the defects that are associated with the empirical approaches. Finally, as an additional objective of the dissertation consists of examining the home market effect phenomena through the ownership-basis theoretical framework, this chapter reviews the theoretical and empirical literature of the home market effect.

This chapter is divided into three main sections. Section 2.2 reviews the definitions and measurements of the international economic integration. Particular focus is devoted to the border effects literature. Section 2.2 also discusses the locational endogeneity as a potential factor that affects the measurement of the border effects. Section 2.2 devotes particular attention to FDI as a form of locational endogeneity. Section 2.3 reviews the theoretical literature that analyzes the effects of regionalism and the empirical attempts to determine the effects of RIA. Section 2.4 reviews the theoretical literature and the empirical probes of the home market effect.

2.2 Literature Review on Border Effects

2.2.1 Defining and Measuring the Magnitude of Economic Integration

The pioneering approach of Feldstein and Herioka (1980) constitutes an early attempt to examine one aspect of international economic integration. Feldstein and Herioka (1980) analyze the level of international integration of the capital market between the OECD countries by examining the extent of capital mobility. They find that the rate of domestic saving and the rate of investment across the OECD countries are highly positively correlated. Feldstein and Herioka (1980) argue that these results are not in accordance with high level of international integration in the capital market. The issue is that domestic savings and investment should be independent if capital markets are perfectly integrated. While the Feldstein-Herioka theory is subjected to substantial criticisms, these results were puzzling due to the initially perceived high international integration of the capital market between the OECD countries.

Measuring the level of international economic integration is the concern of a broad strand of economic research. The main approach adopted in the literature has been to contrast the magnitude of an economic attribute (e.g. price, transaction) when determined at the international level to the magnitude of this economic attribute when determined at the intranational level. After controlling for the economic size of the country of production and country of consumption, distance and other geographical and other non-policy factors, complete international economic integration is reached when the magnitude of the economic attribute determined at the international level corresponds to the magnitude of this economic attribute when determined at the intranational level.

Two principle methods are pursued in the literature to measure the extent of international economic integration by contrasting the magnitude of the economic attribute when determined at the international level to the magnitude of this economic attribute when determined at the intranational level. The first method is based on intranational *contra* international price covariance. Engel and Rogers (1996) hypothesize that distance-related factors induce limitations in price covariance between locations. Letting d_{ij} represent the cost-equivalence of the distance separating two locations i and j, then the variability of their price ratios can occur over the interval $[1/d_{ij}, d_{ij}]$. In addition, Engel and Rogers (1996) emphasize that price variability also occurs due to border-related factors. They denominate a higher intranational degree of homogeneity, nominal price stickiness and the formal and informal trade barriers as the principle candidates of the border-related factors. Engel and Rogers (1996) conduct the empirical application using fourteen different disaggregated consumer price indices over cities in the U.S. and Canada. Their empirical approach test the discrepancy in price covariance between cities located on the same side of the border and between cities located on different sides of the border. Engel and Rogers (1996) find that, after controlling for distance, the presence of the international border has contributed significantly in lower covariance of price indices for a pair of cities situated on different sides of the border. The effect of the border persists, though to a lesser extent, after controlling for the nominal price stickiness. Engel and Rogers (1996) represent the effect of the border by its equivalent distance magnitude. Following the work of Engel and Rogers (1996), the price-covariance method to detect the extent of international economic integration has inspired a wide strand of literature (e.g. Engel and Rogers, 2000a; Engel and Rogers, 2000b; de Serres, Hoeller and de la Maisonneuve, 2001 and Rogers and Smith, 2001)[2].

The second method utilizes the conventional gravity equation to determine the extent of international economic integration. In its basic conventional form, the gravity equation explains bilateral trade flows with the economic size of the country of production and country of consumption, distance separating them and a factor capturing the non-distance trade barriers. The latter consists of other non-policy trade barriers and policy trade barriers. The second method consists of contrasting intranational trade to international trade after controlling for the economic size of the country of production and country of consumption, distance and other non-policy trade barriers. The next section illustrates the literature related to the second method.

2.2.2. Gravity Equation and the Border Effects

This strand of literature utilizing the conventional gravity equation to determine the magnitude of international economic integration is initiated by the pioneering paper of McCallum (1995). The results obtained in McCallum (1995) challenge the initial perception of a highly integrated Canada-U.S. economy. Using a basic conventional form of the gravity equation, McCallum (1995) assesses the relevance of 1988's Canada-U.S. national borders on international trade. Whereas the year of study was before CUSFTA came into implementation, the facts that direct trade barriers policies between the two countries were already low and that the cultural, institutional and informational linkages between these two countries are perceived to be substantial, have lead to the expectation of a low significance of the Canada-U.S. national border. After controlling for economic size and distance, McCallum (1995) finds that, in 1988, an average Canadian province is twenty times more likely to export to another province

[2] International economic integration can be measured by positive covariance in many different activities (e.g. the business cycle) in addition to price covariance approach initiated by Engel and Rogers (1996).

than to a U.S state, hence countering the conventional wisdom. This unforeseen result is coined "the border effects".

Helliwell (1996) further affirms the relative tight economic linkage of the Canadian federation compared to the economic linkage to the U.S. by examining Québec interprovincial trade relative to Québec trade with U.S. states. He finds larger magnitudes of border effects than those reported in McCallum.

While the original concept of border effects is determined from the exporting direction, Wei (1996) introduces the notion of "home bias" in consumption as an equivalent concept to the border effects determined from the importing direction. He develops a theoretical framework based on the Armington assumption that differentiates goods by the country of production and where consumers exhibit constant elasticity of substitution (CES) preferences across the differentiated goods[3]. Wei (1996) investigates the case of the home bias among the OECD countries and finds that an average OECD country imports ten times more from itself than from another OECD country after controlling for economic size and distance. This level dropped to two and a half after controlling for linguistic ties, contiguity and relative distance to the rest of the world (i.e. remoteness). Wei (1996) argues that the fact that home bias is amplified by the elasticity of substitutions combined with a possible bias in preferences for locally produced goods renders the welfare implications associated trade policy barriers relatively small. Helliwell (1998) estimates the OECD home bias over the period 1988-1992 by conducting measurements for individual years separately. He detects higher home-bias levels than Wei (1996), clustering around a magnitude of ten after controlling for linguistic ties, contiguity and remoteness.

Following this early research, a list of papers focuses on measuring the sectoral border effects and attempts to disentangle the border effects into the elementary components (e.g. Chen, 2003; Evans, 2003; Head and Ries, 2000; Hillberry, 1999; Hummels, 1999). The efforts to disentangle the border effects into the elementary components are basically aiming to isolate the extent of the welfare implications associated with the removal of the policy trade barriers.

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[3] In other words, the Armington assumption assigns each region with one differentiated good.

A parallel strand of the literature focuses on the theoretical and empirical misspecifications that have affected the previous outcome. Based on the seminal work of Anderson (1979), Anderson and van Wincoop (2003) derive an elegant theoretical gravity model from a framework that maintains the Armington assumption and where consumers exhibit CES preferences across the differentiated goods. Their theoretical gravity equation embraces the price indices of the bilateral trade associates. These price indices are coined "multilateral resistance" to trade as they reflect the average trade opportunity of the importer and the exporter with all their trading associates. The perceived price of an exporter i by an importer j is low when the average of the perceived prices of all trading partners of the latter is relatively high. Analogously, a higher average perceived price of exporter i's goods by its importing partners is accompanied with a lower demand and therefore lower supply price.

By conducting comparative statics, Anderson and van Wincoop (2003) show that multilateral resistance is more sensitive to an increase in trade impediments in the case of smaller countries. The intuition is that a bigger share of smaller country is crossing the international border. Therefore, a bigger share is subjected to trade impediments. As a result, a convenient explanation is given to the surprising low level of integration between Canada and the U.S. found in McCallum's paper. Their theoretically-based gravity equation leads to a magnitude of border effects between Canada and the U.S. of ten, which is half of the magnitude of border effects between Canada and the U.S. obtained in the earlier McCallum's paper.

Feenstra (2002) steps toward generalizing the model and the inferences of Anderson and van Wincoop (2003) by deviating from the Armington assumption. He assigns each country by a specific number of varieties. He also controls the potential endogeneity of production and market size by transferring them to the right hand side of the gravity equation. Feenstra (2002) argues that controlling the price indices with fixed effects will lead to a consistent estimate while circumventing the customized computational procedure as in the case of Anderson and van Wincoop (2003).

2.2.3. Locational Endogeneity

Locational endogeneity constitutes a potential factor that influences the measurement of the border effects. Industrial agglomeration resulting from the attachment to a specific geographic location and/or from the spillover benefits characterizes a prominent mean of locational endogeneity. Ellison and Glaeser (1997) quantify these agglomerative forces in the U.S. by developing an index measuring them for each of the 3-digit SIC industries. Hillberry (1999) finds that the Ellison-Glaeser indices significantly explain the disaggregated border effects.

Wolf (2000) suggests that if trade barriers at the international border are the exclusive reason for border effects, then, jurisdictional borders within the nation should not matter. He tests this proposition by measuring the gap between the U.S. intra-state trade to U.S. inter-state trade after controlling for economic mass and distance. He finds magnitudes of border effects ranging between three and four, depending on the specification. Wolf (2000) explains this outcome as resulting from the formation of clusters of vertically integrated industries[4].

Hillberry (2002) discusses the aggregation bias that accompanies the measurement of the Canada-U.S. border effects. He states that agglomeration characterizes the U.S. industrial sector and induces the allocation of industry with lower barriers to trade closer to the border at equilibrium. As a result, there will be a compositional variation in the industrial output and trade across units. The implications are that larger trade flows of goods will be associated with lower border effects and lower trade flows of goods will be associated with larger border effects. Hillberry (2002) argues that the absence of appropriate weighting will eventually result in an upward bias in the measurement of the border effects. He shows that controlling for the compositional variation across commodities and for the observations of zero trade between the trade associates substantially reduces the computed magnitude of the border effects. One can think of a potential fulfill of Hillberry's insight to be carried out

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[4] Head and Ries (2000) argue that these results might have been driven by the erroneous measurement of the intra-state distances.

through the inducive border barriers-jumping strategy, expected to be prominent in industries facing higher cross-border trade barriers.

2.2.4. FDI as Form of Locational Endogeneity

The notion of locational endogeneity also encompasses FDI. While international commerce might well be conducted through the transaction of foreign affiliates of MNEs, the literature has disregarded this fact. Caves (1971) distinguishes two basic types of FDI: vertical and horizontal. Vertical FDI describes the fragmentation of the production process across countries. On the other hand, horizontal FDI describes the replication of the production of similar goods in different countries. Vertical FDI and horizontal FDI constitute the boundaries of the continuous hybrid range of FDI. The motives of vertical FDI and horizontal FDI are treated by various theories.

The theoretical treatment of the occurrence of vertical FDI is mainly associated with the neoclassical trade theory (i.e. the Heckscher-Ohlin theory). The Heckscher-Ohlin-Vanek theorem states that differences in relative endowments induce the indirect movement of the relatively abundant factors through their implicit content in goods. When cross-border trade is subjected to barriers, Mundell (1957) shows that the direct movement of factors supersedes the implicit movement of factors in goods. The intuition is that trade barriers raise the price of the imported good and hence the return to the factor that is used intensively in the production of the imported good in the importing country. Hence, this situation generates an incentive for the direct flow of the production factor that is used intensively in the production of the imported goods to the importing country. Vertical FDI mainly characterizes the capital flow from industrialized countries to the developing countries.

The motives of firms to undertake horizontal FDI are best outlined by proceeding through the components of the ownership-location-internalization (OLI) paradigm developed in the management literature by Dunning (1977, 1981). The ownership component of the OLI paradigm reflects a firm's proprietary asset. A proprietary asset is defined by the organizational, technological and/or product differentiation advantages that are specific to a given firm. In order to acquire a proprietary asset, a firm must incur costs at the corporate level that are fixed and sunk in nature. A proprietary asset has "public good" properties (i.e. it can be conveyed to any production facility at negligible costs) and confers the competitiveness ability of firms in the local as well as in the foreign markets. The location component of the OLI paradigm is associated with the selection of the mode to reach the consumer of the foreign markets. A given firm is more likely to opt to serve the foreign consumers by producing abroad, the higher are the cross-border trade barriers and transportation costs, the higher is the scale at the corporate level (i.e. the higher are the fixed costs incurred at the corporate level) and the lower is the scale at the plant level (i.e. the lower are the fixed costs associated with establishing production facility abroad). Finally, the internalization component of the OLI paradigm is associated with the option of whether the production abroad will be conducted by licensing an arm's length producer or by direct engagement in production abroad. The latter becomes more advantageous when the perceived risk of proprietary asset dissipation and other transaction costs are higher than when firms internalize them within their boundaries[5].

The proximity-concentration trade-off hypothesis can be viewed as the theoretical expression of the aforementioned OLI paradigm in the economic literature in the case of horizontal FDI. In the conventional proximity-concentration trade-off framework, a firm decides whether to serve foreign markets via FDI or exports based on the outcome of the trade-off procedure. Benefits from circumventing cross-border trade costs and reaping scale economies at the corporate level stands on the side of FDI. However, these advantages from undertaking FDI are weighed against the costs of establishing production facilities in the foreign countries and the costs of additional information and scanning requirements associated with FDI. In a conventional proximity-concentration trade-off framework, the option of licensing an arm's length producer is commonly ruled out.

Krugman (1983) initiates the economic modeling of the decision to serve foreign markets by exporting versus producing abroad. He develops a parsimonious model derived from the monopolistic competition setup of Krugman (1980). This model marks

[5] The literature also suggests additional incentives to undertake FDI such as risk diversification (with MNE activities spanning in geographic dimensions and/or in product dimensions) and rivalry between oligopolistic firms (e.g. Knickerbocker, 1973).

the trade-off between circumventing transportation and tariff costs and incurring additional operating cost when producing abroad.

Brainard (1993) provides an extended theoretical setting for the proximity-concentration trade-off hypothesis. She characterizes three potential equilibria: pure trade equilibrium (i.e. foreign consumers are solely served via cross-border trade), pure multinational equilibrium (i.e. foreign consumers are solely served via sales of foreign affiliates) and mixed equilibrium (i.e. both modes of international commerce coexist). Pure multinational equilibrium is more likely to occur the higher the cross-border trade barriers and transportation costs and the lower the plant scale relative to the corporate scale. The reverse is true in the case of pure trade equilibrium. Moderate ranges of these proximity-concentration parameters yield mixed equilibrium. Within these moderate ranges, a higher proportion of the foreign market is served via FDI the higher the cross-border trade barriers and transportation costs and the lower the plant scale relative to the corporate scale.

Brainard (1997) empirically tests the relevance of the proximity-concentration trade-off hypothesis in explaining the activities of foreign affiliates in the U.S. and the activities of U.S. affiliates abroad. She exploits the 1989 data on FDI in the U.S. and U.S. FDI abroad compiled by the Bureau of Economic Analysis (BEA). She deals with the potential simultaneity between exporting and foreign affiliate sales by running regressions of their shares from total bilateral commerce. In addition, Brainard (1997) remedies the simultaneity via instrumental variables when regressing the levels of foreign affiliate sales and exports. The results indicate an overall substantial support to the proximity-concentration trade-off hypothesis.

Considerations of the role of FDI when determining the magnitude of the border effects are rare and scant in the empirical trade literature. Hillberry (1999) offers seven hypotheses in explaining the variation in cross commodity border effects. He tests the proposed hypotheses by regressing the estimated border effects on relevant proxies. One of these hypotheses states that industries characterized by higher activities of foreign affiliates of MNEs should have lower border effects. He argues that this outcome arises from the fact that the MNEs have already incurred the fixed costs and hence they benefit from the return to scale in conducting international trade. However, he also mentions that FDI is likely to arise to circumvent higher transaction costs in conducting cross-border trade. In that case, the initial hypothesis will be reversed. Hillberry (1999) employs the share of foreign affiliates from total employment in each given industry as proxy for the activities of the foreign affiliates of MNEs. The proxy of the activities of the foreign affiliates of MNEs is found to be insignificant in explaining the estimated border effects.

Evans (2001a) probes the location and nationality factors that underlie the measurement of the border effects. She disentangles the location factors by measuring the border effects between imports from the U.S. and sales of foreign affiliates of U.S. MNEs. On the other hand, she identifies the nationality factors by comparing the discrepancy between imports from the U.S. and intranational sales by domestically owned firms to the discrepancy between sales of foreign affiliates of U.S. MNEs and the intranational sales by domestically owned firms. Evans (2001a) finds that the border effects are mainly attributed to the location factors. The nationality factors do not seem to contribute in the explanation of the magnitude of the border effects.

FDI is a prominent type of locational endogeneity. FDI is not theoretically treated when deriving the gravity equation. As a result, the implications of FDI on the measurement of the border effects are not well established in the literature.

2.3 The Effects of RIAs

2.3.1 The Effects of RIAs: Review of the Theory

There are two main strands of theoretical literature that aim to assess the welfare effects of RIAs. The first strand focuses on *global* welfare implications of RIAs. In other word, this literature investigates whether the formation of RIAs leads to an improvement in global welfare. While there is a theoretical consensus that global free trade will eventually lead to a global welfare improvement, a controversy arises on whether the formation of RIAs prompt equivalent outcomes or not.

Krugman (1991a, 1991b) builds a stylized theoretical model based on the Armington assumption. He shows that a move toward the enlargement of RIAs, in the sense of more members in each bloc and smaller total number of blocs, is not necessarily accompanied with a monotonic improvement in global welfare. The reason associated with this outcome is that the enlargement of RIAs will potentially increase the external tariffs as a result of non-cooperative behavior of larger RIAs. Deardorff and Stern (1992) counter Krugman's outcome by replacing the Armington assumption setup, adopted in Krugman (1991a, 1991b), with a comparative cost advantage setup and assume a prohibitive tariff between non-members of RIA. Deardorff and Stern (1992) show that the continuous enlargement of blocs will eventually lead to a monotonic increase in the world welfare. Haveman (1992) extends the sequence of the controversy. While maintaining the comparative cost advantage framework, Haveman (1992) replaces the prohibitive tariff between non-members of RIA, assumed in Deardorff and Stern (1992), with an optimal tariff. In this case, the inferences converge back toward those obtained by Krugman (1991a, 1991b). Frankel (1997) and Frankel, Stein and Wei (1998) show that the deepening of RIAs, in the sense of reduction in trade barriers between the RIAs insiders, does not necessarily lead to a monotonic improvement of global welfare.

The second strand of theoretical literature studies the welfare effects of RIAs for the insiders. This theoretical analysis is initiated by Viner (1950). Viner (1950) shows that the formation of a custom union (CU) does not necessarily lead to a welfare improvement of the insiders[6]. This outcome is the result of two potential offsetting effects. Viner (1950) shows that welfare-improving trade creation between the insiders of CU is countered by a welfare-reducing trade diversion from the outsiders of CU with lower cost of production. The latter manifests itself in terms of a loss in tariff revenues[7].

Pomfret (1997) evaluates the Vinerian inferences for the case of a free trade area (FTA)[8]. In a partial equilibrium setup, he shows that an insider with relatively lower trade barriers *vis-à-vis* the outsiders might in fact experience a welfare improvement while the counterpart with relatively higher trade barriers *vis-à-vis* the outsiders might

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[6] The RIA is defined as CU when the insiders adopt a common external trade barriers *vis-à-vis* the outsiders.

[7] The Vinerian theory is not immune from critiques. For example, Meade (1955) questions to what extent the assumed infinite supply elasticity in Viner (1950) is realistic.

[8] The RIA is defined as FTA when the insiders retain independent external trade barriers *vis-à-vis* the outsiders.

experience a welfare reduction. These results hold even when a rigorous rule of origin accompanies the implementation of FTA. The welfare improvement of the insider with relatively lower trade barriers might be the results of trade creation with the insider as well as with the outsider[9].

The aforementioned theoretical analyses of RIAs are more consistent with the early wave of RIAs occurred in the 50s and 60s. This early wave of RIAs differs from the new wave of RIAs that occurred from the 80s onward with two main respects. First, the new wave of RIAs takes place in a different milieu characterized by: 1) a higher magnitude in FDI, and 2) less "barricaded" world resulting from continuous drop in information and communication barriers and from multilateralism and bilateral agreements. In addition, the content of RIAs further steps beyond the conventional lessening of the cross-border barriers to encompass agreements on foreign investment provisions and on institutions (e.g. intellectual property rights). Ethier (2001) highlights the theoretical consequences by stating that "The new regionalism is taking place in a world fundamentally different from that of the old regionalism, so that old-regionalism-theory is not necessarily relevant" (p. 159). Therefore, one of the main prerequisites of the empirical analyses of the effects of new RIAs is to *simultaneously* encompass FDI and cross-border trade in carrying out such analysis.

Kindleberger (1966) provides some early guidelines in understanding the various simultaneous effects of RIAs on trade and FDI. He augments Viner's vision by associating trade creation from one insider to another with investment diversion from one insider to another when RIA comes into effect. Kindleberger (1966) also relates the trade diversion that occurs from an outsider to an insider with RIA inducive investment creation from an outsider to an insider.

The following illustration characterizes the trade creation-investment diversion linkages which take place between RIA insiders. Consider RIA where the magnitude of dismantling of tariff and non-tariff barriers of cross-border trade relatively outweighs the

[9] The post-Vinerian theoretical extensions probe the design of the external tariff of CU so that the welfare implications of CU would be unambiguously positive for the insider as well as for the rest of the world. Hence, regionalism becomes a welfare increasing for the insiders and non-welfare reducing for the outsiders. Kemp and Wan (1976) are the first to initiate this literature. Panagariya and Krishna (2001) develop the Kemp-Wan FTA counterpart by maintaining a list of assumptions such as assuming away trade deflection.

magnitude of liberalization of FDI. In this case, a firm headquartered in one of the RIA insiders that has initially undertaken cross-border horizontal expansion to reach the market of another insider might opt now to depend more on trade in carrying out the international commerce. As a result, RIA induces trade creation effect directly through the reduction of the cross-border trade barriers but also indirectly through the reshuffling in the configuration of the international commerce with its partner. In this case, investment diversion effect will be recorded.

The aforementioned linkage of trade creation-investment diversion between the RIA insiders needs not to necessarily arise. Alternative scenarios highlight variant linkages. Consider the case of bi-staged production process of a given industry. Assume that in a pre-RIA setting, a given firm headquartered in one of the RIA insiders has located the downstream stage in another RIA insider counterpart due to industrial agglomeration considerations while keeping the upstream stage in the home country. Lower barriers in cross border trade and a more liberalized FDI environment brought about by RIA will be likely to characterize an outcome of "trade creation-investment creation".

Consider now a scenario that leads to the trade diversion-investment creation outcome between the insiders. Suppose that prior to the implementation of RIA, a firm headquartered in one of the RIA insiders has initially undertaken a horizontal expansion into another RIA insider to internalize the proprietary asset. Consider now the post-implementation period of RIA with the initial transaction costs (that induces the internalization of the firm proprietary asset) being persistent. In this case, the liberalization of FDI associated with national treatment provisions brought about by RIA induces FDI driven by the internalization considerations to operationally manifests itself even more. To the extent that these FDI provisions fostering the internalization incentive outweigh those that facilitate the cross-border trade, the outcome will be characterized by trade diversion-investment creation linkages between the insiders.

Next, we highlight an illustration of the trade diversion-investment creation linkages of the inward international exchange of an RIA insider with an RIA outsider. Suppose in a pre-RIA setting, a firm headquartered in a given RIA outsider initially opts to reach the consumer of an RIA insider *via* exporting. When RIA is implemented, this firm headquartered in the outsider might become out-competed in the RIA insider by firms headquartered in another RIA insider. It might also anticipate compensating protectionist practices by the RIA insiders against the outsiders (e.g. through more acute anti-dumping policies). In this case, the firm headquartered in the outsider might opt not to be engaged in any form of international commerce with the RIA insider or it might opt to adopt a defensive reaction by supplanting trade with FDI[10]. Thus, the outcome will be characterized by trade diversion-investment creation linkage between the outsider and the insider[11].

When investigating the effects of RIAs on each mode of international commerce (i.e. trade and transactions of foreign affiliates of MNEs), it is important to note that the previously illustrated scenarios (as well as other potential scenarios) are not mutually exclusive. The net effects of RIAs on each mode of international commerce become the matter of a descriptive and empirical investigation[12].

2.3.2 The Effects of RIAs: Review of the Empirical Investigations

A massive empirical literature attempts to investigate the effects of various RIAs. Throughout a wide range of this empirical literature, the welfare implications are derived following the analyses of the effects of RIA on international trade. Two different approaches are commonly pursued. The first approach is an *ex-ante* one and consists of implementing simulations of the computable general equilibrium (CGE) to derive *ex-ante* predictions of RIAs (e.g. Brown, Deardorff and Stern, 1992; Brown and Stern, 1989; Cox and Harris, 1985).

The second approach is an *ex-post* positive one. Some of the literature that pursues this approach to analyze the effect of RIA at aggregate industrial levels relies on the conventional gravity model (e.g. Aitken, 1973; Aitken and Obutelewicz, 1977;

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[10] This situation does not deny the presence of the offensive incentives of the firm headquartered in an RIA outsider. The offensive initiatives are mainly motivated by the larger RIA market rendering the FDI to be more attractive than trade in reaching the markets of the RIA insiders.

[11] The outcome of trade diversion-investment creation in the inward international commerce of an insider with an outsider might not necessarily arise. One can construct various scenarios that lead to different outcomes.

Hamilton and Winters, 1992; Frankel and Wei, 1996; Frankel, 1997; Bayoumi and Eichengreen, 1997; Krueger, 1999). In this case, the explanatory variable that captures the effects of RIA is conventionally specified by a dummy variable that takes the value of one for trade observation between two RIA insiders and zero otherwise.

Other literature following the positive approach examines the effects of RIAs using data at higher levels of industrial disaggregation. This literature derives welfare inferences by exploiting the commodity and time variation of tariffs. Clausing (2001a) studies the welfare implication of CUSFTA for the U.S. She examines the effect of the changes in tariffs on the changes in the import levels by relying on a parsimonious demand-supply system. Clausing (2001a) detects significant evidence on the occurrence of trade creation and no evidence on the occurrence of trade diversion. These results convey welfare-improving indication of CUSFTA for the U.S.

Romalis (2005) follows an alternative approach to determine the effects of CUSFTA and the North American Free Trade Agreement (NAFTA) on output, prices and welfare. By estimating commodity demand and supply elasticities, he employs an iterative approach to determine the changes in the supply prices. Then, an iterative approach is followed to determine the effect of CUSFTA/NAFTA on output levels, prices and on welfare where the latter is represented by the national income. Romalis (2005) detects significant effect of CUSFTA/NAFTA on output but a moderate effect on prices. He also finds a moderate effect of CUSFTA/NAFTA on welfare: the increase in the real value of output (hence, trade creation effect) is countered by a loss in tariff revenues or (hence, trade diversion effect).

Another line of empirical analyses studies the effects of RIAs on the flow and stock of FDI. Baldwin, Forslid and Haaland (1996) examine the impact of the 1992's European Single Market Program (ESMP) on FDI in the insiders represented by European Union (EU) countries and in the outsiders represented by the European Free Trade Association (EFTA) countries. Baldwin et al. (1996) outline some empirical evidence of investment creation effect of the ESMP in the EU countries and investment diversion effect of the ESMP in the EFTA countries. Employing a simulation model,

[12] It is important to mention that analyzing the welfare effects of the RIAs through the magnitude of trade and operational FDI dismisses some other sources of potential welfare gain. For example, the RIAs are considered to be conducive catalyst to reap economy of scale and to spur competitiveness and efficiency.

they find that the non-participation of the EFTA countries in the ESMP causes a slight drop in the capital stock while the participation induces a significant surge in the capital stock.

Blomström and Kokko (1997) identify two main offsetting effects of RIAs on FDI. If FDI is initially undertaken to overcome cross-border trade barriers, then reducing these barriers will induce substitution of the international commerce that is conducted *via* FDI by international commerce that is conducted *via* cross-border trade. However, if the initial reason in undertaking FDI is the internalization of the proprietary asset, RIAs might enhance the investment environment and therefore lead to an increase in the flow and stock of FDI and hence the transactions of foreign affiliates of MNEs. The last argument also holds when FDI is vertical in nature and entices cross-border passage of intermediate goods. Blomström and Kokko (1997) find through descriptive analyses that annual bilateral flows of FDI between the U.S. and Canada do not exhibit a clear CUSFTA-related pattern. They also find that the ratio of production of foreign affiliates of U.S. MNEs in Canada to Canada GDP exhibits a decreasing trend following the implementation of CUSFTA. However, Blomström and Kokko (1997) find that the ratio of production of foreign affiliates of Canadian MNEs in the U.S. to the U.S. GDP does not exhibit any clear CUSFTA-related pattern.

Buckley, Clegg, Forsans and Reilly (2004) follow a dynamic empirical method to determine the effects of CUSFTA on the U.S. FDI flow to Canada. Rather than modeling CUSFTA effects as a structural intercept shift, Buckley et al. (2004) assess the impact of CUSFTA through the coefficients of the determinants of FDI flow. The main findings are that CUSFTA has lead to an increase in the responsiveness of the U.S. FDI flow to Canada by a factor of two. Buckley et al. (2004) also find positive effects of the real exchange rate of the Canadian dollar relative to the U.S. dollar, in coherence with the theory that a depreciation of the host country currency will render its assets less expensive. Hence, in this case, FDI gains more attractiveness relative to exporting. Finally, Buckley et al. (2004) find that an increase in the opportunity costs proxied by the values of bonds will induce a retraction in the flow of FDI. Egger and Pfaffermayr (2002) establish a novelty by examining the effect of the 1990's European integration through the employment of a gravity equation to the FDI stock.

One potential effect of RIAs manifests itself through the modifications in the production structure and efficiency. Head and Ries (1999) examine whether CUSFTA prompts efficiency through rationalization of the production structure (i.e. reduction in the number of plants associated with an increase in production per plant). They show that different outcomes are derived from different theoretical frameworks. Head and Ries (1999) find little empirical evidence of the net effect of CUSFTA on the increasing scale of production which they attribute to currency depreciation, undercounting of small firms and the switch toward industries that are characterized with high scale.

An empirical analysis aiming to assess the integral effects of RIAs should simultaneously encompass both channels of international commerce (i.e. cross-border trade and transactions of foreign affiliates of MNEs). Such empirical analysis is still missing from the literature. In addition, utilizing the gravity equation in a cross-sectional empirical setting to assess the effects of RIAs evokes caution. Eichengreen and Irwin (1995) find that RIA dummy variables have positive and significant coefficients long before the implementation of RIA. They propose to control for trade history as a remedy to net the effects of RIAs. These findings convey the requisite to contrast the post-RIA status to the pre-RIA status in order to isolate the effects of RIA. This necessity is yet to be emphasized in the empirical analyses.

2.4 The Home Market Effect

2.4.1 The Home Market Effect: Review of the Theory

Two broad theoretical classes contribute in the explanation of the causes and patterns of international trade. The first class consists of relative cost advantage trade theories: the Ricardian trade theory and the Heckscher–Ohlin trade theory. The Ricardian trade theory states that a country exhibiting comparatively higher technical efficiency in a given sector will be an exporter of the goods produced in that sector. The Heckscher–Ohlin trade theory states that a country with a relative abundance of a production factor has a comparative cost advantage in the sector that uses the abundant factor more intensively. Hence, this country becomes an exporter of goods produced in that sector.

There is a prevalence of one-way trade in both of these relative cost advantage trade theories.

These relative cost advantage trade theories do not explain the considerable amount of trade between developed countries and the large amount of intra-industry trade that arises between them. New trade theories, characterized by imperfect competition, are proposed to explain the causata of trade between countries with similar relative cost advantages and the intra-industry trade phenomenon (e.g. Krugman, 1980; Brander, 1981 and Brander and Krugman, 1983).

Krugman (1980) develops a model based on the Dixit and Stiglitz (1977) monopolistic competition framework featuring IRS and costless product differentiation. First, he considers a basic theoretical setup characterized by two IRS sectors producing differentiated varieties, two countries identical in size with mirror image preferences in the two IRS sectors and one factor of production: labor [13]. The mirror image assumption controls for the disparity in factor prices (i.e. wage rate) and convey the focus to be on the relative market size as dictating patterns of trade in a given IRS sector. Krugman (1980) shows that, in the absence of trade barriers, there is balance in trade at equilibrium in each IRS sector. Once introduced into the model, trade barriers induce the larger market to become a net exporter of the goods produced by the corresponding IRS sector. Krugman (1980) finds that countries with relatively larger market size in a given IRS sector host a disproportional number of firms. In other words, an increase in relative market size leads to an increase in relative production by a factor of more than one for one. As a result, the country with larger market size ends up being a net exporter. This phenomenon is coined "home market effect". The intuitive explanation underlying the home market effect is that there is a tendency for firms to locate in the larger markets in order to circumvent larger barriers in reaching their consumers. At the same time, some firms still opt to produce in the smaller market because of the protection conferred by trade barriers that insinuate them from higher level of competition.

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[13] Brander (1981) and Brander and Krugman (1983) develop an alternative framework based on Cournot competition in segmented markets. Brander (1981) and Brander and Krugman (1983) show that intra-industry trade in homogeneous goods occurs. This phenomenon is coined "reciprocal dumping".

Krugman (1980) considers another theoretical setup characterized by two countries of different size and one IRS sector and one factor of production: labor. When balance in trade is compelled, he finds that the smaller country ends up offering a lower wage to compensate for its locational disadvantage. In other words, lower wages occur to counterbalance the smaller country disadvantage associated with the fact that by allocating the production facility in the smaller market, a larger fraction of firm's output will be facing the cross-border trade barriers.

Helpman and Krugman (1985) extend the analysis of Krugman (1980). Helpman and Krugman (1985) consider a world with two countries and two sectors: IRS sector producing differentiated varieties and constant return to scale (CRS) sector producing homogeneous good and one factor of production: labor. This setup is convenient as freely traded homogeneous good produced with identical technology ensures the equality of the factor price in both countries and insulate the model from factor price endogeneity concerns. The assumption of identical technology in the IRS sector controls for the potential comparative cost advantage in production. Denoting the relative market size of country i to the global market size by s_i and the share of production *within* the national border of country i from global production by x_i, Helpman and Krugman (1985) derive the following fundamental equation

$$x_i = \begin{cases} 0 & \textit{for} \quad s_i \leq \dfrac{\tau^{1-\sigma}}{1+\tau^{1-\sigma}} \\[2ex] \dfrac{1+\tau^{1-\sigma}}{\left(1-\tau^{1-\sigma}\right)} s_i - \dfrac{\tau^{1-\sigma}}{\left(1-\tau^{1-\sigma}\right)} & \textit{for} \quad \dfrac{\tau^{1-\sigma}}{1+\tau^{1-\sigma}} \leq s_i \leq \dfrac{1}{1+\tau^{1-\sigma}} \\[2ex] 1 & \textit{for} \quad s_i \geq \dfrac{1}{1+\tau^{1-\sigma}} \end{cases} \tag{2.1}$$

where $\tau > 1$ and $\sigma > 1$ represent the cross-border trade barriers and the elasticity of substitution, respectively. Equation (2.1) shows that an increase in s_i leads to a more than one for one increase in x_i. Countries with larger market size are therefore *net* exporters in the IRS sector under consideration. These implications are in clear contrast to those derived from traditional trade theories based on the comparative cost advantage where countries with larger markets are net importers.

Another key insight from this equation is that a reduction in trade barriers accentuates the magnitude of the home market effect and consequently leads to the deindustrialization of the smaller country. An intuitive explanation underlines this outcome. Trade barriers provide protection advantage that leads some firms to allocate their production in the smaller country. When trade barriers are lowered, this advantage will be lessened and fewer firms will opt to locate in the smaller market.

The Helpman-Krugman model encompasses a set of assumptions: 1) utility function is characterized by CES across varieties of the IRS sector, 2) trade costs is of iceberg form, 3) trade costs are only occurring in the IRS sector, 4) firms are not engaged in strategic interactions (i.e. each firm is considered to be relatively small to the market), 5) each variety is produced by only one firm, 6) each firm produces one variety and 7) each firm is equivalent to one plant. The last assumption implies that each firm is located in only one market and is serving the foreign market via export. In the Helpman-Krugman model, the cost of setting up a plant in the foreign market is implicitly assumed to be prohibitive.

Some theoretical literature analyzes the robustness of the home market effect phenomenon and the accompanying implications when relaxing some of the aforementioned assumptions of the Helpman-Krugman framework. Davis (1998) examines the prevalence of the home market effect when cross-border trade in the sector producing homogeneous good entails costs. He shows that the home market effect will completely diminish with sufficiently high cross-border trade cost in the sector producing homogeneous good. Starting from a proportional equilibrium, he considers a shift in the production of the IRS sector toward the larger country. This shift results in a reduction of trade costs in the IRS sector in proportion to the difference in relative market sizes, hence, less than one for one. Now, the smaller country pays for its imports of differentiated goods by exporting homogeneous goods to the larger country. As a result, trade costs are incurred in the CRS sector, increasing in one for one proportion with a unit shift. Saving in total costs of trading the differentiated good should offset the new trade costs incurred in trading the homogeneous good. Unless the trade costs of the IRS sector are sufficiently higher than those of CRS sector, the production shift is unprofitable and countries end up producing in proportion to their market size in both sectors.

The challenge of the concept of home market effect phenomenon by Davis (1998) has promoted a response by Krugman and Venables (1999). Krugman and Venables (1999) build a framework with many CRS and IRS sectors. They show that the home market effect is still maintained as long as some of the CRS sectors face low trade costs and/or some of IRS sectors do not entail a fixed cost of entry.

The literature shows that the home market effects does not exclusively emanate from the monopolistic competition framework. Feenstra, Markusen and Rose (1998) consider the reciprocal dumping model of Brander (1981) and Brander and Krugman (1983) where intra-industry trade in homogeneous goods occurs as a result of strategic interaction and markets segmentation. Feenstra et al. (1998) show that the home market effect phenomenon emerges in the reciprocal dumping framework of Brander (1981) and Brander and Krugman (1983).

Head, Mayer and Ries (2002) find that the home market effect is pervasive in different setups. They construct a basic general framework and subject it to the relaxation of assumptions. They first consider the relaxation of the first two of the aforementioned assumptions of the Helpman-Krugman model. Using the monopolistic competition framework of Ottaviano, Tabuchi and Thisse (2002), where the derived demand function is linear, and trade costs are specific, Head et al. (2002) find that larger country runs trade surplus and that the share of production rises disproportionally with the share of consumers. They also reconsider the Brander (1981) framework to relax the first four of the aforementioned assumptions of the Helpman-Krugman model. The home market effect reemerges again. Finally, Head et al. (2002) consider Markusen and Venables (1988) model where the location of production determines the variety (i.e. Armington assumption). They show that the fact that Markusen and Venables model is characterized by imperfect competition, scale economy, and firms' mobility does not necessarily lead to the home market effect phenomenon. The home market effect might be reversed in this case and therefore the larger country might end up being net importers. Hence, Head et al. (2002) show that IRS is necessary but not sufficient condition for the phenomenon of home market effect to arise.

The key feature of the Helpman-Krugman model when allowing for the number of firms to adjust (i.e. long run) is the more than one for one relationship between the relative production share and the relative market share. Firms endogenously reallocate their production facilities disproportionally in the larger market as a response to changes in market size and other exogenous factors. Head and Ries (2001a) analyze the implications of short run IRS model on the home market effect in a given industry. The short run implies that the number of operating firms is not adjusted as a response to changes in the exogenous factors. Head and Ries (2001a) show that the short run prediction of the IRS model is a reversed relationship between the share of production *in* a given country and the relative market size of that country (i.e. less than one for one). This relationship is a common feature of different frameworks with number of firms being fixed[14]. In these frameworks that does not allow the number of firms to adjust, the increase in market size is met by both imports and local production, which implies less than a one for one relationship and hence a reversed home market effect.

The prominence of FDI in international commerce between industrialized countries suggests the need for an analysis of the home market effect when relaxing the seventh of the aforementioned assumptions of the Helpman-Krugman model (i.e. each firm is equivalent to one plant). In this case, firms can serve the foreign market either via export or via horizontal FDI. Therefore, when the second mode of serving the foreign market is selected, a given firm will be equivalent to two plants located in two different countries. The consequence of relaxing the seventh assumption has not been examined in the literature.

2.4.2 The Home Market Effect: Review of the Empirical Investigations

Several empirical applications exploit the home market effect phenomenon to discriminate between competing trade theories (i.e. trade theories based on comparative

[14] For example, in Brander's (1981) reciprocal dumping framework, Feenstra et al. (1998) show that a reversed home market effect occur when the number of firms engaged in Cournot oligopolistic competition is fixed in each country.

cost advantages and new trade theories based on imperfect competition and IRS). Evidence of the home market effect phenomenon can be inferred by testing the effect of relative market size on relative production structure (Davis and Weinstein, 1996; Davis and Weinstein, 1998; Head and Ries, 2001a). It can also be inferred from a higher market size elasticity of export in the industries producing differentiated products (Feenstra et al., 1998).

Davis and Weinstein (1996) evaluate the abilities of the economic geography and the differences in factor endowments (i.e. Heckscher-Ohlin model) to explain the industrial structure across the OECD countries. They start from a hypothesis that differences in factor endowments determine production structure at sectoral level, while the economic geography does so at higher level of disaggregation. An initial test reveals evidence of the home market effect phenomenon. However, this evidence is dissipated once testing the posit that differences in factor endowments also affect the production structure at higher level of disaggregation. Testing the home market effect in a multicountry context is conducted on a relative market size basis. Davis and Weinstein (1996) also test the potential effect of the *absolute* market size on the production structure. Krugman (1980) postulates that, as a result of economic geography, the CRS industries will concentrate in the smaller country while IRS industries do so in the larger country. Therefore, the absolute market size might also matter. Davis and Weinstein (1996) do not find support to Krugman's postulate.

These surprising outcomes describing the minor effect of the economic geography on market structure have lead Davis and Weinstein (1998) to argue that the simplification of the geographic consideration might have driven the initial results of Davis and Weinstein (1996). Davis and Weinstein (1998) go a step further in employing a richer geographical description. Instead of representing the idiosyncratic demand of a given country by its local demand, the idiosyncratic demand of a given country is now represented by the global demand facing the producers in a given location. Davis and Weinstein (1998) show that a richer geographic consideration leads to a support for the economic geography in explaining the market structure.

Head and Ries (1997) show that the relative size of manufacturing industries in Canada as compared to the U.S. have declined following the implementation of

CUSFTA. The downsizing of industries in the smaller market following trade liberalization is consistent with the home market effects. Head and Ries (1997) find that the downsizing is more accentuated in larger industries. Some macroeconomic factors, such as business cycles and exchange rate appreciation, are proposed to explain the decline in the relative size of industries. Head and Ries (1997) show that a combination of tariff reductions and business cycles provides part of the explanation of the decrease in relative size of industries.

Head and Ries (2001a) investigate the relative ability of two alternative models in explaining the Canada-U.S. industrial structure in manufacturing industries: the IRS model and the constant return to scale with national product differentiation (NPD) model. Goods in the NPD model are differentiated by the location of production. Head and Ries (2001a) derive these two models as specific cases of a general setup. The main distinguishing feature between these two models is the variant relationship they generate between the relative market size and the relative production. The IRS model leads to the home market effect as an increase in the relative market size leads to a more than one for one increase in relative production. However, the NPD model generates a "reverse" home market effect as the increase in the relative market size will be met by an increase in supply from both countries implying less than one for one increase in relative production. The empirical results shows that the between-industries' estimates support the long run IRS model while the within-industry estimates confer a support the NPD model. Head and Ries (2001a) realize that findings of less than one for one increase in production share do not necessarily negate the IRS model. They show that such outcome can be generated from the short run version of the IRS models. Therefore, Head and Ries (2001a) conduct an additional test that distinguishes the NPD model from the short run IRS model. Head and Ries (2001a) find an overall support for the NPD model.

Hanson and Xiang (2004) propose a different approach in evaluating the home market effect. Their theoretical setup deviates from the standard Helpman and Krugman (1985) setup (i.e. one IRS industry-one CRS industry setup) by allowing for a continuum of IRS industries with no CRS industry. These industries are identified by the level of cross-border trade barriers they encounter and by the level of product differentiation. This setup renders the wages to be endogenously determined. The Hanson and Xiang

(2004) approach focuses on the *extent* of the home market effect, being more accentuated in the case of high trade barriers and/or low elasticity of substitution industries. Their theoretical prediction is detected empirically through what they termed a difference-in-difference gravity specification. The first difference manifests itself through the relative exports of two countries to a third market in a given industry. In this case, the effect of relative market size of the exporters on the relative exports to the third market is shown to be ambiguous. Using a second difference between relative exports in high trade barriers/ low elasticity of substitution industry and the relative exports in low trade barriers/ high elasticity of substitution industry establishes a clear link. When the home market effect exists, relative market size has a positive effect on the difference-in-difference of exports expression. Hanson and Xiang (2004) conduct an empirical analysis showing strong support for their theory.

Controlling the sources of comparative cost advantage is crucial in the empirical analyses that attempt to test the presence of home market effect. Partial control may lead to biased inferences. The empirical literature on home market effect (Head and Ries, 2001a; Davis and Weinstein, 1996; Davis and Weinstein, 1998) follows a tradition in representing the comparative cost advantages through the neoclassical trade theory (i.e. Heckscher-Ohlin theory). Beside the Heckscher-Ohlin comparative cost advantage, Hanson and Xiang (2004) consider the divergence in unit cost of production as an additional source of comparative cost advantage (i.e. Ricardian technological disparity).

The concept of home market effect is formulated in theoretical setups that do not encompass transactions of foreign affiliates of MNEs. In the original framework of Krugman (1980) and Helpman and Krugman (1985), as well as in subsequent work, a firm is equivalent to one plant located in one country and is serving the foreign markets via cross-border trade. In other words, the location-basis approach is adopted in the home market effect literature. The ownership-basis approach is not examined yet in the home market effect literature.

CHAPTER III

THE THEORETICAL MODEL

3.1 Introduction

International commerce is performed *via* cross-border trade as well as *via* transactions of foreign affiliates of MNEs. However, throughout all the theoretical frameworks used to derive the gravity equation (e.g. Anderson, 1979; Bergstrand, 1989, 1990; Deardorff, 1998; Haveman and Hummels, 2001) and to highlight the home market effect (e.g. Krugman, 1980; Helpman and Krugman, 1985), the location-basis approach in defining international transactions is adopted. The location-basis approach records the transaction between economic agents of being international when they are located in different countries. The location-basis approach dismisses the implications associated with broader sets of international transactions (i.e. transactions of foreign affiliates of MNEs). In addition, these theoretical frameworks assume that all firms are engaged in exporting activities to all trade associates[15].

The non-recognition of FDI through the transactions of foreign affiliates of MNEs in these theoretical setups renders the results derived from the empirical application of the conventional gravity equation dubious. This fact holds in particular in the computation of the magnitude of economic integration through the border effects. After all, FDI constitutes one of the main aspects of globalization. In order to remedy these defects, this chapter relies on the theoretical setup with ownership/nationality-basis approach in defining international transactions. The ownership/nationality-basis

[15]Evans (2001b) realizes that only a fraction of goods that are available domestically are actually traded. Evans (2001b) argues that the magnitude of the border effects reflects the barriers when crossing the international border as well as the divergence in the set of goods that are available at home and those that are internationally traded.

approach records the transaction between economic agents of being international based on their ownership/nationality attributes. Hence, the ownership/nationality criterion is convenient in accounting for the transactions of foreign affiliates of MNEs.

As the empirical application is to be carried out for the industrialized OECD countries at high level of industrial aggregation, a modified framework of the new trade theory becomes relevant. The basic theoretical setup of Helpman et al. (2004) that encompasses the transactions of foreign affiliates of MNEs and allows for firms not to be engaged in any form of international commerce with a given commerce associate provides is convenient. In this basic theoretical setup, the option of whether to export or to foreign direct invest to reach the consumers of a given commerce associate is determined through the celebrated proximity-concentration trade-off framework. Heterogeneity is assumed across firms in order to obtain mixed equilibrium with some firms opting to export, to foreign direct invest and not to be engaged in any form of international commerce with a given commerce associate. Heterogeneity across firms is specified through the productivity attribute.

While the initial objective is to derive the ownership-basis gravity equation, the ownership-basis framework compels further theoretical exercises. This chapter exploits the ownership-basis framework to build theoretical indices that reflect barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce. In addition, this chapter analyzes the home market effect in the ownership-basis framework (Krugman, 1980; Helpman and Krugman, 1985). There are two criteria that can be distinguished in analyzing the phenomena of the home market effect in the ownership-basis framework: the location-basis criterion and the ownership-basis criterion. The location-basis home market effect implies that an increase in relative market size of a given economic entity induces more than one for one increase in the share of total production *within* this economic entity. The ownership-basis home market effect implies that an increase in relative market size of a given economic entity induces more than one for one increase in the share of total production by firms owned by this economic entity.

The rest of this chapter is organized as follows. Section 3.2 discusses the necessity to introduce heterogeneity across firms in order to obtain a mixed equilibrium.

Section 3.3 develops the basic theoretical setup. Section 3.4 retrieves the ownership-basis gravity equation. Section 3.5 retrieves identical ownership-basis gravity equation from an alternative theoretical setup where heterogeneity across firms is specified through a fixed cost attribute. Section 3.6 exploits the ownership-basis gravity equation to develop readily theoretical measures of the barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce. Section 3.7 analyzes the location-basis and the ownership-basis home market effect through the ownership-basis framework. Section 3.8 concludes this chapter.

3.2 Homogeneous or Heterogeneous Firms?

The methodology followed in this chapter is to modify a conventional trade framework to account for the transactions of foreign affiliates of MNEs. The basic theoretical setup of Helpman et al. (2004) characterized by multi-sector multi-country general equilibrium, Dixit and Stiglitz (1977) monopolistic competition with constant elasticity of substitution (CES) preferences across varieties and heterogeneous firms is adopted[16]. This framework generates intra-industrial international commerce and is compatible with our datasets covering industrialized OECD countries in the manufacturing sector. The motives to invest abroad versus exporting are explained by the proximity-concentration trade-off hypothesis (Krugman, 1983; Brainard, 1993 and 1997)[17]. FDI is represented in the horizontal form.

The basic theoretical setup of Helpman et al. (2004) generates a mixed equilibrium where exporting and FDI coexist. Does the existence of mixed equilibrium requires a setup with heterogeneous firms in a monopolistic competition framework? To

[16] The basic theoretical setup of Helpman et al. (2004) draws on the dynamic industry model initially developed by Hopenhayn (1992) in a perfect competition framework and extended by Melitz (2002) to a Dixit and Stiglitz (1977) monopolistic competition framework. In both of these frameworks, cross border trade is assumed to be the sole channel of international commerce. Helpman et al. (2004) modify Melitz (2002) model of monopolistic competition by considering the transactions of foreign affiliates of MNEs as alternative channel of international commerce to cross-border trade. Helpman et al. (2004) also modify the dynamic aspect of the Melitz (2002) model toward a static aspect.

[17] Selecting this particular framework does not deny the contribution of the other causata of trade and FDI (e.g. relative cost advantage theories) in explaining the observed patterns of international commerce. We rely on the empirical and accounting techniques to compensate for the theoretical deficiency.

answer this question, two cases with homogeneous firms are considered. Consider the first case with no entry and exit adjustments (i.e. fixed number of firms). To describe the implications in this case, we build on the example provided by Head and Ries (2004). Consider an initial situation of pure long-run equilibrium where all firms opt to penetrate the foreign market via exporting. This initial situation implicitly implies prohibitive barriers to establish production facilities abroad. Now, consider a removal of the barriers to invest abroad. A sequential switch of homogeneous firms from exporting to horizontal FDI leads to a hybrid outcome. Only a fraction of firms will end up producing abroad. The underlying intuition is that the sequential switch from exporting to horizontal FDI intensifies the competition in the foreign market. Therefore, it renders the overseas investment continuously less attractive. This process continues up to the point where it is not profitable anymore for the marginal firm to incur the cost of establishing production facility abroad by switching into the horizontal FDI mode. This effect is termed "market crowding effect". Brainard (1993) obtains mixed equilibrium with homogeneous firms in a monopolistic competition framework by holding the total number of firms constant.

Now, consider the second case with long-run adjustment characterized by free entry and exit. In this case, the homogeneity assumption does not lead to a mixed equilibrium outcome where export and FDI coexist. Instead, there is a pure equilibrium where all firms either export or horizontally invest abroad. For illustration, consider an initial situation of pure long-run equilibrium where all firms opt to export due to prohibitive fixed costs of investing abroad. Now, assume that the barriers to invest abroad are removed and that there is a continuous switch by firms from exporting to horizontal FDI in serving the foreign market. Where does this switching activities halt? The increase in horizontal FDI and the resulting intensification of the competition will drive some of the local firms of the host country out of the market. Therefore, the marginal firm, which has previously opted to remain exporter, finds it more profitable to switch to overseas production. Continuous iterations will eventually lead to a pure horizontal FDI equilibrium. As our theoretical framework has a long-run aspect characterized by entry and exit adjustment, a mixed equilibrium requires heterogeneity across firms[18]. A final note is that free entry and exit condition with homogeneous firms does not necessarily lead to pure equilibrium in other theoretical frameworks. For example, Markusen (1984) obtains a mixed equilibrium in a Cournot oligopoly framework with free entry and exit and homogeneous firms.

3.3 The Basic Theoretical Setup

My theoretical framework is built on the Helpman et al. (2004) theoretical setup. Consider a hypothetical world with M countries. Labor is the sole factor of production. A given country i is endowed with L_i units of labor. There are $K+1$ sectors. One sector produces a homogeneous good with constant returns to scale (CRS). The other K sectors are characterized by differentiated products and increasing return to scale (IRS). Conventional work using the differentiated product framework assumes that each firm is equivalent to one variety as well as to one plant. Therefore, each firm is only producing in one market and is serving the other markets via export. In this case, the cost of setting up a plant in other markets is implicitly assumed to be prohibitive. In my proposed framework that encompasses the transactions of foreign affiliates of MNEs, each firm is still equivalent to one variety but is not necessarily equivalent to one plant. For a given sector k, the number of firms headquartered in country i (and equivalently the number of varieties produced by firms headquartered in country i) is denoted by n_{ik}.

A two-tier utility function is assumed. The upper tier is a Cobb-Douglas utility function. Hence, the share of total expenditure consumers allocated for a given sector is exogenous. The upper-tier utility function for country i is

$$\ln U_i = \sum_k \varsigma_i^k \ln C_i^k + \left(1 - \sum_k \varsigma_i^k\right) \ln Q_i \tag{3.1}$$

[18] Heterogeneous firms are introduced in various studies and have lead to a concomitant export and production abroad. Helpman et al. (2003) and Head and Ries (2003) do so when testing the hypothesis that firms with higher productivity are engaged in foreign activities (i.e. exports or FDI) and firms with highest productivity undertake FDI. In both papers, firms are distributed over a spectrum of productivity defined as units of output per unit of labour.

where C_i^k is a composite consumption level of varieties in the IRS sector k producing differentiated products, Q_i represents the consumption level of the homogeneous good and ς_i^k is the share of total expenditure associated with a given IRS sector k. For sector k, preferences are characterized by a CES of σ^k between varieties. The lower-tier utility function of the sector k is

$$C_i^k = \left\{ \int_{v_i^k} c_i\left(v_i^k\right)^{\frac{1}{\theta^k}} dv_i^k + \sum_{s \neq i} \left[\int_{v_s^k} c_i\left(v_s^k\right)^{\frac{1}{\theta^k}} dv_s^k \right] \right\}^{\theta^k} \tag{3.2}$$

where $\theta^k = \sigma^k / \left(\sigma^k - 1\right)$, $c_i\left(v_i^k\right)$ and $c_i\left(v_j^k\right)$ are the consumption levels of country i consumers for a variety v_i^k produced by firms headquartered in country i and for a variety v_j^k produced by firms headquartered in country j in a given sector k, respectively. In what follows, the sector superscript k is dropped as the theoretical analysis is carried out for a representative industry.

Delivering goods from one location to the other is assumed to be subjected to the conventional iceberg costs. When $\tau_{ij}^X > 1$ units are shipped from country j to country i one unit reaches the country of destination (i.e. a fraction of $\left(\tau_{ij}^X - 1\right)/\tau_{ij}^X$ is melted along the way). In other words, exporting goods from country j to country i faces an *ad valorem* trade barriers equivalent to τ_{ij}^X. The trade barriers are made up of costs associated with international distance, trade policy and other social, geographic, institutional and cultural barriers. Similarly, delivering goods produced by foreign affiliates of country j MNEs to country i consumers is subjected to iceberg cost of $\tau_{ij}^I > 1$. The barriers accompanying the sales of foreign affiliates of MNEs are made up of costs associated with intranational distance, discriminatory policy of *ad valorem* nature, such as supplementary tax on profits of foreign affiliates as well as other social, geographic, institutional and cultural barriers. The iceberg cost is extended to intranational delivery to the domestic consumers and assumed to be mainly due to intranational transportation distance costs. The intranational iceberg cost for country i is depicted by $\tau_{ii} > 1$.

The total expenditure by consumers of country i in the IRS sector under consideration is depicted by E_i. Maximizing the lower-tier utility function subject to the budget constraint yields the optimal consumption levels. The consumption level by country i consumers of a variety v_i produced by a domestic firm headquartered in country i is

$$c_i(v_i) = \frac{(p_i(v_i)\tau_{ii})^{-\sigma}}{P_i^{1-\sigma}} E_i \tag{3.3}$$

where $P_i = \left(\int_{v_i} (p_i(v_i)\tau_{ii})^{1-\sigma} + \int_{v_s^X, s \neq i} (p_i(v_s^X)\tau_{is}^X)^{1-\sigma} + \int_{v_s^I, s \neq i} (p_i(v_s^I)\tau_{is}^I)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$ is the CES consumer price index for country i, $p_i(v_s^X)$ is the producer price of exported variety v_s^X produced by firm headquartered in country s and $p_i(v_s^I)$ is the producer price of variety v_s^I produced by a firm headquartered in country s *via* FDI in country i. The consumption levels of variety v_j produced by a firm headquartered in country j by consumers of country i if exported or produced through horizontal FDI are respectively

$$c_i(v_j^X) = \frac{(p_i(v_j^X)\tau_{ij}^X)^{-\sigma}}{P_i^{1-\sigma}} E_i, \tag{3.4}$$

$$c_i(v_j^I) = \frac{(p_i(v_j^I)\tau_{ij}^I)^{-\sigma}}{P_i^{1-\sigma}} E_i. \tag{3.5}$$

Following Helpman et al. (2004), the productivity attribute, defined as units of output per unit of labour, is selected to reflect heterogeneity across firms. This setup leads to mixed equilibrium where some firms are exporting, foreign direct investing and not engaging in any form of international commerce with a given commerce associate[19].

The productivity of a firm headquartered in country j and producing variety v_j is denoted by $\gamma(v_j)$. At the moment of entry, a firm conceiving to headquarter in country j and producing variety v_j is assumed to draw its productivity from a distribution function $H_j(\gamma)$. Prior to the draw, the potential entrant must incur the industry specific establishment cost (or entry cost) in country j that consists of corporate fixed cost denoted by κ_j.

Corporate fixed cost is associated with proprietary and knowledge-based asset development. It includes initial R&D expenditures (such as variety development and prototype design), initial information costs, creation of business routine, reputation and other organizational activities. The knowledge based asset has a public good aspect of being non-exclusive. Once it is incurred, it can be supplied costlessly to any production facility. Depending on the drawn productivity level, the potential entrant may decide to operate or not.

Without loss of generality, all countries are assumed to have identical technology in the CRS sector. This assumption leads to wage-equalization across countries. The wages are normalized to unity. The introduction of a sector producing homogeneous good in this theoretical setup is convenient as it insulates the model from price endogeneity concerns.

Once decided to operate, a firm must incur plant fixed cost φ_j and distribution and marketing fixed cost λ_j to initiate production aiming to serve the domestic market. Plant fixed cost, φ_j, represents machinery and tangible asset requirements to initiate production. Marketing and distribution fixed cost consists of initial market information cost and the establishment of marketing and service networks.

Exporting necessitates a fixed cost of λ_{ij}^X resulting from the unfamiliarity with the foreign market and the extra information costs required on the foreign market when establishing the marketing and the distribution network. The configuration of fixed costs

[19] An alternative approach based on heterogeneity in the fixed costs is presented in section 3.5.

incurred when investing abroad consists of : 1) plant fixed cost, φ_j, scaled by a factor of $\delta_{ij}^I > 1$ to reflect the direct restriction on foreign ownership of capital and 2) marketing and distribution fixed cost incurred when exporting (i.e. λ_{ij}^X), additively augmented by λ_{ij}^I due to the direct engagement considerations when producing abroad. Hence, the total fixed cost incurred when producing abroad becomes $\delta_{ij}^I \varphi_j + \lambda_{ij}^X + \lambda_{ij}^I$[20].

A convenient way to explicitly represent prices and mark-ups in terms of productivity is to adopt the monopolistic competition mark-up pricing. The monopolistic competition setup assumes that the number of varieties is large enough so that the elasticity of substitution approximates the price elasticity of demand (Helpman and Krugman, 1985)[21]. For a firm headquartered in country j and producing variety v_j, the producer price become

$$p(v_j) = \theta \gamma (v_j)^{-1}. \tag{3.6}$$

With exogenous elasticity of substitution, the mark-ups is fixed. It is independent of the number of firms operating in the market under consideration. The reason why the mark-up persists as the number of firms increases is that consumers perceive each product as being differentiated.

The next step is to determine the critical productivities leading to a categorization firms into those that opt non-engagement in international commerce,

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[20] One can also think of other costs incurred by firms investing abroad such as the costs associated with the potential limitation of foreign firms to: access public sector contracts, to enjoy investment protection schemes, to hire foreign labour, to establish contractual arrangements with local firms and other discriminatory treatment.

[21] Assuming that the firms perceive the sectoral expenditure E_i to be exogenous, the price elasticity of demand facing each firm is derived from equation (3.4) as

$$\xi = \sigma + \frac{p_i(v_i)^{1-\sigma}}{P_i^{1-\sigma}}(1-\sigma).$$

Hence, when the number of varieties is large, the second term becomes negligible.

export and foreign direct invest. For a firm headquartered in country j and producing variety v_j, the operational profit derived from serving the local market is

$$\pi_j(v_j) = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)\gamma(v_j)^{\sigma-1}(\tau_{jj})^{1-\sigma}\frac{E_j}{P_j^{1-\sigma}} - \varphi_j - \lambda_j . \tag{3.7}$$

The supplementary profits of this firm headquartered in country j and producing variety v_j, from serving country i's consumers through exporting or foreign direct investing are respectively

$$\pi_i^X(v_j) = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)\gamma(v_j)^{\sigma-1}\left(\tau_{ij}^X\right)^{1-\sigma}\frac{E_i}{P_i^{1-\sigma}} - \lambda_{ij}^X , \tag{3.8}$$

$$\pi_i^I(v_j) = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)\gamma(v_j)^{\sigma-1}\left(\tau_{ij}^I\right)^{1-\sigma}\frac{E_i}{P_i^{1-\sigma}} - \delta_{ij}^I\varphi_j - \lambda_{ij}^X - \lambda_{ij}^I . \tag{3.9}$$

The boundary productivity level of a firm headquartered in country j that opts to operate is denoted by $\hat{\gamma}_j^N$. It is determined by $\pi_j(v_j) = 0$. We get

$$\left(\hat{\gamma}_j^N\right)^{\sigma-1} = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)^{-1}(\tau_{jj})^{\sigma-1}(\varphi_j + \lambda_j)\left(\frac{E_j}{P_j^{1-\sigma}}\right)^{-1} . \tag{3.10}$$

The boundary productivity level of a firm headquartered in country j indifferent between non-engagement in international commerce with country i and exporting to country i is determined through the equation $\pi_i^X(v_j) = 0$. Denoting the boundary productivity to export by $\hat{\gamma}_{ij}^X$, we get

$$\left(\hat{\gamma}_{ij}^{X}\right)^{\sigma-1} = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)^{-1}\left(\tau_{ij}^{X}\right)^{\sigma-1}\lambda_{ij}^{X}\left(\frac{E_i}{P_i^{1-\sigma}}\right)^{-1}. \tag{3.11}$$

The boundary productivity of a firm headquartered in country j indifferent between exporting and foreign direct investing is determined through the equation $\pi_i^X\left(v_j\right) = \pi_i^I\left(v_j\right)$. Denoting this boundary productivity by $\hat{\gamma}_{ij}^{I}$, we get

$$\left(\hat{\gamma}_{ij}^{I}\right)^{\sigma-1} = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)^{-1}.\left[\delta_{ij}^{I}\varphi_j + \lambda_{ij}^{I}\right]\left[\frac{E_i}{P_i^{1-\sigma}}\left(\left(\tau_{ij}^{I}\right)^{1-\sigma} - \left(\tau_{ij}^{X}\right)^{1-\sigma}\right)\right]^{-1}. \tag{3.12}$$

Besides the zero cut-off profit conditions, there exists a free entry condition. The equilibrium is realized when country j's potential entrant perceives the net value of entry, υ_j, of being zero. The net value of entry is given by

$$\upsilon_j = \int_{\hat{\gamma}_j^N}^{\infty} \pi_j dH_j(\gamma) + \sum_{s \neq j} \int_{\hat{\gamma}_{sj}^X}^{\hat{\gamma}_{sj}^I} \pi_{sj}^X dH_j(\gamma) + \sum_{s \neq j} \int_{\hat{\gamma}_{sj}^I}^{\infty} \pi_{sj}^I dH_j(\gamma) - \kappa_j = 0 \text{ [22]}. \tag{3.13}$$

3.4 Retrieving the Ownership-Basis Gravity Equation

Previous literature derives the gravity model from different theoretical frameworks (e.g. Anderson, 1979; Bergstrand, 1989, 1990; Deardorff, 1998; Haveman and Hummels, 2001). However, the theoretical setups in this literature adopt the location-basis approach in defining international transactions and hence do not encompass the operational aspect of FDI (i.e. transactions of foreign affiliates of MNEs). These theoretical setups assume that all firms export to all destinations. This section retrieves the gravity equation when the roles of FDI and non-engagement in international commerce are acknowledged. As a result, the gravity model becomes an empirical

[22] The equilibrium in this model can be interpreted in a context of dynamic industry model *á la* Hopenhayn (1992) and Melitz (2002) by letting the incumbent firms be subjected to a probability of exit shocks and by introducing the time dimension into equation (3.13). This setup leads the equilibrium to be interpreted as a long-run steady state equilibrium.

device that explains international commerce rather than cross-border trade. Let the value of imports of country i from country j be depicted by $import_{ij}$. Also, let the sales of foreign affiliates of firms headquartered in country j to country i consumers be depicted by $sale_{ij}$. We have

$$\begin{aligned} import_{ij} &= \frac{E_i}{P_i^{1-\sigma}}\left(\tau_{ij}^X\right)^{1-\sigma} \int_{\hat{\gamma}_{ij}^X}^{\hat{\gamma}_{ij}^I} \theta^{1-\sigma}\gamma^{\sigma-1} n_j dH_j(\gamma) \\ &= n_j \frac{E_i}{P_i^{1-\sigma}}\left(\theta\tau_{ij}^X\right)^{1-\sigma} \int_{\hat{\gamma}_{ij}^X}^{\hat{\gamma}_{ij}^I} \gamma^{\sigma-1} dH_j(\gamma), \end{aligned} \tag{3.14}$$

$$\begin{aligned} sale_{ij} &= \frac{E_i}{P_i^{1-\sigma}}\left(\tau_{ij}^I\right)^{1-\sigma} \int_{\hat{\gamma}_{ij}^I}^{\infty} \theta^{1-\sigma}\gamma^{\sigma-1} n_j dH_j(\gamma) \\ &= n_j \frac{E_i}{P_i^{1-\sigma}}\left(\theta\tau_{ij}^I\right)^{1-\sigma} \int_{\hat{\gamma}_{ij}^X}^{\hat{\gamma}_{ij}^I} \gamma^{\sigma-1} dH_j(\gamma). \end{aligned} \tag{3.15}$$

Finally, let the sales of firms headquartered in country i to their local market be denoted by $commerce_{ii}$. We get

$$\begin{aligned} commerce_{ii} &= \frac{E_i}{P_i^{1-\sigma}}\tau_{ii}^{1-\sigma} \int_{\hat{\gamma}_i^N}^{\infty} \theta^{1-\sigma}\gamma^{\sigma-1} n_i dH_j(\gamma) \\ &= n_i \frac{E_i}{P_i^{1-\sigma}}\left(\theta\tau_{ii}\right)^{1-\sigma} \int_{\hat{\gamma}_i^N}^{\infty} \gamma^{\sigma-1} dH_j(\gamma). \end{aligned} \tag{3.16}$$

The "nominal" total number of firms headquartered in country j, n_j, is solved by relying on the market clearing condition. The total sales of the firms headquartered in country j is equated to the total purchases by all commerce associates including intranational commerce. Let the total global sales of firms headquartered in country j be denoted by Y_j. We obtain

$$n_j = \theta^{\sigma-1} Y_j \left\{ \begin{array}{l} \frac{E_j}{P_j^{1-\sigma}} \tau_{jj}^{1-\sigma} \int_{\hat{\gamma}_j^N}^{\infty} \gamma^{\sigma-1} dH_j(\gamma) + \\ \sum_{s \neq j} \frac{E_s}{P_s^{1-\sigma}} \left[\left(\tau_{sj}^X\right)^{1-\sigma} \int_{\hat{\gamma}_{sj}^X}^{\hat{\gamma}_{sj}^I} \gamma^{\sigma-1} dH_j(\gamma) + \left(\tau_{ij}^I\right)^{1-\sigma} \int_{\hat{\gamma}_{sj}^I}^{\infty} \gamma^{\sigma-1} dH_j(\gamma) \right] \end{array} \right\}^{-1}. \quad (3.17)$$

The CES-scaled productivity of a firm headquartered in country j and producing variety v_j is defined by $\gamma(v_j)^{\sigma-1}$. The expression $n_j \int_{\hat{\gamma}_j^N}^{\infty} \gamma^{\sigma-1} dH_j(\gamma)$ is interpreted as the total "effective" number of firms headquartered in country j. Hence, the "effective" number of firms headquartered in country j opting to export and invest abroad become $n_j \int_{\hat{\gamma}_{ij}^X}^{\hat{\gamma}_{ij}^I} \gamma^{\sigma-1} dH_j(\gamma)$ and $n_j \int_{\hat{\gamma}_{ij}^I}^{\infty} \gamma^{\sigma-1} dH_j(\gamma)$, respectively. This setup leads to the generation of the "effective fractions" of firms headquartered in country j opting not to be engaged in international commerce with country i, to export to country i and foreign direct invest in country i. These effective fractions are denoted by g_{ij}^N, g_{ij}^X and g_{ij}^I, respectively. We get

$$g_{ij}^N = \frac{\int_{\hat{\gamma}_j^N}^{\hat{\gamma}_{ij}^X} \gamma^{\sigma-1} dH_j(\gamma)}{\int_{\hat{\gamma}_j^N}^{\infty} \gamma^{\sigma-1} dH_j(\gamma)}, \quad (3.18)$$

$$g_{ij}^X = \frac{\int_{\hat{\gamma}_{ij}^X}^{\hat{\gamma}_{ij}^I} \gamma^{\sigma-1} dH_j(\gamma)}{\int_{\hat{\gamma}_j^N}^{\infty} \gamma^{\sigma-1} dH_j(\gamma)}, \quad (3.19)$$

$$g_{ij}^I = \frac{\int_{\hat{\gamma}_{ij}^I}^{\infty} \gamma^{\sigma-1} dH_j(\gamma)}{\int_{\hat{\gamma}_j^N}^{\infty} \gamma^{\sigma-1} dH_j(\gamma)}. \quad (3.20)$$

Letting $Z_{ij} = \left[g_{ij}^X\left(\tau_{ij}^X\right)^{1-\sigma} + g_{ij}^I\left(\tau_{ij}^I\right)^{1-\sigma}\right]^{-1}$, we can write

$$n_j = \frac{\theta^{\sigma-1}Y_j}{\int_{\gamma_j^N}^{\infty}\gamma^{\sigma-1}dH_j(\gamma)\left(\frac{E_j}{P_j^{1-\sigma}}\tau_{jj}^{1-\sigma} + \sum_{s\neq j}\frac{E_s}{P_s^{1-\sigma}}Z_{sj}^{-1}\right)}. \tag{3.21}$$

As in the previous literature, we assume a multiplicative decomposition of the current barriers in international commerce into those captured by a distance function $dist_{ij}^{\chi}$ and remainder term representing the policy-related barriers denoted by t_{ij}^X and t_{ij}^I for cross-border trade and sales of foreign affiliates, respectively. Hence, we have $\tau_{ii} = dist_{ii}^{\chi}$ and $\tau_{ij}^X = dist_{ij}^{\chi}t_{ij}^X$ and $\tau_{ij}^I = dist_{ii}^{\chi}t_{ij}^I$.

The common term *commerce* is used to represent the three different potential types of commerce: intranational commerce, international commerce *via* cross-border trade and international commerce *via* transactions of foreign affiliates of MNEs. Letting $\Omega_j = \left(\frac{E_j}{P_j^{1-\sigma}}\tau_{jj}^{1-\sigma} + \sum_{s\neq j}\frac{E_s}{P_s^{1-\sigma}}Z_{sj}^{-1}\right)^{1/(1-\sigma)}$ to denote the CES "supply index" of the producer, the *trichotomized* version of the theoretical ownership-basis gravity equation becomes

$$commerce_{ij} = \begin{cases} \dfrac{E_iY_i}{\left(P_i\Omega_i\right)^{1-\sigma}}dist_{ii}^{\chi(1-\sigma)} & if\ i = j \\ \dfrac{E_iY_j}{\left(P_i\Omega_j\right)^{1-\sigma}}dist_{ij}^{\chi(1-\sigma)}g_{ij}^X\left(t_{ij}^X\right)^{1-\sigma} & if\ i \neq j,\ commerce_{ij} = import_{ij}\,. \\ \dfrac{E_iY_j}{\left(P_i\Omega_j\right)^{1-\sigma}}dist_{ii}^{\chi(1-\sigma)}g_{ij}^I\left(t_{ij}^I\right)^{1-\sigma} & if\ i \neq j,\ commerce_{ij} = sale_{ij} \end{cases} \tag{3.22}$$

The ownership-basis gravity equation can be displayed in a parallel *dichotomized* version that presents the international commerce as an aggregate of cross-border trade and transactions of foreign affiliates of MNEs (i.e. $commerce_{ij}^{A} = import_{ij} + sale_{ij}$). The *dichotomized* ownership-basis gravity equation becomes

$$commerce_{ij}^{A} = \begin{cases} \dfrac{E_i Y_i}{\left(P_i \Omega_i\right)^{1-\sigma}} dist_{ii}^{\chi(1-\sigma)} & \text{if } i = j \\ \\ \dfrac{E_i Y_j}{\left(P_i \Omega_j\right)^{1-\sigma}} \left(dist_{ij}^{\chi(1-\sigma)} g_{ij}^{X} \left(t_{ij}^{X}\right)^{1-\sigma} + dist_{ii}^{\chi(1-\sigma)} g_{ij}^{I} \left(t_{ij}^{I}\right)^{1-\sigma} \right) & \text{if } i \neq j \end{cases} . \quad (3.23)$$

It is easy to notice that in the absence of FDI (i.e. $g_{ij}^{I} = 0$, $\forall i \neq j$) and when all firms in one country are exporting to all destinations (i.e. $g^{X} = 1$, $\forall i \neq j$), the ownership-basis gravity equation (3.23) will converge to the conventional form of the gravity equation. Equation (3.23) shows that the distance separating the consumers of one country and the producers of the other country is endogenously determined. The same note holds for the overall barriers separating the producers of one country and the consumers of the other country.

3.5 The Ownership-Basis Gravity Equation from Alternative Theoretical Setup

This section outlines the alternative method of deriving the ownership-basis gravity equation when heterogeneity is introduced through a fixed cost attribute. There are variants of fixed cost specifications to capture heterogeneity. Therefore, our approach is illustrative.

We assumed that all firms headquartered in a given country s have identical productivity γ_s. The assumption that all countries have identical technology in the CRS resulting in a cross country equalized wages is maintained. The wages are normalized to unity.

The heterogeneity of firms is attributed to their capacity in conducting business abroad. The idiosyncratic capacity to conduct business abroad is depicted by the factor μ^{-1}. It is assumed that at the moment of entry, a potential entrant conceiving to be headquartered in country j and to produce variety v_j draws the inverse of their capacity factor to conduct business abroad from a distribution $G_j(\mu^{-1}) = G(\mu^{-1}; \alpha_j, \beta_j)$ where α_j is the country specific shape parameter and $\beta_j \geq 1$ is the country specific scale parameter of the distribution $G_j(\mu)$. The idiosyncratic capacity of this firm to conduct business abroad is denoted by $\mu(v_j)^{-1}$.

For this potential firm under consideration, the fixed cost when exporting to country i consists of an exporting fixed cost basis $\tilde{\lambda}_{ij}^X$ magnified by the inverse of the firm idiosyncratic capacity factor. Hence, the idiosyncratic fixed cost incurred by the firm associated with country j in exporting to country i becomes $\mu(v_j)\tilde{\lambda}_{ij}^X$.

The fixed cost incurred by this potential firm when undertaking FDI in country i comprises two components. The first component consists of the plant fixed cost φ_j scaled by a factor $\delta_{ij}^I > 1$ to reflect the direct restriction on the foreign ownership of capital. The second component is idiosyncratic. As a reflection of the higher social and business fixed costs when engaging in direct production in country i, the exporting fixed cost basis $\tilde{\lambda}_{ij}^X$ is increased by $\tilde{\lambda}_{ij}^I$. Hence, for this firm conceiving to produce variety v_j, the idiosyncratic fixed cost when investing abroad becomes $\mu(v_j)(\tilde{\lambda}_{ij}^X + \tilde{\lambda}_{ij}^I)$.

Adopting the monopolistic competition mark-up pricing, the profit derived by firms producing variety v_j from serving their domestic market becomes

$$\pi_j(v_j) = \pi_j = (\theta^{1-\sigma} - \theta^{-\sigma})\gamma_j^{\sigma-1}(\tau_{jj})^{1-\sigma}\frac{E_j}{P_j^{1-\sigma}} - \kappa_j - \varphi_j - \lambda_j. \qquad (3.24)$$

Supplementary profits of this firm producing variety v_j from serving country i's consumers by exporting or foreign direct investing are respectively given by

$$\pi_i^X(v_j) = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)\gamma_j^{\sigma-1}\left(\tau_{ij}^X\right)^{1-\sigma}\frac{E_i}{P_i^{1-\sigma}} - \mu(v_j)\tilde{\lambda}_{ij}^X, \tag{3.25}$$

$$\pi_i^I(v_j) = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)\gamma_j^{\sigma-1}\left(\tau_{ij}^I\right)^{1-\sigma}\frac{E_i}{P_i^{1-\sigma}} - \delta_{ij}^I\varphi_j - \mu(v_j)\left(\tilde{\lambda}_{ij}^I + \tilde{\lambda}_{ij}^X\right). \tag{3.26}$$

The boundary idiosyncratic capacity factor of a firm headquartered in country j indifferent between merely operating at the domestic level and exporting to country i is denoted by $\hat{\mu}_{ij}^X$. It is determined through the equation $\pi_i^X(v_j) = 0$. The boundary capacity factor becomes

$$\hat{\mu}_{ij}^X = \left(\theta^{1-\sigma} - \theta^{-\sigma}\right)\gamma_j^{\sigma-1}\left(\tau_{ij}^X\right)^{1-\sigma}\frac{E_i}{P_i^{1-\sigma}}\frac{1}{\tilde{\lambda}_{ij}^X}. \tag{3.27}$$

The boundary idiosyncratic capacity factor of a firm headquartered in country j indifferent between exporting and foreign direct investing is denoted by $\hat{\mu}_{ij}^I$. It is determined through the equation $\pi_i^X(v_j) = \pi_i^I(v_j)$. In this case, the boundary capacity factor is given by

$$\hat{\mu}_{ij}^I = \frac{1}{\tilde{\lambda}_{ij}^I}\left[\gamma_j^{\sigma-1}\left(\theta^{1-\sigma} - \theta^{-\sigma}\right)\left[\left(\tau_{ij}^I\right)^{1-\sigma} - \left(\tau_{ij}^X\right)^{1-\sigma}\right]\frac{E_i}{P_i^{1-\sigma}} - \delta_{ij}^I\varphi_j\right]. \tag{3.28}$$

The fraction of country j's firms opting not to be engaged in any form of international commerce with country i is determined as

$$g_{ij}^N = G\left(\left(\hat{\mu}_{ij}^X\right)^{-1};\alpha_j,\beta_j\right). \tag{3.29}$$

The fractions of country j's firms that opt to export to country i and foreign direct invest in country i become respectively

$$g_{ij}^{X} = G\left(\left(\hat{\mu}_{ij}^{I}\right)^{-1};\alpha_j,\beta_j\right) - G\left(\left(\hat{\mu}_{ij}^{X}\right)^{-1};\alpha_j,\beta_j\right), \tag{3.30}$$

$$g_{ij}^{I} = 1 - G\left(\left(\hat{\mu}_{ij}^{I}\right)^{-1};\alpha_j,\beta_j\right). \tag{3.31}$$

The value of intranational commerce conducted by firms headquartered in country j, the value of exports by firms headquartered in country j to country i, and the value of sales of foreign affiliates of firms headquartered in country j to country i become respectively

$$commerce_{ii} = n_i\left(\theta\gamma_i\right)^{1-\sigma}\frac{E_i}{P_i^{1-\sigma}}\tau_{ii}^{1-\sigma}, \tag{3.32}$$

$$import_{ij} = g_{ij}^{X} n_j\left(\theta\gamma_j\right)^{1-\sigma}\frac{E_j}{P_j^{1-\sigma}}\left(\tau_{ij}^{X}\right)^{1-\sigma}, \tag{3.33}$$

$$sale_{ij} = g_{ij}^{I} n_j\left(\theta\gamma_j\right)^{1-\sigma}\frac{E_j}{P_j^{1-\sigma}}\left(\tau_{ij}^{I}\right)^{1-\sigma}. \tag{3.34}$$

The total number of firms headquartered in country j is solved through the market clearing condition by equating country j total sales to the total purchases by all its commerce associates including intranational commerce. We get

$$n_j = Y_j\left(\sum_s \frac{E_s}{P_s^{1-\sigma}} Z_{sj}\right)^{-1}\left(\theta\gamma_j\right)^{\sigma-1}. \tag{3.35}$$

Substituting the value of the total number of firms represented in equation (3.35) into equations (3.32), (3.33) and (3.34), the theoretical ownership-basis gravity equations (3.22) and (3.23) are retrieved.

3.6 Theoretical Measures of Current Barriers in International Commerce

The ownership-basis gravity equation can be exploited to construct indices measuring: 1) the current barriers associated with cross-border trade; 2) current barriers associated with transactions of foreign affiliates of MNEs and 3) current barriers associated with aggregate international commerce. Let the ratio of sales of firms headquartered in country i to their domestic market (i.e. intranational commerce of country i) relative to value of cross-border trade from firms headquartered in country j to country i be denoted by T_{ij}. Also, let the ratio of sales of firms headquartered in country i to their domestic market relative to sales of foreign affiliates of firms headquartered in country j to country i be denoted by S_{ij}. We get

$$T_{ij} = \frac{Y_i}{(\Omega_i)^{1-\sigma}} \frac{Y_j^{-1}}{(\Omega_j)^{\sigma-1}} \tau_{ii}^{1-\sigma} \left(g_{ij}^X \left(\tau_{ij}^X \right)^{1-\sigma} \right)^{-1}, \tag{3.36}$$

$$S_{ij} = \frac{Y_i}{(\Omega_i)^{1-\sigma}} \frac{Y_j^{-1}}{(\Omega_j)^{\sigma-1}} \tau_{ii}^{1-\sigma} \left(g_{ij}^I \left(\tau_{ij}^I \right)^{1-\sigma} \right)^{-1}. \tag{3.37}$$

The *effective* current barriers of cross-border trade from country j to country i are represented by the expression $Z_{ij}^T = \left(g_{ij}^X \left(\tau_{ij}^X \right)^{1-\sigma} \right)^{-1}$. The *effective* current barriers in cross-border trade consist of the direct effects of the cross-border trade barriers when crossing the border (i.e. $\left(\tau_{ij}^X \right)^{\sigma-1}$) inversely weighted by the effective fraction of firms headquartered in country j that opt to export to country i (i.e. g_{ij}^X). This formulation takes into account the indirect effects of the cross-border trade barriers (in absolute term and in relative term to the barriers associated with FDI) on the configuration of international commerce of country j with country i. In other words, the cross-border trade barriers are not only assessed through their direct cross-border trade limiting effect but also through their indirect reshuffling effect on the effective number of firms headquartered in country j opting to reach consumers of country i through cross-border trade option, *ceteris paribus*. A convenient manipulation that isolate the effective current barriers of cross-border trade is performed by constructing the geometric mean of T_{ij} and T_{ji}. Let the geometric mean of T_{ij} and T_{ji} be denoted by B_{ij}^{T}, we have

$$B_{ij}^{T} = \left(T_{ij}.T_{ji}\right)^{1/2} = \left\{\frac{\tau_{ii}^{1-\sigma}}{\left(Z_{ij}^{T}\right)^{-1}}.\frac{\tau_{jj}^{1-\sigma}}{\left(Z_{ji}^{T}\right)^{-1}}\right\}^{1/2} = \left\{\left[\frac{\tau_{ii}^{1-\sigma}}{g_{ij}^{X}\left(\tau_{ij}^{X}\right)^{1-\sigma}}\right].\left[\frac{\tau_{jj}^{1-\sigma}}{g_{ji}^{X}\left(\tau_{ji}^{X}\right)^{1-\sigma}}\right]\right\}^{1/2}. \qquad (3.38)$$

The expression B_{ij}^{T} constitutes a measure indexing the *effective* current barriers in cross-border trade between country i and country j relative to barriers in intranational commerce.

Likewise the case of the effective current barriers of cross-border trade, the effective current barriers accompanying the transactions of foreign affiliates of firms headquartered in country j with country i are represented by the expression $Z_{ij}^{S} = \left(g_{ij}^{I}\left(\tau_{ij}^{I}\right)^{1-\sigma}\right)^{-1}$. Let the geometric mean of S_{ij} and S_{ji} be denoted B_{ij}^{S}, we get

$$B_{ij}^{S} = \left(S_{ij}.S_{ji}\right)^{1/2} = \left\{\frac{\tau_{ii}^{1-\sigma}}{\left(Z_{ij}^{S}\right)^{-1}}.\frac{\tau_{jj}^{1-\sigma}}{\left(Z_{ji}^{S}\right)^{-1}}\right\}^{1/2} = \left\{\left[\frac{\tau_{ii}^{1-\sigma}}{g_{ij}^{I}\left(\tau_{ij}^{I}\right)^{1-\sigma}}\right].\left[\frac{\tau_{jj}^{1-\sigma}}{g_{ji}^{I}\left(\tau_{ji}^{I}\right)^{1-\sigma^{-1}}}\right]\right\}^{1/2}. \qquad (3.39)$$

The expression B_{ij}^{S} constitutes a measure indexing the effective current barriers in transactions of foreign affiliates of MNEs between country i and country j relative to barriers in intranational commerce.

Next, let the ratio of sales of firms headquartered in country i to their domestic market (i.e. intranational commerce of country i) relative to the aggregate bilateral commerce from country j to country i (i.e. $import_{ij} + sale_{ij}$) be denote by C_{ij}^{A}. We have

$$C_{ij} = \frac{Y_i}{(\Omega_i)^{1-\sigma}} \frac{Y_j^{-1}}{(\Omega_j)^{\sigma-1}} \tau_{ii}^{1-\sigma} \left(g_{ij}^{X} \left(\tau_{ij}^{X}\right)^{1-\sigma} + g_{ij}^{I} \left(\tau_{ij}^{I}\right)^{1-\sigma}\right)^{-1}. \tag{3.40}$$

The *effective* current barriers in international commerce from country j to country i are represented by the expression $Z_{ij} = \left[g_{ij}^{X} \left(\tau_{ij}^{X}\right)^{1-\sigma} + g_{ij}^{I} \left(\tau_{ij}^{I}\right)^{1-\sigma}\right]^{-1}$. Denoting the geometric mean of C_{ij} and C_{ji} by B_{ij}^{C}, we get

$$\begin{aligned} B_{ij}^{C} &= \left(C_{ij}.C_{ji}\right)^{1/2} = \left\{\frac{\tau_{ii}^{1-\sigma}}{Z_{ij}^{-1}} . \frac{\tau_{jj}^{1-\sigma}}{Z_{ji}^{-1}}\right\}^{1/2} \\ &= \left\{\left[\frac{\tau_{ii}^{1-\sigma}}{g_{ij}^{X} \left(\tau_{ij}^{X}\right)^{1-\sigma} + g_{ij}^{I} \left(\tau_{ij}^{I}\right)^{1-\sigma}}\right] . \left[\frac{\tau_{jj}^{1-\sigma}}{g_{ji}^{X} \left(\tau_{ji}^{X}\right)^{1-\sigma} + g_{ji}^{I} \left(\tau_{ji}^{I}\right)^{1-\sigma}}\right]\right\}^{1/2}. \end{aligned} \tag{3.41}$$

The expression B_{ij}^{C} constitutes a measure indexing the *effective* current barriers in international commerce between country i and country j relative to barriers in intranational commerce.

These indices are conveniently exploited to examine the effects of RIAs. Probing the occurrence of a structural changes in the evolvement of B_{ij}^{T} and B_{ij}^{S} detects whether trade creation (or trade diversion) and investment diversion (or investment creation) have occurred between the insiders as well as between an insider and an outsider as a result of RIA. On the other hand, examining the evolvement of B_{ij}^{C} provides a useful tool to examine the overall effects of RIA on international economic integration.

3.7 The Home Market Effect

A final exploitation of the theoretical framework illustrated in section 3.4 and 3.5 is to investigate the implications resulting from the introduction of the horizontal FDI on the home market effect phenomenon. In this theoretical framework, a firm producing a variety is not necessarily equivalent to one plant. It can reach its consumers through cross-border trade as well as through FDI. This setup warrants two types of home market effect. The first type of home market effect is location-basis. It relates relative market size to share of production within the national border from global production. Production within the national border is conducted by national firms (i.e. firm headquartered in the domestic market) as well as by foreign affiliates of MNEs. The second type of home market effect is nationality/ownership basis. In this case, the home market effect describes the effect of relative market size on the share of firms headquartered in a given country from global production.

3.7.1 Case of Symmetry in Trade and FDI Barriers

Conventionally, the phenomenon of the home market effect is developed in a theoretical setup with a world consisting of two countries (Krugman, 1980; Helpman and Krugman, 1985). We illustrate the two-country version of the basic theoretical setup where heterogeneity across firms is depicted by the fixed cost attribute that is associated with conducting business abroad (i.e. the theoretical setup developed in section 3.5). Selecting the theoretical framework where heterogeneity across firms is depicted by the fixed cost attribute is followed for the ease of mathematical manipulations. This section covers the case where cross-border trade barriers and FDI barriers are symmetric in both directions. The case of asymmetry is examined in section 3.7.2.

A world composed of two countries, country i and country j, is assumed. The industry subscript k is dropped as the analysis is carried out for a representative IRS industry. As described in the basic theoretical setup in section 3.4, identical technology in the constant return to scale industry is assumed across countries rendering the wages to be exogenously determined and identical across countries. The comparative cost advantage is controlled by allowing equivalent productivity levels in the IRS sector across the two countries.

Let η_i denotes the relative number of operating firms headquartered in country i to the global number of operating firms (i.e. $\eta_i = \frac{n_i}{n_i + n_j}$). Incomplete global specialization (i.e. when production is not completely predominated by firms headquartered in a particular country) occurs when $\eta_i \neq 0,1$.

The establishment cost (i.e. κ) and the initial fixed costs incurred to initiate production that is intended to the local market (i.e. φ and λ) are assumed to be equivalent across the two countries. Hence, we obtain $\frac{E_i}{P_i^{1-\sigma}} = \frac{E_j}{P_j^{1-\sigma}}$. In this case, the domestic consumptions of varieties produced by the firms headquartered in the domestic market across countries becomes equivalent (i.e. $c_i(v_i) = c_j(v_j) \ \ \forall\ v_i, v_j$). As a result, we get $\hat{\mu}_{ij}^X = \hat{\mu}_{ji}^X = \hat{\mu}^X$ and $\hat{\mu}_{ij}^I = \hat{\mu}_{ji}^I = \hat{\mu}^I$.

This setup leads to equivalence in the fractions of firms that opt not to be engaged in any form of international commerce with the commerce associate country, that opt to export to its commerce associate country and that opt to foreign direct invest in the commerce associate country (i.e. $g_{ij}^N = g_{ji}^N = g^N$; $g_{ij}^X = g_{ji}^X = g^X$; $g_{ij}^I = g_{ji}^I = g^I$). Let the relative market size of country i to the global market size be denoted by $s_i = \frac{E_i}{E_i + E_j}$. Incomplete global specialization occurs when $\frac{Z^{-1}}{1+Z^{-1}} \leq s_i \leq \frac{1}{1+Z^{-1}}$, where $Z = \left[\left(1-g^I\right)\tau^{1-\sigma} + g^I\right]^{-1}$. The equation relating η_i and s_i is given by

$$\eta_i = \frac{1+Z^{-1}}{1-Z^{-1}} s_i - \frac{Z^{-1}}{1-Z^{-1}}. \tag{3.42}$$

3.7.1.1 Location-Basis Home Market Effect

Industrialization in a given location emanates from the operation of domestic firms as well as from the operation of the foreign affiliates of MNEs. When horizontal FDI occurs, there are two consequences for the industry located in the host country. First, there will be the "industrialization effect" resulting from an increase in production in the FDI host country. Second, there will be the "competition effect" that causes reduction in the production of firms located in the host country and/or exit of firms in the long run[23].

Let the share of production *within* the national border of country i from global production be denoted by x_i^{lb}. In other words, x_i^{lb} represents the "location-basis" share of production in country i from global production. In this case where cross-border trade barriers and FDI barriers are symmetric in both directions, the equation relating x_i^{lb} to s_i becomes

$$x_i^{lb} = \frac{n_i\left(c_{ii} + g^X\left(\tau^X\right)^{1-\sigma} c_{jj}\right) + n_j g^I\left(\tau^I\right)^{1-\sigma} c_{ii}}{n_i\left(c_{ii} + g^X\left(\tau^X\right)^{1-\sigma} c_{jj} + g^I\left(\tau^I\right)^{1-\sigma} c_{jj}\right) + n_j\left(c_{jj} + g^X\left(\tau^X\right)^{1-\sigma} c_{ii} + g^I\left(\tau^I\right)^{1-\sigma} c_{ii}\right)}$$
$$= \frac{1 + g^X\left(\tau^X\right)^{1-\sigma} - g^I\left(\tau^I\right)^{1-\sigma}}{1 - g^X\left(\tau^X\right)^{1-\sigma} - g^I\left(\tau^I\right)^{1-\sigma}} s_i - \frac{g^X\left(\tau^X\right)^{1-\sigma}}{1 - g^X\left(\tau^X\right)^{1-\sigma} - g^I\left(\tau^I\right)^{1-\sigma}}. \qquad (3.43)$$

Let $z_i^{lb} = \dfrac{1 + g^X\left(\tau^X\right)^{1-\sigma} - g^I\left(\tau^I\right)^{1-\sigma}}{1 - g^X\left(\tau^X\right)^{1-\sigma} - g^I\left(\tau^I\right)^{1-\sigma}}$. Equation (3.43) indicates that the location-basis home market effect phenomenon persists in the theoretical framework that allows for horizontal FDI and for the non-engagement in any form of international commerce as it can be easily shown that $z_i^{lb} > 1$ (i.e. an increase in s_i leads to a more than one for one increase in x_i^{lb}).

Comparative statics exercises are conducted to examine the effects of cross-border trade barriers (i.e. τ^X) and FDI barriers that are expressed through direct restrictions on the ownership of foreign capital (i.e. δ^I) and through the barriers accompanying the operation of the foreign affiliates (i.e. τ^I) on the magnitude of the location-basis home market effect. We get the following three propositions.

Proposition-3.1: An increase in the cross-border trade barriers lessens the magnitude of the location-basis home market effect.

Proof of Proposition-3.1:

$$\frac{dz_i^{lb}}{d\tau^X} = \frac{\partial z_i^{lb}}{\partial \tau^X} + \left(\frac{\partial z_i^{lb}}{\partial g^X}\frac{\partial g^X}{\partial \tau^X} + \frac{\partial z_i^{lb}}{\partial g^I}\frac{\partial g^I}{\partial \tau^X} \right). \tag{3.44}$$

The first term reflects the direct effect of the cross-border trade barriers while the second term (between parentheses) reflects the indirect effect of these barriers on the configuration of international commerce. We get

$$\frac{\partial z_i^{lb}}{\partial \tau^X} = -\frac{2(\sigma-1)g^X(\tau^X)^{-\sigma}\left(1-g^I(\tau^I)^{1-\sigma}\right)}{\left(1-g^X(\tau^X)^{1-\sigma}-g^I(\tau^I)^{1-\sigma}\right)^2} < 0, \tag{3.45}$$

$$\begin{aligned} \frac{\partial z_i^{lb}}{\partial g^X}\frac{\partial g^X}{\partial \tau^X} + \frac{\partial z_i^{lb}}{\partial g^I}\frac{\partial g^I}{\partial \tau^X} &= \frac{2(\tau^X)^{1-\sigma}\left(1+g^X(\tau^I)^{1-\sigma}-g^I(\tau^I)^{1-\sigma}\right)}{\left(1-g^X(\tau^X)^{1-\sigma}-g^I(\tau^I)^{1-\sigma}\right)^2}\frac{\partial G(\hat{\mu}^I)}{\partial \tau^X} \\ &- \frac{2(\tau^X)^{1-\sigma}\left(1-g^I(\tau^I)^{1-\sigma}\right)}{\left(1-g^X(\tau^X)^{1-\sigma}-g^I(\tau^I)^{1-\sigma}\right)^2}\frac{\partial G(\hat{\mu}^X)}{\partial \tau^X} < 0. \end{aligned} \tag{3.46}$$

These results show that an increase in the cross-border trade barriers induces a reduction in the magnitude of the location-basis home market effect. **Q.E.D.**

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[23] One can think of an additional effect associated with the technological spillover from the foreign affiliates of MNEs to the domestic firms. In our analysis, we do not discuss this effect.

This outcome resembles the one obtained in the Helpman-Krugman conventional theoretical framework where the occurrence of FDI is implicitly ruled out and where all firms are engaged in exporting to the trade associate. The direct effect of an increase in the cross-border trade barriers has an underlying explanation that coincides with the one provided in the Helpman-Krugman conventional theoretical framework. With more firms initially opting to headquarter in the larger country, an increase in the cross-border trade barriers induces a more than one for one cut in exports by the larger country. This situation will lead to a more accentuated reduction in competition in the smaller country compared to the reduction in competition in the larger country. Therefore, more firms will eventually exploit the relatively less competitive environment in the smaller country by reallocating their headquarters and/or through relatively higher new entry in the smaller country. The reallocation of headquarters and/or the relatively higher new entry to the smaller country will lead to the reduction in the magnitude of the location-basis home market effect.

The indirect effect of an increase in cross-border trade barriers manifests itself through the configuration of the international commerce. The increase in the cross-border trade barriers induces higher fraction of firms to opt to reach consumers in the other country *via* FDI. With initially more firms improportionally headquartered in the larger country, the indirect effect of an increase in cross-border trade barriers will be as follow. There will be more than one for one increase in the aggregate production of the foreign affiliates of larger country MNEs in the smaller country. Therefore, the indirect effect of an increase in cross-border trade barriers on the configuration of international commerce will eventually lead to the reduction in the magnitude of the location-basis home market effect.

Proposition-3.2: An increase in the operational barriers facing the foreign affiliates of MNEs has an ambiguous effect on the magnitude of the location-basis home market effect. The direct effect leads to a reduction in the magnitude of the location-basis home market effect while the indirect effect leads to an increase in the magnitude of the location-basis home market effect.

Proof of Proposition-3.2:

$$\frac{dz_i^{lb}}{d\tau^I} = \frac{\partial z_i^{lb}}{\partial \tau^I} + \left(\frac{\partial z_i^{lb}}{\partial g^X}\frac{\partial g^X}{\partial \tau^I} + \frac{\partial z_i^{lb}}{\partial g^I}\frac{\partial g^I}{\partial \tau^I} \right). \tag{3.47}$$

As in the case of the cross-border trade barriers, the first term reflects the direct effect of the operational barriers facing the foreign affiliates of MNEs while the second term (between parentheses) reflects the indirect effect of these barriers on the configuration of international commerce. We get

$$\frac{\partial z_i^{lb}}{\partial \tau^I} = -\frac{2(\sigma-1)\left(\tau^I\right)^{-\sigma} g^X g^I \left(\tau^X\right)^{1-\sigma}}{\left(1-g^X\left(\tau^X\right)^{1-\sigma}-g^I\left(\tau^I\right)^{1-\sigma}\right)^2} < 0, \tag{3.48}$$

$$\frac{\partial z_i^{lb}}{\partial g^X}\frac{\partial g^X}{\partial \tau^I} + \frac{\partial z_i^{lb}}{\partial g^I}\frac{\partial g^I}{\partial \tau^I} = \frac{2\left(\tau^X\right)^{1-\sigma}\left(1+g^X\left(\tau^I\right)^{1-\sigma}-g^I\left(\tau^I\right)^{1-\sigma}\right)}{\left(1-g^X\left(\tau^X\right)^{1-\sigma}-g^I\left(\tau^I\right)^{1-\sigma}\right)^2}\frac{\partial G\left(\hat{\mu}^I\right)}{\partial \tau^I} > 0. \tag{3.49}$$

An increase in the magnitude of the operational barriers facing the foreign affiliates of MNEs has an ambiguous effect on the magnitude of the location-basis home market effect. **Q.E.D.**

The explanation underlying the direct effect is as follows. With more firms initially opting to headquarter in the larger country, an increase in the operational barriers facing the foreign affiliates of MNEs induces more than one for one cut in the sales of foreign affiliates of larger country MNEs in the smaller country. This situation will lead to a more accentuated reduction in competition in the smaller country compared to the reduction in competition in the larger country. Therefore, more firms will eventually exploit the relatively less competitive environment in the smaller country by reallocating their headquarters and/or through relatively higher new entry to the smaller country. The reallocation of headquarters and/or the relatively higher new entry to the smaller country will lead to the reduction in the magnitude of the location-basis home market effect. The intuitive explanation underlying the indirect effect of an increase in the operational barriers facing the foreign affiliates of MNEs is illustrated as follows. The increase in the operational barriers facing the foreign affiliates of MNEs induces a retraction in the fraction of firms that opt to reach foreign consumers via FDI. With improportionally more firms headquartered in the larger country, there is more than one for one retraction in the fraction of foreign affiliates of larger country MNEs in the smaller country. Therefore, the indirect effect leads to an increase in the magnitude of the location-basis home market effect.

Proposition-3.3: An increase in the direct restrictions on the ownership of foreign capital leads to an increase in the magnitude of the location-basis home market effect.

Proof of Proposition-3.3:

$$\begin{aligned}\frac{dz_i^{lb}}{d\delta^I} &= \frac{\partial z_i^{lb}}{\partial g^X}\frac{\partial g^X}{\partial \delta^I} + \frac{\partial z_i^{lb}}{\partial g^I}\frac{\partial g^I}{\partial \delta^I} \\ &= \frac{2\left(\tau^X\right)^{1-\sigma}\left(1 + g^X\left(\tau^I\right)^{1-\sigma} - g^I\left(\tau^I\right)^{1-\sigma}\right)}{\left(1 - g^X\left(\tau^X\right)^{1-\sigma} - g^I\left(\tau^I\right)^{1-\sigma}\right)^2}\frac{\partial G\left(\hat{\mu}^I\right)}{\partial \delta^I} > 0.\end{aligned} \quad (3.50)$$

The effect of an increase in the direct restriction on the ownership of the foreign capital manifests itself exclusively through the configuration of international commerce and leads to an increase in the location-basis home market effect. **Q.E.D.**

The underlying intuition corresponds to the one provided in the case of the indirect effect of an increase in the operational barriers facing the foreign affiliates of MNEs on the location-basis home market effect.

Next, we conduct a comparison between the magnitude of our location-basis home market effect and the magnitude of the home market effect derived from the conventional Helpman-Krugman theoretical framework where all firms in one country are engaged in exporting activities with their commerce associate. The conventional Helpman-Krugman equation relating the relative share of production of one country to the relative market share is represented in equation (2.1). We rewrite this equation in the case of incomplete specialization

$$x_i^{hk} = \frac{1+\left(\tau^X\right)^{1-\sigma}}{1-\left(\tau^X\right)^{1-\sigma}} s_i - \frac{\left(\tau^X\right)^{1-\sigma}}{1-\left(\tau^X\right)^{1-\sigma}}. \tag{3.51}$$

In the conventional Helpman-Krugman framework, incomplete specialization occurs when $\frac{\left(\tau^X\right)^{1-\sigma}}{1+\left(\tau^X\right)^{1-\sigma}} \leq s_i \leq \frac{1}{1+\left(\tau^X\right)^{1-\sigma}}$. Let the magnitude of the conventional Helpman-Krugman home market effect to be represented by $z_i^{hk} = \frac{1+\left(\tau^X\right)^{1-\sigma}}{1-\left(\tau^X\right)^{1-\sigma}}$. It can be easily shown that $z_i^{lb} < z_i^{hk}$ as $1-g^X-g^I\left(\tau^I\right)^{1-\sigma} < 1$.

3.7.1.2 Ownership-Basis Home Market Effect

Now, an original concept of the home market effect is introduced by examining the relation between the relative market size (i.e. s_i) and the production share of firms headquartered in country i from global production. The latter is denoted by x_i^{ob}. In other words, x_i^{ob} represents the "ownership-basis" share of production by firms headquartered in country i from the global production. We get

$$\begin{aligned} x_i^{ob} &= \frac{n_i\left(c_{ii}+g^X\left(\tau^X\right)^{1-\sigma}c_{jj}+g^I\left(\tau^I\right)^{1-\sigma}c_{jj}\right)}{n_i\left(c_{ii}+g^X\left(\tau^X\right)^{1-\sigma}c_{jj}+g^I\left(\tau^I\right)^{1-\sigma}c_{jj}\right)+n_j\left(c_{jj}+g^X\left(\tau^X\right)^{1-\sigma}c_{ii}+g^I\left(\tau^I\right)^{1-\sigma}c_{ii}\right)} \\ &= \frac{1+Z^{-1}}{1-Z^{-1}} s_i - \frac{Z^{-1}}{1-Z^{-1}}. \end{aligned} \tag{3.52}$$

Let $z_i^{ob} = \frac{1+Z^{-1}}{1-Z^{-1}}$. Equation (3.51) shows that the home market effect phenomenon manifests itself also at the ownership-basis as $z_i^{ob} > 1$.

Comparative statics exercises are conducted to examine the effects of cross-border trade barriers (i.e. τ^X) and FDI barriers that are expressed through direct restrictions on the ownership of foreign capital (i.e. δ_{ij}^I) and through the barriers accompanying the operation of the foreign affiliates (i.e. τ^I) on the magnitude of the ownership-basis home market effect. We get the following three propositions.

Proposition-3.4: An increase in cross-border trade barriers has an ambiguous effect on the magnitude of the ownership-basis home market effect. The direct effect leads to a reduction in the magnitude of the ownership-basis home market effect while the indirect is ambiguous.

Proof of Proposition-3.4:

$$\frac{dz_i^{ob}}{d\tau^X} = \frac{\partial z_i^{ob}}{\partial \tau^X} + \left(\frac{\partial z_i^{ob}}{\partial g^X} \frac{\partial g^X}{\partial \tau^X} + \frac{\partial z_i^{ob}}{\partial g^I} \frac{\partial g^I}{\partial \tau^X} \right). \tag{3.53}$$

The first term reflects the direct effect of the cross-border trade barriers while the while the second term (between parentheses) reflects the indirect effect of the cross-border trade barriers on the configuration of international commerce. We get

$$\frac{\partial z_i^{ob}}{\partial \tau^X} = -\frac{2(\sigma-1)g^X\left(\tau^X\right)^{-\sigma}}{\left(1-g^X\left(\tau^X\right)^{1-\sigma}-g^I\left(\tau^I\right)^{1-\sigma}\right)^2} < 0, \tag{3.54}$$

$$\frac{\partial z_i^{ob}}{\partial g^X}\frac{\partial g^X}{\partial \tau^X}+\frac{\partial z_i^{ob}}{\partial g^I}\frac{\partial g^I}{\partial \tau^X}=\underbrace{-\frac{2\left|\left(\tau^I\right)^{1-\sigma}-\left(\tau^X\right)^{1-\sigma}\right|}{\left(1-g^X\left(\tau^X\right)^{1-\sigma}-g^I\left(\tau^I\right)^{1-\sigma}\right)^2}\frac{\partial G\left(\hat{\mu}^I\right)}{\partial \tau^X}}_{(+)}$$

$$\underbrace{-\frac{2\left(\tau^X\right)^{1-\sigma}}{\left(1-g^X\left(\tau^X\right)^{1-\sigma}-g^I\left(\tau^I\right)^{1-\sigma}\right)^2}\frac{\partial G\left(\hat{\mu}^X\right)}{\partial \tau^X}}_{(-)}. \tag{3.55}$$

Hence, an increase in the cross-border trade barriers has an ambiguous effect on the magnitude of the ownership-basis home market effect. **Q.E.D.**

The intuition underlying the direct effect of the cross-border trade barriers on the magnitude of the ownership-basis home market effect corresponds to the one provided in the case of the direct effect of the cross-border trade barriers on the magnitude of the location-basis home market effect. With more firms initially opting to headquarter in the larger country, an increase in the cross-border trade barriers induces a more than one for one cut in exports by the larger country. This situation will lead to a more accentuated reduction in competition in the smaller country compared to the reduction in competition in the larger country. Therefore, more firms will eventually exploit the relatively less competitive environment in the smaller country by reallocating their headquarters and/or through relatively higher new entry to the smaller country. The reallocation of headquarters and/or the relatively higher new entry to the smaller country will lead to the reduction in the magnitude of the ownership-basis home market effect.

The increase in cross-border trade barriers has various effects on the configuration of international commerce. It induces some of the initially exporting firms to take a step forward and engage in FDI while at the same time it also induces other initially exporting firms to completely retract from international commerce and exclusively focus on the domestic market. As a result, the indirect effect of an increase in cross-border trade barriers on the configuration of international commerce is ambiguous. As an illustration, consider the case where FDI inducive effect of an increase in cross-border trade barriers outweighs the international commerce retraction effect of an increase in cross-border trade barriers. In this case, there will be an accentuation of the magnitude of the ownership-basis home market effect.

Proposition-3.5: An increase in the operational barriers facing the foreign affiliates of MNEs lessens the magnitude of the ownership-basis home market effect.

Proof of Proposition-3.5

$$\frac{dz_i^{ob}}{d\tau^I}=\frac{\partial z_i^{ob}}{\partial \tau^I}+\left(\frac{\partial z_i^{ob}}{\partial g^X}\frac{\partial g^X}{\partial \tau^I}+\frac{\partial z_i^{ob}}{\partial g^I}\frac{\partial g^I}{\partial \tau^I}\right). \tag{3.56}$$

The first term reflects the direct effect of the operational barriers facing the foreign affiliates of MNEs while the second term (between parentheses) reflects the indirect effect of the operational barriers facing the foreign affiliates of MNEs on the configuration of international commerce. We get

$$\frac{\partial z_i^{ob}}{\partial \tau^I}=-\frac{2(\sigma-1)(\tau^I)^{-\sigma}g^I}{\left(1-g^X(\tau^X)^{1-\sigma}-g^I(\tau^I)^{1-\sigma}\right)^2}<0, \tag{3.57}$$

$$\frac{\partial z_i^{ob}}{\partial g^X}\frac{\partial g^X}{\partial \tau^I}+\frac{\partial z_i^{ob}}{\partial g^I}\frac{\partial g^I}{\partial \tau^I}=-\frac{2\left((\tau^I)^{1-\sigma}-(\tau^X)^{1-\sigma}\right)}{\left(1-g^X(\tau^X)^{1-\sigma}-g^I(\tau^I)^{1-\sigma}\right)^2}\frac{\partial G(\hat{\mu}^I)}{\partial \tau^I}<0. \tag{3.58}$$

Hence, an increase in the operational barriers facing the foreign affiliates of MNEs leads to a reduction in the magnitude of the ownership-basis home market effect. **Q.E.D.**

The explanation underlying the direct effect of the operational barriers facing the foreign affiliates of MNEs on the magnitude of the ownership-basis home market effect corresponds to the one provided in the case of the direct effect of the operational barriers on the location-basis home market effect. With more firms initially opting to headquarter in the larger country, an increase in the operational barriers facing the foreign affiliates of MNEs induces more than one for one level of cut in the sales of foreign affiliates of larger country MNEs in the smaller country. This situation will lead to a more accentuated reduction in competition in the smaller country compared to the reduction in competition in the larger country. Therefore, more firms will eventually exploit the relatively less competitive environment in the smaller country by reallocating their headquarters and/or through relatively higher new entry to the smaller country. The reallocation of headquarters and/or the relatively higher new entry to the smaller country will lead to the reduction in the magnitude of the ownership-basis home market effect.

The indirect effect of an increase in the operational barriers facing the foreign affiliates of MNEs on the magnitude of the ownership basis home market effect has the following intuition. The increase in the operational barriers facing the foreign affiliates of MNEs induces a retraction in the fraction of the firms that opt to reach foreign consumers through FDI. With improportionally more firms headquartered in the larger country, there is more than one for one retraction in the fraction of foreign affiliates of larger country MNEs in the smaller country. Therefore, the indirect effect leads to a reduction in the magnitude of the ownership-basis home market effect.

Proposition-3.6: An increase in the direct restrictions on the ownership of foreign capital leads to the reduction in the magnitude of the ownership-basis home market effect.

Proof of Proposition-3.6:

$$\begin{aligned} \frac{dz_i^{lb}}{d\delta^I} &= \frac{\partial z_i^{lb}}{\partial g^X}\frac{\partial g^X}{\partial \delta^I} + \frac{\partial z_i^{lb}}{\partial g^I}\frac{\partial g^I}{\partial \delta^I} \\ &= -\frac{2\left(\left(\tau^I\right)^{1-\sigma} - \left(\tau^I\right)^{1-\sigma}\right)}{\left(1 - g^X\left(\tau^X\right)^{1-\sigma} - g^I\left(\tau^I\right)^{1-\sigma}\right)^2}\frac{\partial G\left(\hat{\mu}^I\right)}{\partial \delta^I} < 0. \end{aligned} \tag{3.59}$$

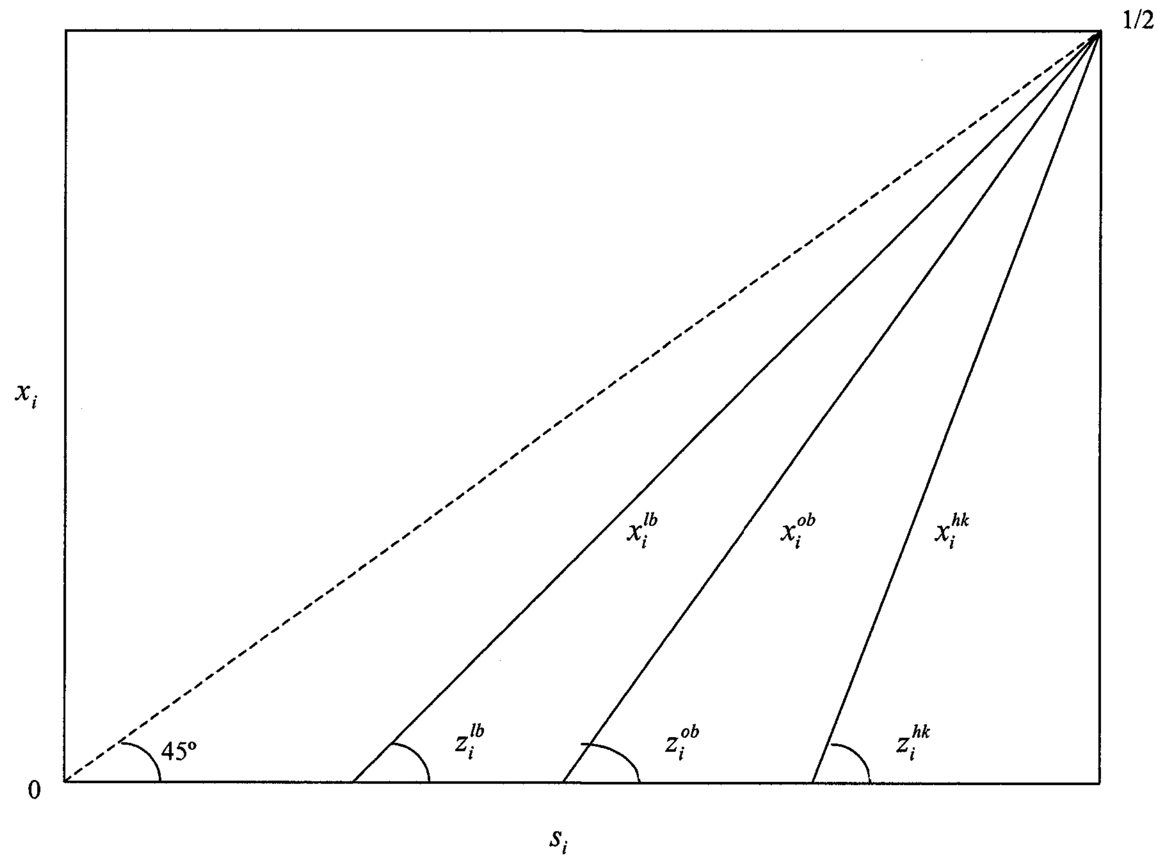
The effect of the direct restriction on the ownership of foreign capital manifests itself exclusively through the configuration of international commerce and leads to the reduction in the magnitude of the ownership-basis home market effect. **Q.E.D.**

The underlying intuition corresponds to the one provided in the case of the indirect effect of the operational barriers facing the foreign affiliates of MNEs on the ownership-basis home market effect.

Comparing the magnitude of the ownership-basis home market effect to the magnitude of the home market effect obtained from the conventional Helpman-Krugman framework leads to ambiguity in the direction of inequality. The direction of the inequality depends on the magnitude of the exogenous parameters in the expression $g^I\left[\left(\tau^I\right)^{1-\sigma}-\left(\tau^X\right)^{1-\sigma}\right]-g^N\left(\tau^X\right)^{1-\sigma}$ with positive sign indicating that $z_i^{ob} > z_i^{hk}$. The case of $z_i^{ob} > z_i^{hk}$ is more likely to occur the higher the liberalization and attractiveness of the FDI and hence is less likely the higher the liberalization and attractiveness of exporting.

The case of symmetry reveals that the magnitude of the ownership-basis home market effect is more accentuated then the location-basis home market effect (i.e. $z_i^{ob} > z_i^{lb}$). Figure-3.1 illustrates the location-basis home market effect and the ownership-basis home market effect. It also depicts the conventional Helpman-Krugman home market effect. Figure-3.1 consider the case where $z_i^{ob} < z_i^{hk}$.

Figure-3.1: Location-Basis, Ownership-Basis and Helpman-Krugman Home Market Effect.



3.7.2 Case of Asymmetry in Trade and FDI Barriers

This section illustrates the location-basis home market effect and the ownership-basis home market effect in the case of asymmetry in barriers to cross-border trade and to foreign direct invest In other words, firms headquartered in different countries face dissimilar levels of cross-border trade and FDI barriers.

The control of the comparative cost advantage is maintained by setting $\gamma_i = \gamma_j = \gamma$ in order to isolate the home market effect. The assumption that the establishment cost (i.e. κ) and the initial fixed costs incurred to initiate production that is intended to the local market (i.e. φ and λ) are equal across the two countries is also maintained. We get $\frac{E_i}{P_i^{1-\sigma}} = \frac{E_j}{P_j^{1-\sigma}}$.

The equation relating the relative number of firms headquartered in country i to the global number of operating firms (i.e. η_i) and the relative market size of country i to the global market size (s_i) becomes

$$\eta_i = \frac{\left(\tau_{jj}^{1-\sigma} + Z_{ij}\right)s_i - Z_{ij}}{\left(\tau_{ii}^{1-\sigma} - Z_{ij}\right) - \left[\left(\tau_{ii}^{1-\sigma} - Z_{ij}\right) - \left(\tau_{jj}^{1-\sigma} - Z_{ji}\right)\right]s_i}. \tag{3.60}$$

In this case of asymmetry in cross-border trade barriers and FDI barriers, incomplete global specialization occurs when $\frac{Z_{ij}}{\tau_{jj}^{1-\sigma} + Z_{ij}} \leq s_i \leq \frac{\tau_{ii}^{1-\sigma}}{\tau_{ii}^{1-\sigma} + Z_{ji}}$.

The mathematical manipulations reveal that the phenomenon of location-basis home market effect remains robust for the introduction of asymmetry in cross-border trade barriers and FDI barriers. The equation relating share of production *within* the national border of country i from global production (i.e. x_i^{lb}) and the relative market share of country i to the global market size (i.e. s_i) becomes

$$x_i^{lb} = \left(\begin{array}{l} \tau_{ii}^{1-\sigma}\tau_{jj}^{1-\sigma} + Z_{ij}Z_{ji} - g_{ij}^{I}\left(\tau_{ij}^{I}\right)^{1-\sigma} Z_{ji} - g_{ji}^{I}\left(\tau_{ji}^{I}\right)^{1-\sigma} Z_{ij} \\ + g_{ij}^{X}\left(\tau_{ij}^{X}\right)^{1-\sigma}\tau_{ii}^{1-\sigma} + g_{ji}^{X}\left(\tau_{ji}^{X}\right)^{1-\sigma}\tau_{jj}^{1-\sigma} \end{array}\right)\frac{1}{\left(\tau_{ii}^{1-\sigma}\tau_{jj}^{1-\sigma} - Z_{ij}Z_{ji}\right)}s_i - \frac{g_{ij}^{X}\left(\tau_{ij}^{X}\right)^{1-\sigma}\tau_{ii}^{1-\sigma} + g_{ji}^{X}\left(\tau_{ji}^{X}\right)^{1-\sigma} Z_{ij}}{\left(\tau_{ii}^{1-\sigma}\tau_{jj}^{1-\sigma} - Z_{ij}Z_{ji}\right)}. \tag{3.61}$$

It can be easily proved that the slope of equation (3.61) (i.e. z_i^{lb}) is bigger than one as $\left(\tau_{jj}^{1-\sigma} + Z_{ji}\right)g_{ij}^{X}\left(\tau_{ij}^{X}\right)^{1-\sigma} + \left(\tau_{ii}^{1-\sigma} + Z_{ij}\right)g_{ji}^{X}\left(\tau_{ji}^{X}\right)^{1-\sigma} > 0$.

The equation relating the production share of firms headquartered in country i from global production (i.e. x_i^{ob}) and s_i reveals the persistence of the ownership-basis home market effect in the case of asymmetry in cross-border trade barriers and FDI barriers. We get

$$x_i^{ob} = \frac{\left(\tau_{jj}^{1-\sigma} + Z_{ij}\right)\left(\tau_{ii}^{1-\sigma} + Z_{ji}\right)}{\left(\tau_{ii}^{1-\sigma}\tau_{jj}^{1-\sigma} - Z_{ij}Z_{ji}\right)} s_i - \frac{Z_{ij}\left(\tau_{ii}^{1-\sigma} + Z_{ji}\right)}{\left(\tau_{ii}^{1-\sigma}\tau_{jj}^{1-\sigma} - Z_{ij}Z_{ji}\right)}. \quad (3.62)$$

It can be easily shown that the slope equation relating x_i^{ob} and s_i in equation (3.62) (i.e. z_i^{ob}) is larger than one.

3.8 Concluding Remarks

International commerce is performed *via* cross-border trade as well as *via* transactions of foreign affiliates of MNEs. The latter depicts the operational aspect of FDI. FDI is disregarded in the theoretical derivation of the gravity equation. Recognizing FDI in the gravity equation requires the adoption of the ownership/nationality criterion in recording transactions between economic agents as international. Building on the theoretical setup of Helpman et al. (2004), this chapter develops an ownership-basis gravity equation that recognizes FDI through the transactions of foreign affiliates of MNEs and allows for the non-engagement in any form of international commerce. While the heterogeneity in the basic theoretical setup of Helpman et al. (2004) is specified by the productivity attribute of firms, this chapter also re-derives the ownership-basis gravity equation form a theoretical framework that specifies heterogeneity across firms by a fixed cost attribute.

The ownership-basis gravity equation allows us to build measures of effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce relative to barriers in intranational commerce. There are some compelling empirical advantages that can be associated with these measures. The effect of an event (e.g. implementation of RIA) can be analyzed by tracking the effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce relative to barriers in intranational commerce through time and by detecting the occurrence of structural break. In addition, these measures allow one to perform empirical tests to determine the effects of various factors on these effective current barriers.

Finally, this chapter exploits the ownership-basis theoretical framework to study the implications on the home market effect phenomenon. This chapter shows that the home market effect occurs for two different criteria: location-basis and ownership-basis. The location-basis home market effect implies that an increase in relative market size of a country induces more than one for one increase in the share of total production *within* this country. The ownership-basis home market effect implies that an increase in relative market size of a country induces more than one for one increase in the share of total production by firms owned by this country. This chapter also studies the various effects of cross-border trade barriers and FDI barriers on the magnitude of the location-basis home market effect and ownership-basis home market effect.

CHAPTER IV

EMPIRICAL APPLICATION:

MEASURING THE OWNERSHIP-BASIS BORDER EFFECTS

4.1 Introduction

A wide range of empirical literature has utilized the conventional gravity equation to determine the extent of international economic integration through the computation of the border effects. Some of the obtained results countered initial perceptions by revealing low economic integration between two economies, initially perceived to be highly integrated (e.g. McCallum, 1995). The follow-up literature suggests theoretical and empirical corrections to dissipate the perception-countering results of low economic integration (e.g. Anderson and van Wincoop, 2003). How these observations are modified when recognizing the role of FDI as well as the non-engagement in any form of international commerce is the purpose of this chapter.

This chapter empirically applies the theoretical ownership-basis gravity equation to compute an amended ownership-basis measure of the border effects by simultaneously rendering homage to cross-border trade and transactions of foreign affiliates of MNEs as alternative channels of international commerce. My empirical application is limited to the OECD countries reporting the inward activities of foreign affiliates of MNEs in the aggregate manufacturing industry for the year 1999. This chapter also examines the empirical defects that are accompanying the application of the conventional gravity equation in measuring the border effects. The magnitude of the border effects obtained from the ownership-basis gravity equation is contrasted to the magnitude of the border effects obtained from the conventional gravity equation.

The rest of this chapter is organized as follows. Section 4.2 discusses the consequences on the conventionally measured border effects by building the location-basis conventional gravity equation from the ownership-basis theoretical setup. Section 4.3 represents the empirical specification. Section 4.4 details the sources and construction of the datasets. Section 4.5 shows the empirical results. Section 4.6 conducts the sensitivity analysis. Finally, section 4.7 displays the concluding remarks.

4.2 Consequences on the Conventionally Measured Border Effects

This section analyzes the various consequences from disregarding the transactions of foreign affiliates of MNEs and the non-engagement in any form of international commerce when determining the border effects through the conventional gravity equation. The conventional gravity equation has a location-basis aspect (i.e. tracking the movement of goods between two locations). This section reconstructs the location-basis gravity equation by referring to the ownership-basis theoretical setup, where international commerce is defined on ownership/nationality-basis. Hence, the ownership/nationality-basis approach in defining international commerce accounts for cross-border trade and transactions of foreign affiliates of MNEs.

Let the inward location-basis commerce from country j to country i to be denoted by $commerce_{ij}^{lb}$. The location-basis intranational commerce in country i (i.e. $commerce_{ii}^{lb}$) consists of the domestic sales of firms headquartered in country i and the total sales of foreign affiliates of foreign MNEs in country i. The theoretical location-basis gravity equation derived from the ownership-basis theoretical setup is given by

$$commerce_{ij}^{lb} = \begin{cases} \dfrac{E_i Y_i}{(P_i \Omega_i)^{1-\sigma}} dist_{ii}^{\chi(1-\sigma)} + \sum_s \dfrac{E_i Y_s}{(P_i \Omega_s)^{1-\sigma}} dist_{ii}^{\chi(1-\sigma)} g_{is}^{I} \left(t_{is}^{I}\right)^{(1-\sigma)} & if\ i = j \\ \\ \dfrac{E_i Y_j}{\left(P_i \Omega_j\right)^{1-\sigma}} dist_{ij}^{\chi(1-\sigma)} g_{ij}^{X} \left(t_{ij}^{X}\right)^{(1-\sigma)} & if\ i \neq j \end{cases} \tag{4.1}$$

The logarithmic version of equations (4.1) becomes

$$\ln commerce_{ij}^{lb} = \begin{cases} \ln\left(\frac{E_i}{P_i^{1-\sigma}}\right) + \ln\left(\frac{Y_i}{\Omega_i^{1-\sigma}}\right) + \chi(1-\sigma)\ln dist_{ii} + \ln A & ;if\ i = j \\ n\left(\frac{E_i}{P_i^{1-\sigma}}\right) + \ln\left(\frac{Y_j}{\Omega_j^{1-\sigma}}\right) + \chi(1-\sigma)\ln dist_{ij} + \ln g_{ij}^X \left(t_{ij}^X\right)^{1-\sigma} & if\ i \neq j \end{cases} \tag{4.2}$$

where $A_i = \left(1 + \sum_s \frac{Y_s}{\Omega_s^{1-\sigma}} \left(\frac{Y_i}{\Omega_i^{1-\sigma}}\right)^{-1} g_{is}^I \left(t_{is}^I\right)^{1-\sigma}\right) > 1$. Transferring equations (4.2) into the common empirical specification followed in the literature to measure the border effects, we get

$$COM_{ij}^{lb} = a + a_i + a_j + a_1 \ln DIST_{ij} + a_2 D_{ij}^X + a_3 X_{ij} + \varepsilon_{ij}^a \tag{4.3}$$

where COM_{ij}^{lb} is the logarithmic value of imports from location j to location i; a_i is the fixed effect of country of consumption i capturing the consumer economic size (i.e. E_i) and consumer CES price index (i.e. P_i); a_j is the fixed effect of country of production j capturing the supply economic size of the country of production (i.e. Y_j) and CES supply index of the country of production (i.e. Ω_j); $DIST_{ij}$ is the bilateral distance separating the two countries i and j; D_{ij}^X is a dummy variable that takes the value of unity when $i \neq j$; X_{ij} is a vector of bilateral non-policy barriers and ε_{ij}^a is the stochastic error term.

Two main defects are highlighted when estimating the magnitude of the border effects with the conventional gravity equation. The first defect is conceptual. The measure of the border effects obtained from the conventional gravity equation is intended to capture the effective current policy-related barriers to cross-border trade (after controlling for distance and other non-policy barriers such as cultural differences, trust, established transportation linkages) and does not constitute a measure of the level of international economic integration. The effective current policy-related barriers to cross-border trade are determined by

$$\left[\hat{g}_{ij}^{X}\left(t_{ij}^{X}\right)^{1-\sigma}\right]^{-1} \tag{4.4}$$

where $\hat{g}_{ij}^{X}$ is the value of g_{ij}^{X} after controlling for bilateral distance (i.e. $DIST_{ij}$) and bilateral non-policy barriers (i.e. X_{ij}) and the elements captured by the fixed effects.

The second defect is computational and is associated with the empirical estimation even if the intent is to measure the effective current policy-related barriers to cross-border trade. The exponential of the coefficient on the bilateral dummy variable represents an average over

$$\hat{A}_i\left[\hat{g}_{ij}^{X}\left(t_{ij}^{X}\right)^{1-\sigma}\right]^{-1} \tag{4.5}$$

where $\hat{A}_i > 1$ is the values of A_i after controlling for bilateral distance (i.e. $DIST_{ij}$), bilateral non-policy barriers (i.e. X_{ij}) and the elements captured by the fixed effects. An additional computational defect is that the value of $\left[\hat{g}_{ij}^{X}\left(t_{ij}^{X}\right)^{1-\sigma}\right]^{-1}$ does not converge to one when the policy barriers are eliminated[24].

4.3 Empirical Specification

The initial step in formulating the empirical specification is to decide whether the dichotomized version or the trichotomized version of the ownership-basis gravity equation is best suited to measure the ownership-basis border effects. The trichotomized version of the ownership basis gravity equation exhibits an important advantage in disentangling the policy-related barriers into those associated with cross-border trade and those associated with FDI, separately. This disentanglement has the advantage of prescribing the policy implication associated with each mode of international commerce and to infer the feasible extent of liberalization in each mode of international commerce. In addition, the trichotomized version of the ownership-basis gravity equation conveys fewer concerns regarding the potential non-linear relationship between international commerce and distance compared to the dichotomized version of the ownership basis gravity equation.

The trichotomized version of the theoretical ownership-basis gravity equation (3.22) is exploited for two purposes. The first is to assess the policy-related barriers to international commerce and contrast the results to those obtained from the conventional gravity equation. The second is to asses the relative contribution of each mode of international commerce (i.e. cross-border trade and transactions of foreign affiliates of MNEs) in order to assess the feasible extent of liberalization in each mode of international commerce. The trichotomized version of the ownership-basis gravity equation is translated into two sub-empirical equations. The first equation is associated with the cross-border trade and is given by

$$IMP_{ij} = b + b_i + b_j + b_1 \ln DIST_{ij} + b_2 D_{ij}^X + b_3 LANG_{ij} + b_4 CONT_{ij} + \varepsilon_{ij}^b \qquad (4.6)$$

where IMP_{ij} is the logarithmic value of import by country i from country j; b_i is the fixed effect of country of consumption i capturing the consumer economic size (i.e. E_i), consumer CES price index (i.e. P_i); b_j is the fixed effect of country of production j capturing the supply economic size of the country of production (i.e. Y_j) and CES supply index of the country of production (i.e. Ω_j); $DIST_{ij}$ is defined as before; D_{ij}^X defined as before and ε_{ij}^b is the stochastic error term. Following the previous literature

[24] Controlling for bilateral distance, bilateral non-policy barriers and the fixed effects, firms become indifferent in the mode of reaching foreign markets. In other words, while $\hat{g}_{ij}^X + \hat{g}_{ij}^I = 1$, the value of $\hat{g}_{ij}^X$ is indeterminate and does not necessarily converge to one.

(e.g. Wei, 1996; Helliwell, 1998; Hummels, 1999), the basic empirical equation (4.6) includes two dummy variables: a common language dummy variable, $LANG_{ij}$, that takes the value of unity when the two countries speak the same language and a contiguity dummy variable, $CONT_{ij}$, that takes the value of unity when the countries share common border. Speaking common language is thought to stand for the social-cultural linkages, convergence in preferences but also reflects mitigation in the cost of communication and information compared to the case where the two countries speak different languages. Contiguity is thought to also reflect the mitigation in the cost of communication and information and convergence in preferences. In addition, contiguity captures alternative transportation infrastructure and network (e.g. highways, railways) that link the contiguous economic[25]. It is important to note that, the intranational distance explaining the current configuration of international commerce is captured by the fixed effects[26,27].

The second empirical equation derived from the trichotomized version of the ownership-basis gravity equation and associated with the transactions of foreign affiliates of MNEs is given by

$$FAS_{ij} = c + c_i + c_j + +c_1 \ln DIST_{ij} + c_2 D_{ij}^I + c_3 LANG_{ij} + c_4 CONT_{ij} + \varepsilon_{ij}^c \tag{4.7}$$

where FAS_{ij} is the logarithmic value of sales of foreign affiliates of MNEs of country j in country i; c_i is the fixed effect of country of consumption i capturing the consumer economic size (i.e. E_i) and consumer CES price index (i.e. P_i); c_j is the fixed effect of

[25] The language and contiguity dummy variables are rough proxies that are subjected to a heavy burden of criticism. For example, the Netherlands and Japan are treated equivalently in terms of common language and contiguity with the United Kingdom. Yet, the Netherlands and the United Kingdom are expected to be higher on the scale of common language and contiguity compared to case of Japan and the United Kingdom. In addition, historical commerce partnership and political cooperation between the Netherlands and the United Kingdom are not captured by language and contiguity dummy variables or bilateral distance.

[26] The consumer economic size, supply economic size of the country of production and the intranational distance are not explicitly included into the empirical specifications as the values of the coefficients are estimated relative to the fixed effects that are dropped to avoid perfect collinearity.

[27] The regressand IMP_{ij} differs from the regressand COM_{ij}^{lb} by the fact that the former nets the aggregate inward transactions of foreign affiliates of MNEs when computing intranational commerce.

country of production j capturing the supply economic size of the country of production (i.e. Y_j) and CES supply index of the country of production (i.e. Ω_j); $DIST_{ij}$ is defined as before and is included here to proxy for the non-policy barriers (e.g. information) captured by the bilateral distance; D^I_{ij} is a dummy variable that takes the value of unity when $i \neq j$; $LANG_{ij}$ and $CONT_{ij}$ are defined as before and ε^c_{ij} is the stochastic error term. As in equation (4.6), the intranational distance explaining the current configuration of international commerce is captured by the fixed effects.

Equation (4.6) and equation (4.7) are empirically linked through the seemingly unrelated regression estimation (SURE) model. After controlling for market size, price indices, bilateral distance and other non-policy factors, a given country consumes $\exp(-b_2)$ times more of goods produced by its domestic firms than imported goods. At the same time, a given country consumes $\exp(-c_2)$ times more of goods produced by its domestic firms than goods produced by foreign affiliates of MNEs. The theoretical equivalence of $\exp(-b_2)$ and $\exp(-c_2)$ are

$$\left[\hat{g}^X_{ij}\left(t^X_{ij}\right)^{1-\sigma}\right]^{-1} \tag{4.8}$$

$$\left[\hat{g}^I_{ij}\left(t^I_{ij}\right)^{1-\sigma}\right]^{-1} \tag{4.9}$$

where $\hat{g}^X_{ij}$ and $\hat{g}^I_{ij}$ are the values of g^X_{ij} and g^I_{ij} after controlling for bilateral distance (i.e. $DIST_{ij}$) and bilateral non-policy barriers (i.e. X_{ij}) and the elements captured by the fixed effects, respectively.

The ownership-basis border effect from country j to country i is theoretically defined as

$$\hat{Z}_{ij} = \left[\hat{g}^X_{ij}\left(t^X_{ij}\right)^{1-\sigma} + \hat{g}^I_{ij}\left(t^I_{ij}\right)^{1-\sigma}\right]^{-1}. \tag{4.10}$$

In other words, $\hat{Z}_{ij}$ represents the *effective* current barriers in international commerce from country j to country i after controlling for market size, price indices, bilateral distance and other non-policy factors. Hence, the magnitude of the ownership-basis border effects is computed as[28]

$$BE = \frac{1}{\exp(b_2) + \exp(c_2)} \qquad (4.11)$$

The magnitude of the ownership-basis border effects is determined as a weighted average of the three various types of policy-related barriers encountered in international commerce: policy barriers in cross-border trade, policy barriers associated with the transactions of foreign affiliates of MNEs and an implicit prohibitive policy barriers associated with the non-engagement in any form of international commerce. The weights are determined by the current policy-related configuration of international commerce. One additional feature of the ownership-basis border effects is that it captures, beside the policy barriers that have operational aspects, the policy barriers that have fixed cost aspects. This fact is clear in my model as the policy barriers of fixed cost aspects constitute one of the basic determinants of the current configuration of international commerce. The policy barriers of fixed cost aspects are particularly important in reflecting the effects of the direct restrictions on the foreign ownership of capital[29].

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[28] The inverse of the expressions (4.8) and (4.9) illustrate the value of cross-border trade per unit value of intranational commerce and the value of transactions of foreign affiliates per unit value of intranational commerce. The summation of these inversed expressions results in the value of international commerce per unit value of intranational commerce. Taking the inverse of the summation gives the intranational commerce per unit value of international commerce and hence the nationality-basis border effects.

[29] There is alternative theoretical method to define the ownership-basis border effects. The effective current barriers in international commerce between country i and country j in the absence of policy barriers are denoted by

$$\tilde{Z}_{ij} = \left[\tilde{g}_{ij}^{X} dist_{ij}^{\chi(1-\sigma)} + \tilde{g}_{ij}^{I} dist_{ii}^{\chi(1-\sigma)}\right]^{-1}$$

where $\tilde{g}_{ij}^{X}$ and $\tilde{g}_{ij}^{I}$ are the effective fractions of firms headquartered in country j opting to export to country i and to foreign direct invest in country i in the absence of policy barriers. Conceptually, the

A final note is that pervious empirical work conjectures that the disparity in income per capita between the country of consumption i and the country of production j acts as a proxy for disparity in capital (K) to labor (L) ratio (e.g. Brainard, 1997). In our empirical specification, such proxy of the alternative comparative cost advantage theory is captured by the fixed effects.

4.4 Data Description

The empirical analysis is performed for the international commerce between the OECD countries at the aggregate manufacturing industry as defined by the International Standard Industrial Classification Revision 3 (ISIC-Rev.3) for the year 1999. The level of aggregation and the selected year are largely dictated by the availability of data on the bilateral activities of foreign affiliates of MNEs.

The bilateral sales of foreign affiliates of MNEs are collected from the OECD's "Inward Investment by Investing Country for the Total Manufacturing Sector" datasets. In this publication, the variables describing the activities of the foreign affiliates of MNEs are compiled by the host country. In parallel publication, data on the activities of the foreign affiliates of MNEs reported by the source country are compiled in the OECD's "Outward Investment by Investing Country for the Total Manufacturing Sector" datasets. However, this alternative data source on foreign affiliates' activities is more restrictive in terms of country coverage. Therefore, the inward investment standard is adopted as the basis of the empirical analysis in this chapter. The OECD's "Inward Investment by Investing Country for the Total Manufacturing Sector" datasets attribute the ownership of the foreign affiliates of MNEs according to the ultimate beneficial owner (UBO). UBO is defined as the ultimate party which does not encounter an

magnitude of the ownership-basis border effects is computed as the deviation of Z_{ij} from $\widetilde{Z}_{ij}$. In other words, the ownership-basis border effects is defined as

$$BE = \frac{Z_{ij}}{\widetilde{Z}_{ij}}$$

Performing this alternative approach in measuring the ownership-basis border effects is empirically not feasible in the context of our model.

ownership of above 50% by another party, as gradually proceeding through the ownership chain from the parent firm inclusive. Hence, if no party other than the parent firm own more than 50%, UBO coincide with the nationality attribute of the parent firm.

In order to obtain an approximate value of the local sales of foreign affiliates of MNEs in the host country, the total exports conducted by the foreign affiliates of MNEs are net from the total sales of the foreign affiliates of MNEs. It is important to note that some of the total sales by the foreign affiliates of MNEs outside the host country might be conducted without a physical cross-border move of products. Yet, this more specific requirement is hampered by the lack of data availability.

The restriction imposed by the data availability on the activities of the foreign affiliates of MNEs limits the basic empirical analysis for seven destination OECD countries with the complete thirty OECD source countries. The destination countries covered in the basic empirical analysis are: Finland, France, Japan, the Netherlands, Poland, Portugal and Sweden[30].

Total and bilateral cross-border trade values in the manufacturing sector, classified according to the ISIC-Rev.3, are compiled from the OECD's "STAN Bilateral Database". Intranational commerce defined on the ownership-basis is obtained by netting the total exports and total local sales of foreign affiliates of MNEs of all the source countries from total production[31].

The market size of the country of consumption reflecting the total expenditure can be determined by netting the difference between total exports and total imports from total production within the country of consumption. On the other hand, the ownership-basis supply economic size of the country of production can be determined by aggregating the total production at home by domestic firms and the total outward sales conducted by the foreign affiliates of MNEs. While the computation of the total expenditure by a given country is feasible, the availability of data does not allow the

[30] Five additional destination countries (Germany, Italy, Spain, United Kingdom, and United States) collect the sales of the bilateral inward foreign affiliates of MNEs. However, these destination countries compile data on exports of foreign affiliates of MNEs only for some source countries. Proxying the missing values of exports of foreign affiliates of MNEs using the ratio of the total export to total sales of foreign affiliates of MNEs of another "twin" source country in the destination country under consideration will allow for a larger empirical coverage.

[31] Table A.1 of the Appendix illustrates the sales of foreign affiliates of MNEs, value of imports and the share of sales of foreign affiliates of MNEs from total international commerce.

computation of the ownership-basis supply economic size of the country of production due to missing data on the total outward sales of foreign affiliates of MNEs. In this chapter, the GDP values are used to proxy for market size of the country of consumption and the ownership-basis supply economic size of the country of production.

Measuring distance is one of the major concerns accompanying the computation of the border effects as it is shown that variation in the distance measurement can largely affect the results (Wei, 1996; Helliwell, 1996; Head and Mayer, 2000, 2002). One of the conventional measures of distance is the one used by Wei (1996). Wei (1996) adopts the greater circle distance between two economic major cities in the computation of the international distance. Wei (1996) computes the intranational distance as being the quarter of the greater circle international distance of a country with its closest trade partner. Some papers attempt to step closer into a more intricate geographical structure of the distance by taking into consideration the dispersion of the economic activity within a region (Wolf, 1997; Wolf, 2000; Nitsch, 2000; Head and Mayer, 2000, 2002). The approach of Head and Mayer (2000, 2002) in measuring international and intranational distance is adopted in this chapter. Head and Mayer (2000, 2002) determine the distance between the source and the destination countries as

$$dist_{SD} = \sum_{i \in S} \left(\sum_{j \in D} \psi_j dist_{ij} \right) \psi_i \qquad (4.12)$$

where $dist_{ij}$ is the distance between two sub-regional units, and ψ_i represents the economic activity share of the sub-region i. The datasets of this distance measurement are obtained from the "Centre d'Etudes Prospectives et d'Informations Internationales" (CEPII). Head and Mayer (2002) also suggest a theoretical measure of the distance coined the "effective distance". Head and Mayer (2002) effective distance is given by

$$dist_{SD} = \left(\sum_{i \in S} \left(\sum_{j \in D} \psi_j dist_{ij}^{\omega} \right) \psi \right)^{-\omega} \qquad (4.13)$$

When $\omega = 1$, this equation is simply the arithmetic mean (i.e. equation (4.12)). Head and Mayer (2002) find that the empirical estimates of ω centers around -1. In that case, $dist_{SD}$ becomes the harmonic mean. The effects from adopting the greater circle distance of Wei (1996) and the effective distance of Head and Mayer (2002) are examined through the sensitivity analysis in section 4.6. The datasets of the greater circle distance of Wei (1996) and the effective distance of Head and Mayer (2002) are equivalently compiled from the CEPII.

4.5 Empirical Results

The dataset contains some observations with null recorded transactions of foreign affiliates of MNEs from a given source country to a given destination country (i.e. pure exporting status occurs). To deal with the potential censoring of the error term in the sales of foreign affiliates empirical equation (4.7), we pursue the following approach. The Mills' ratio is computed from a probit selection equation explaining the decision to invest abroad (i.e. the occurrence of any level of FDI). Then, the Mills' ratio determined from the probit selection equation is included as a variable in equation (4.7) when performing SURE. The probit selection equation is specified as

$$ID_{ij} = d + d_i + d_1 \ln GDP_i + d_2 \ln GDP_j + d_3 \ln DIST_{ij} + d_4 RCA_{ij} + \varepsilon_{ij}^{d} \qquad (4.14)$$

where ID_{ij} takes the value of unity when any level of FDI occurs from the source country j in the destination country i; d_i is the destination country fixed effect intending to capture the intranational distance as well as the overall level of trade liberalization and FDI liberalization; GDP_i and GDP_j are the gross domestic product of destination country i and source country j, respectively; $DIST_{ij}$ is defined as before; RCA_{ij} is a proxy for the relative cost advantage theory determined by the logarithmic disparity in income per capita between source country j and destination country i, (i.e.

$RCA_{ij} = \ln\frac{GDP_j}{POP_j} - \ln\frac{GDP_i}{POP_i}$ with POP denoting population) and ε_{ij}^{d} is the stochastic error term[32].

The majority of the pure exporting status occurs in the case of countries in transition and smaller countries as source countries. The pure exporting status is thought to be associated with the limited resources to undertake investment in a wide range of destination countries (i.e. case of smaller economies) as well as with underdeveloped mechanism in investing abroad (e.g. case of countries in transition). To isolate these effects, a dummy variable that takes the value of unity for each observation indicating a pure exporting status is employed (i.e. null recorded transactions of foreign affiliates of MNEs) [33].

The estimated average magnitude of the border effects over the destination countries covered in the sample is represented in Table 4.1. Column (i) of Table 4.1 shows the SURE results of the empirical application of the ownership-basis gravity equation in a specification that does not control for common language and contiguity. The estimated coefficients of D_{ij}^{X} and D_{ij}^{I} are highly significant and lead to a magnitude of the border effects of 4.3.

For comparison, column (iii) of Table 4.1 displays results from the conventional gravity equation in a specification that equivalently does not control for common language and contiguity. The results in column (iii) of Table 4.1 show a magnitude of the border effects of 7.4. Hence, the conventional measurement of the border effects leads to an inflated magnitude of the border effects by a factor of 1.7. Interestingly, the coefficient of $\ln DIST_{ij}$ in the sales of foreign affiliates equation is negative and highly significant countering the *prima facie* expectations of positive coefficient of $\ln DIST_{ij}$. One of the reasons explaining the negative coefficient of $\ln DIST_{ij}$ is that bilateral distance also proxies for the information costs that is expected to become even more

[32] For an explicit inclusion of the levels of cross-border trade liberalization and FDI liberalization of the destination countries, one can use the indices displayed in the World Competitiveness Yearbook of the International Institute for Management Development (IMD). However, the effects of these indices can be absorbed by the destination country fixed effects.

[33] The approximation $\ln(1+x) \approx \ln x$ for large x is used to circumvent the inconvenience of the logarithmic transformation of the zero observations of foreign affiliates sales.

important when investing abroad. Another reason is that foreign affiliates of MNEs might still require specific inputs from the home country to complete the manufacturing process. Hence, bilateral distance depicts the transportation cost just as it does for pure exports.

Column (ii) of Table 4.1 shows the SURE results of the empirical application of the ownership-basis gravity equation in a specification that does control for common language and contiguity. The estimated coefficients of D_{ij}^{X} and D_{ij}^{I} are highly significant and lead to a magnitude of the border effects of 5.2. Column (iv) illustrates the equivalent outcome from the conventional gravity equation in a specification that does control for common language and contiguity. The results in column (iv) of Table 4.1 show a magnitude of the border effects of 8.6, an inflated magnitude by a factor of 1.7. While the absolute value of the coefficient on $\ln DIST_{ij}$ in the sales of foreign affiliates equation is reduced, it remains negative and highly significant.

Table 4.1: Overall Average Magnitude of the Border Effects.

	Ownership-Basis Gravity Equation				Conventional Gravity Equation	
	SURE		SURE		OLS	OLS
	(i)		(ii)		(iii)	(iv)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}	COM_{ij}^{lb}
D_{ij}^{X}	-1.549[a]		-1.690[a]		-2.003[a]	-2.156[a]
	(0.324)		(0.343)		(0.347)	(0.370)
D_{ij}^{I}		-4.000[a]		-4.892[a]		
		(0.637)		(0.657)		
$\ln DIST_{ij}$	-1.106[a]	-1.013[a]	-1.045[a]	-0.657[a]	-1.092[a]	-1.028[a]
	(0.085)	(0.174)	(0.096)	(0.191)	(0.091)	(0.104)
$CONT_{ij}$			0.466[c]	1.536[a]		0.482
			(0.247)	(0.474)		(0.266)
$LANG_{ij}$			-0.454	0.225		-0.446
			(0.343)	(0.660)		(0.370)
MR		0.804[a]		0.766[a]		
		(0.196)		(0.190)		
BE	4.332		5.207		7.413	8.635
N	203	203	203	203	203	203
R^2	0.911	0.983	0.912	0.984	0.919	0.904
$RMSE$	0.630	1.245	0.624	1.201	0.675	0.672

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively.

Table 4.2 displays the estimated country specific magnitude of the border effects. Column (i) of Table 4.2 shows the SURE results of the empirical application of the ownership-basis gravity equation in a specification that does not control for common language and contiguity. Column (iii) of Table 4.2 displays the equivalent results from the conventional gravity equation in a specification that does not control for common language and contiguity. The discussion is restricted to the case where the common language and contiguity are controlled.

Column (ii) of Table 4.2 shows the SURE results of the empirical application of the ownership-basis gravity equation in a specification that does control for common language and contiguity. The countries of destination exhibit various levels of border effects ranging from a supernatural openness for the Netherlands with a magnitude of border effects of 0.1 to a heavy significance of the Polish border with a magnitude of border effects of 62.3.

The supernatural openness of the Netherlands is attributed to its characteristic of being an international distribution center involved in re-exporting activities. To our knowledge, there is no available re-exporting datasets, detailed at the source country level. Kusters and Verbruggen (2001) report that, in 2000, re-exports accounted for more than 40% of the total exports of goods by the Netherlands. Kusters and Verbruggen (2001) also notice that re-exports are strongly concentrated in some sectors of the manufacturing industry (e.g. machinery, computers and electronic equipment, textiles and clothing). The high level of the Polish border effects can be partially attributed to the fact that, in 1999, Poland was still enduring the process of economic transition. The policy and bureaucratic trade establishments were (and perhaps still) in the reform process. At the same time, the opportunity to host foreign capital might not be fully exploited in 1999 (i.e. still in the short-run). The higher magnitude of the border effects for Poland warrants the continuous investigation in the transition performance of these economies for the following years once data becomes available.

Table 4.2: Country Specific Magnitude of the Border Effects.

	Ownership-Basis Gravity Equation				Conventional Gravity Equation	
	SURE		SURE		OLS	OLS
	(i)		(ii)		(iii)	(iv)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}	COM_{ij}^{lb}
D_{ij}^X, D_{ij}^I,	-2.061[a]	-4.468[a]	-2.172[a]	-5.654[a]	-2.213[a]	-2.325[a]
(FIN)	(0.636)	(1.334)	(0.645)	(1.309)	(0.718)	(0.733)
D_{ij}^X, D_{ij}^I,	-1.433[b]	-2.102[c]	-1.507[b]	-2.811[b]	-1.863[a]	-1.937[a]
(FRA)	(0.617)	(1.304)	(0.615)	(1.259)	(0.697)	(0.700)
D_{ij}^X, D_{ij}^I,	-0.860	-5.451[a]	-1.094	-7.141[a]	-0.889	-1.124
(JPN)	(0.709)	(1.499)	(0.727)	(1.486)	0.802)	(0.827)
D_{ij}^X, D_{ij}^I,	2.282[a]	0.708	2.150[a]	-0.276	0.890	0.757
(NDL)	(0.640)	(1.347)	(0.643)	(1.309)	(0.724)	(0.731)
D_{ij}^X, D_{ij}^I,	-4.030[a]	-7.529[a]	-4.150[a]	-8.129[a]	-4.434[a]	-4.554[a]
(POL)	(0.622)	(1.334)	(0.620)	(1.287)	(0.703)	(0.705)
D_{ij}^X, D_{ij}^I,	-2.364[a]	-6.901[a]	-2.520[a]	-7.919[a]	-2.533[a]	-2.690[a]
(PRT)	(0.650)	(1.368)	(0.654)	(1.331)	(0.735)	(0.744)
D_{ij}^X, D_{ij}^I,	-1.540[b]	-3.275[b]	-1.608[a]	-4.160[a]	-1.940[a]	-2.009[a]
(SWE)	(0.612)	(1.303)	(0.624)	(1.266)	(0.702)	(0.709)
$\ln DIST_{ij}$	-1.157[a]	-0.969[a]	-1.101[a]	-0.559[a]	-1.157[a]	-1.101[a]
	(0.079)	(0.176)	(0.091)	(0.193)	(0.090)	(0.103)

Notes: Standard errors are in parentheses. [a, b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table 4.2-*Continued.*

	Ownership-Basis Gravity Equation				Conventional Gravity Equation	
	SURE		SURE		OLS	OLS
	(i)		(ii)		(iii)	(iv)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}	COM_{ij}^{lb}
$CONT_{ij}$			0.432[b]	1.655[a]		0.432[c]
			(0.219)	(0.445)		(0.249)
$LANG_{ij}$			-0.488	0.123		-0.488
			(0.303)	(0.618)		(0.344)
MR		0.840[a]		0.793[a]		
		(0.192)		(0.185)		
BE (FIN)	7.203		8.517		9.142	10.224
BE (FRA)	2.772		3.549		6.443	6.935
BE (JPN)	2.339		2.980		2.432	3.077
BE (NDL)	0.085		0.107		0.411	0.469
BE (POL)	54.622		62.276		84.243	94.995
BE (PRT)	10.524		12.378		12.595	14.729
BE (SWE)	3.964		4.630		6.961	7.452
N	203	203	203	203	203	203
R^2	0.931	0.985	0.932	0.987	0.900	0.901
RMSE	0.555	1.166	0.549	1.116	0.675	0.672

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Column (iv) of Table 4.2 displays the results from the conventional gravity equation in a specification that does control for common language and contiguity. The results from column (ii) of Table 4.2 and column (iv) of Table 4.2 indicate inflated magnitudes of the border effects when using the conventional gravity equation. For example, when measured through the conventional gravity equation, the magnitude of the border effects are inflated by a factor of 2.0 for France (from 3.55 to 6.94); by a factor of 4.4 for the Netherlands (from 0.11 to 0.47); by a factor of 1.5 for Poland (from 62.28 to 95.00) and by a factor of 1.6 for Sweden (from 4.63 to 7.45). The inflation occurs to a lesser extent for Japan and Portugal.

Next, the magnitude of the border effects between the European Union (EU) countries is evaluated and is compared to the magnitude of the border effects between two EU-unrelated OECD countries (henceforth UR). The results are displayed in Table 4.3. Column (i) and column (ii) of Table 4.3 show the SURE results of the empirical application of the ownership-basis gravity equation in two specifications: the first does not control for common language and contiguity and the second does control for contiguity and common language. With no control of common language and contiguity, the magnitudes of the border effects between the EU countries and between the UR countries are 4.2 and 5.0, respectively. The magnitudes of the border effects between the EU countries and between the UR countries increase to 5.0 and 6.0 after controlling for common language and contiguity.

Table 4.3: EU-EU Magnitude of the Border Effects.

	Ownership-Basis Gravity Equation				Conventional Gravity Equation	
	SURE		SURE		OLS	OLS
	(i)		(ii)		(iii)	(iv)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}	COM_{ij}^{lb}
D_{ij}^{X}	-1.691[a]		-1.839[a]		-2.121[a]	-2.279[a]
	(0.359)		(0.376)		(0.386)	(0.407)
D_{ij}^{I}		-4.094[a]		-5.010[a]		
		(0.707)		(0.784)		
$D_{ij}^{X}(EU)$	0.177		0.181		0.147	0.151
	(0.193)		(0.191)		(0.207)	(0.207)
$D_{ij}^{I}(EU)$		0.117		0.144		
		(0.382)		(0.368)		
$\ln DIST_{ij}$	-1.081[a]	-0.997[a]	-1.019[a]	-0.637[a]	-1.073[a]	-1.006[a]
	(0.089)	(0.180)	(0.100)	(0.197)	(0.096)	(0.108)
$CONT_{ij}$			0.469[b]	1.539[a]		0.485[c]
			(0.247)	(0.474)		(0.267)
$LANG_{ij}$			-0.451	0.227		-0.443
			(0.343)	(0.660)		(0.370)
MR		0.805[a]		0.769[a]		
		(0.197)		(0.191)		

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively.

Table 4.3-*Continued*

	Ownership-Basis Gravity Equation				Conventional Gravity Equation	
	SURE		SURE		OLS	OLS
	(i)		(ii)		(iii)	(iv)
$BE(UR)$	4.976		6.034		8.338	9.765
$BE(EU)$	4.187		5.040		7.199	8.398
N	203	203	203	203	203	203
R^2	0.911	0.983	0.913	0.984	0.919	0.921
$RMSE$	0.629	1.245	0.623	1.200	0.676	0.673

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively.

Column (iii) of Table 4.3 and column (iv) of Table 4.3 display the results from two specifications of the conventional gravity equation: the first does not control for common language and contiguity and the second does control for common language and contiguity. With no control of common language and contiguity, the magnitudes of the border effects between the EU countries and between the UR countries are 7.2 and 8.3, respectively. Hence, the magnitudes of the border effects between the EU countries and between the UR countries are both inflated by a factor of 1.7 when using the conventional gravity equation. After controlling for contiguity and common language, the magnitudes of the border effects between the EU countries and between the UR countries increase to 8.4 and 9.8, respectively. Hence, the magnitudes of the border effects between the EU countries and between the UR countries are inflated by a factor of 1.7 and by a factor of 1.6 when using the conventional gravity equation, respectively.

4.6 Sensitivity analysis

This section examines the sensitivity of the results obtained from the ownership-basis gravity equation when some potential econometric, specification and measurement issues are considered. Table 4.4 illustrates the results of the sensitivity analysis obtained from the empirical application of the ownership-basis gravity equation when measuring the average magnitude of the border effects over the destination countries covered in the sample. Table A.2 of the Appendix illustrates the results of the equivalent sensitivity analysis obtained from the empirical application of the ownership-basis gravity equation measuring the country specific magnitude of the border effects. The numbers of columns in both Tables correspond to the same sensitivity test. The sensitivity analysis is carried out in the case where contiguity and common language are controlled. To make comparison easier, columns (i) in both Table 4.4 and Table A.2 replicate the results from the basic regressions while columns (1) in both Table 4.4 and Table A.2 display the outcome from the conventional gravity equation.

A potential econometric concern is heteroskedasticity associated with the economic size of the international commerce associates. Frankel (1997) argues that, by using economic-size-weighted least square, the empirical regression of the conventional gravity equation will rely more considerably on the information extracted from cross-border trade between larger units. The same logic applies in the case of the ownership-basis gravity equation. The stochastic functional form of the error term is specified as

$$\varepsilon_{ij} = W\left[\ln\left(E_i Y_j\right)\right]^{-1/2}\tilde{\varepsilon}_{ij} \qquad (4.15)$$

where W is a constant term and $\tilde{\varepsilon}_{ij} \sim N\left(0, \tilde{\sigma}^2\right)$. Column (ii) of Table 4.4 illustrates the results after dealing with the potential heteroskedasticity concern. There is no significant effect on the estimates of the coefficients of the border effects dummy variables. Columns (iii) of Table 4.4 shows that the results remain robust when using alternative stochastic functional form of the error term as

$$\varepsilon_{ij} = W.\left[\ln(E_i)\ln(Y_j)\right]^{-1}\tilde{\varepsilon}_{ij} \qquad (4.16)$$

Table 4.4: Sensitivity Analysis, Overall Average Magnitude of the Border Effects.

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(ii)		(iii)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}
D_{ij}^{X}	-1.690[a]		-1.658[a]		-1.629[a]		-2.156[a]
	(0.343)		(0.339)		(0.334)		(0.370)
D_{ij}^{I}		-4.892[a]		-4.815[a]		-4.735[a]	
		(0.657)		(0.657)		(0.657)	
$\ln DIST_{ij}$	-1.045[a]	-0.657[a]	-1.040[a]	-0.665[a]	-1.035[a]	-0.674[a]	-1.028[a]
	(0.096)	(0.191)	(0.093)	(0.187)	(0.090)	(0.183)	(0.104)
$CONT_{ij}$	0.466[c]	1.536[a]	0.433[c]	1.548[a]	0.404[c]	1.554[a]	0.482
	(0.247)	(0.474)	(0.245)	(0.475)	(0.242)	(0.475)	(0.266)
$LANG_{ij}$	-0.454	0.225	-0.431	0.189	-0.410	0.157	-0.446
	(0.343)	(0.660)	(0.339)	(0.660)	(0.335)	(0.658)	(0.370)
MR		0.766[a]		0.792[a]		0.817[a]	
		(0.190)		(0.193)		(0.197)	
BE	5.207		5.034		4.881		8.635
N	203	203	203	203	203	203	203
R^2	0.912	0.984	0.913	0.984	0.914	0.983	0.904
$RMSE$	0.624	1.201	0.623	1.213	0.621	1.225	0.672

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation.

Table 4.4-*Continued*

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(iv)		(v)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}
D_{ij}^{X}	-1.690[a]		-1.690[a]		-1.690[a]		-2.156[a]
	(0.343)		(0.343)		(0.343)		(0.370)
D_{ij}^{I}		-4.892[a]		-4.794[a]		-4.840[a]	
		(0.657)		(0.660)		(0.657)	
$\ln DIST_{ij}$	-1.045[a]	-0.657[a]	-1.045[a]	-0.631[a]	-1.045[a]	-0.709[a]	-1.028[a]
	(0.096)	(0.191)	(0.096)	(0.191)	(0.096)	(0.192)	(0.104)
$CONT_{ij}$	0.466[c]	1.536[a]	0.466[c]	1.449[a]	0.466[c]	1.525[a]	0.482
	(0.247)	(0.474)	(0.247)	(0.191)	(0.247)	(0.473)	(0.266)
$LANG_{ij}$	-0.454	0.225	-0.454	0.266	-0.454	0.150	-0.446
	(0.343)	(0.660)	(0.343)	(0.661)	(0.343)	(0.660)	(0.370)
MR		0.766[a]		1.122[a]		0.657[a]	
		(0.190)		(0.314)		(0.145)	
BE	5.207		5.188		5.196		8.635
N	203	203	203	203	203	203	203
R^2	0.912	0.984	0.912	0.984	0.912	0.984	0.904
$RMSE$	0.624	1.201	0.624	1.201	0.624	1.203	0.672

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation.

Table 4.4-*Continued.*

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(vi)		(vii)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}
D_{ij}^{X}	-1.690[a]		-1.846[a]		-1.967[a]		-2.156[a]
	(0.343)		(0.337)		(0.334)		(0.370)
D_{ij}^{I}		-4.892[a]		-5.337[a]		-5.863[a]	
		(0.657)		(0.653)		(0.650)	
$\ln DIST_{ij}$	-1.045[a]	-0.657[a]	-1.040[a]	-0.650[a]	-1.036[a]	-0.644[a]	-1.028[a]
	(0.096)	(0.191)	(0.095)	(0.189)	(0.094)	(0.189)	(0.104)
$CONT_{ij}$	0.466[c]	1.536[a]	0.471[c]	1.539[a]	0.475[b]	1.543[a]	0.482
	(0.247)	(0.474)	(0.243)	(0.470)	(0.241)	(0.468)	(0.266)
$LANG_{ij}$	-0.454	0.225	-0.451	0.232	-0.449	0.236	-0.446
	(0.343)	(0.660)	(0.243)	(0.655)	(0.334)	(0.653)	(0.370)
MR		0.766[a]		0.758[a]		0.753[a]	
		(0.190)		(0.190)		(0.190)	
BE	5.207		6.150		7.004		8.635
N	203	203	203	203	203	203	203
R^2	0.912	0.984	0.916	0.984	0.918	0.984	0.904
$RMSE$	0.624	1.201	0.614	1.192	0.608	1.187	0.672

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation.

Table 4.4-*Continued.*

	Ownership-Basis Gravity Equation						CGE	
	SURE		SURE		SURE		OLS	OLS
	(i)		(viii)		(xi)		(2)	(3)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}	COM_{ij}^{lb}
D_{ij}^{X}	-1.690[a]		-1.761[a]		-0.807		-2.242[a]	-1.345
	(0.343)		(0.359)		(0.392)		(0.389)	(0.427)
D_{ij}^{I}		-4.892[a]		-4.734[a]		-4.042[a]		
		(0.657)		(0.663)		(0.753)		
$\ln DIST_{ij}$	-1.045[a]	-0.657[a]	-0.929[a]	-0.658[a]	-0.966[a]	-0.697[a]	-0.908[a]	-0.934[a]
	(0.096)	(0.191)	(0.094)	(0.177)	(0.086)	(0.170)	(0.101)	(0.094)
$CONT_{ij}$	0.466[c]	1.536[a]	0.540[b]	1.463[a]	0.399	1.397[a]	0.562[b]	0.437
	(0.247)	(0.474)	(0.255)	(0.471)	(0.246)	(0.472)	(0.276)	(0.267)
$LANG_{ij}$	-0.454	0.225	-0.616[c]	0.131	-0.445	0.209	-0.603	-0.434
	(0.343)	(0.660)	(0.355)	(0.660)	(0.339)	(0.653)	(0.385)	(0.369)
MR		0.766[a]		0.738[a]		0.772[a]		
		(0.190)		(0.189)		(0.190)		
BE	5.207		5.533		2.156		9.408	3.838
N	203	203	203	203	203	203	203	203
R^2	0.912	0.984	0.907	0.985	0.914	0.985	0.914	0.921
RMSE	0.624	1.201	0.644	1.196	0.616	1.187	0.697	0.671

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation.

The second set of the sensitivity analysis deals with the specification of the probit selection equation (4.14). Column (iv) of Table 4.4 displays the results when the economic size (i.e. GDP_i and GDP_j), bilateral distance (i.e. $DIST_{ij}$) and the proxy of relative cost advantage theory (i.e. RCA_{ij}) are specified in their natural form. Again, the initial results are not altered. Column (v) displays the results when controlling the transition countries and the EU countries as source countries. The motivation behind this test is that the underlying causes accompanying the decision on whether to undertake FDI might vary between the EU countries and the transition countries as source countries. Underdeveloped mechanism in investing abroad might illustrate a supplementary reason of not undertaking FDI in a wide range of destination countries. The control is exercised by including two dummy variables. The first dummy variable takes the value of unity when the source country is a country in transition. The second dummy variable takes the value of unity when the source country is a member of the EU. The results only show a slight modification.

The remaining columns of Table 4.4 examine the cases where the results are subjected to variation. So far, the activities of the foreign affiliates of MNEs are completely attributed to UBO. Unfortunately, detailed data disentangling the ownership of FDI into the ownership of UBO, the ownership of the host country and the ownership of other foreign countries are not available. Columns (vi) and (vii) investigate the modification of the basic results from the ownership-basis gravity equation when FDI ownership of UBO is 75% and 50%, respectively. The remaining FDI ownership is attributed to the host country. The modification of the estimated coefficients of D_{ij}^X when varying the ownership percentage of UBO is attributed to the modification of the values of intranational commerce. On the other hand, the modification of the estimated coefficients of D_{ij}^I when varying the ownership percentage of UBO is attributed to the modification of the values intranational commerce, as well as, to the modification of the values of sales of foreign affiliates of MNEs. The estimated coefficients of D_{ij}^X drops from – 1.69 when UBO ownership is 100% to –1.85 and -1.97 when UBO ownership is 75% and 50%, respectively. The estimated coefficients of D_{ij}^I drops from –4.89 when

UBO ownership is 100% to –5.34 and -5.86 when UBO ownership is 75% and 50%, respectively. The magnitude of the ownership-basis border effects increases from 5.21 when UBO ownership is 100% to 6.15 and 7.00 when UBO ownership is 75% and 50%, respectively.

While the distance measurement of Head and Mayer (2000, 2002) (i.e. equation 4.12) is adopted in reporting the previous results, columns (viii) and (ix) of Table 4.4 report the results when using the greater circle distance of Wei (1996) and the effective distance of Head and Mayer (2002)[34]. Column (viii) and column (ix) show the results when the greater circle distance of Wei (1996) and the effective distance of Head and Mayer (2002) are employed, respectively. The magnitude of the border effects moderately increases from 5.21 to 5.53 when the greater circle distance of Wei (1996) is employed. Yet, relatively more accentuated modifications of the results are recorded when the effective distance of Head and Mayer (2002) is employed. In this case, the magnitude of the border effects drops from 5.21 to 2.15. Columns (2) and (3) of Table 4.4 reports the results from the empirical application of the conventional gravity equation when adopting the greater circle distance of Wei (1996) and the effective distance of Head and Mayer (2002), respectively.

Finally, there is the concern regarding the specification of the distance function. Some of the previous literature on border effects (e.g. McCallum, 1995; Wei, 1996; Wolf, 2000) indicates that the empirical results have survived some tests of sensitivity regarding the potential non-linear relationship between the values of cross-border trade and distance. Meanwhile, some other literature does not conduct any equivalent sensitivity analysis (e.g. Anderson and van Wincoop, 2003; Feenstra, 2002; Helliwell; 1996). Our theoretically derived ownership-basis gravity equation and the conventional gravity equation derived from the ownership-basis setup are more likely to convey empirical non-linear relationship between values of international commerce and distance. This study does not deal with the empirical probe of the appropriate distance function leaving this issue for future work.

[34]Table A.3 of the appendix illustrates the values of the alternative bilateral distance measures.

4.7 Concluding Remarks

This chapter conducts empirical applications of the ownership-basis gravity equation to compute amended measures of the border effects. This chapter shows that the application of the conventional gravity equation to determine the magnitude of the border effects as a reflection of the magnitude of international economic integration suffers from two defects: conceptual and computational. The conceptual defect is associated with the interpretation of the conventionally measured border effects. If border effects are meant to express the magnitude of international economic integration, then the conventional measurement of border effects becomes inappropriate. This chapter shows that the conventionally measured border effects is intended to assess cross-border trade barriers. Meanwhile, there exists a computational defect even if the conventional measurement of border effects is intended to capture cross-border trade barriers.

In the presence of FDI, the concept of the border effect is redefined as the border separating the producers of one country from the consumers of another country rather than the barriers at the international border. This is why the magnitude of the border effects obtained from the ownership-basis gravity equation is coined ownership-basis border effects. The magnitude of the ownership-basis border effects is determined as a weighted average of three various types of policy barriers encountered in international commerce: policy barriers in cross-border trade, policy barriers associated with the transactions of foreign affiliates of MNEs and an implicit prohibitive policy barriers associated with the non-engagement in any form of international commerce. The weights are determined by the current policy-related configuration of international commerce. One additional feature of the ownership-basis border effects is that it captures, beside the policy barriers that have operational aspects, the policy barriers that have fixed cost aspects. This fact is clear in our model as the policy barriers of fixed cost aspects constitute one of the basic determinants of the current configuration of international commerce. The policy barriers of fixed cost aspects are particularly important in reflecting the effects of the direct restrictions on the foreign ownership of capital.

The empirical application is conducted for a subset of OECD countries reporting the inward activities of the foreign affiliates of MNEs in the aggregate manufacturing industry as defined by the ISIC-Rev.3 classification. The results obtained from the ownership-basis gravity equation are contrasted to the results obtained from the conventional gravity equation. The results obtained from the ownership-basis gravity equation indicate that the magnitudes of the border effects are significantly inflated when using the conventional gravity equation. Interestingly, the coefficients capturing FDI barriers show significantly higher magnitudes compared to those capturing cross-border trade barriers. These results are suggestive in the following sense. While the main focus of initial multilateral and bilateral agreements is the lessening of the cross-border trade barriers, it seems that more opportunity are still to be exploited through the lessening of FDI barriers in operational and fixed cost terms. Hence, these results describe suggestive potential direction for the ongoing and future multilateral and bilateral agreements.

CHAPTER V

EMPIRICAL APPLICATION: THE EFFECTS OF THE CANADA-U.S. FREE TRADE AGREEMENT (CUSFTA)

5.1 Introduction

The conventional gravity equation has served a wide strand of empirical literature in assessing the effects of RIAs. The method is generally carried out in a cross sectional empirical setting. The method is simple and consists of employing a dummy variable that takes the value of unity for each observation in trade between the insiders of a particular RIA. However, two main caveats are to be considered when carrying out this method using the conventional gravity equation. The first caveat is related to the fact that the configuration of international commerce consists of cross-border trade and transactions of foreign affiliates of MNEs. The conventional gravity equation is derived from a theoretical setup where cross-border trade is the sole channel of international commerce. As a result, this theoretical defect is forwarded into the empirical application. The requisite to consider FDI in the theoretical derivation of the gravity equation is emphasized by the descriptive observations indicating the prominence of the foreign affiliates of MNEs in conducting international commerce (See section 5.2 for illustrations). The second caveat is related to the requisite that the analyses of the effects of RIAs should be performed by contrasting the post-RIA status to the pre-RIA status. After controlling for economic size, bilateral distance and other non-policy barriers, Eichengreen and Irwin (1995) report findings where two RIA insiders exhibit significantly higher trade level between them then with RIA outsiders long before the implementation of RIA. These findings cast doubts on the conventional approach of employing RIA dummy variable in a post-RIA implementation period. In this case, ambiguity arises on whether the relatively higher trade level between RIA insiders is indeed attributed to the implementation of RIA *per se*.

This chapter deals with these two caveats. The first caveat is approached by exploiting the theoretical ownership-basis gravity equation that encompasses both channels of international commerce. The second caveat is approached through the employment of panel datasets. In a cross-sectional empirical setting, Eichengreen and Irwin (1995) propose the control of trade history in order to net the effects of RIAs. This chapter deals with the second caveat more directly by contrasting the post-RIA status to the pre-RIA status. The detection of a structural break will be interpreted as evidence of the effects of RIA.

The RIA under consideration in this chapter is CUSFTA that came into implementation on January, 1st 1989. By taking into consideration the two aforementioned caveats, two subsequent objectives are pursued in this chapter. The first objective consists of evaluating the effects of CUSFTA on each channel of international commerce. In other words, this chapter applies the ownership-basis gravity equation to detect whether RIA has induced trade creation (or trade diversion) and investment diversion (or investment creation) between the insiders of CUSFTA. At the same time, this chapter draws inferences regarding the occurrence of trade diversion (or trade creation) and investment creation (or investment diversion) between an insider of CUSFTA and an outsider of CUSFTA. The second objective consists of assessing the overall effects of CUSFTA on economic integration between the U.S. and Canada.

This empirical application is carried out for the aggregate manufacturing industry defined according to the U.S. standard industrial classification (US-SIC) and covering the period 1983-1996. The selections of CUSFTA as the RIA of interest, the level of aggregation and the time interval are largely dictated by the availability of data on the operations of the foreign affiliates of MNEs. The Bureau of Economics Analysis (BEA) is one of the very few institutions that compile datasets on the operations of the foreign affiliates of MNEs over time. In these datasets, the U.S. is the hub of all the inward and outward international transactions.

The next section represents a descriptive illustration of the levels and patterns of transactions of foreign affiliates of MNEs relative to cross-border trade between the U.S. and Canada and between the U.S. and other OECD countries. Section 5.3 represents a descriptive analysis of CUSFTA effects on international commerce barriers between the U.S. and Canada and between the U.S. and other OECD countries. Section 5.4 formulates the empirical specification. Section 5.5 describes the datasets. Section 5.6 displays and discusses the empirical results. Section 5.7 illustrates the concluding remarks.

5.2 FDI versus Trade between the U.S. and Canada

There is a common tradition in the economic literature to illustrate the levels and patterns of FDI through its capital aspect (i.e. FDI flow and FDI cumulative stock). However, when a common measurement standard of FDI and cross-border trade is required, FDI is best represented through its operational aspect (i.e. transactions of foreign affiliates of MNEs).

Figure 5.1 delineates the prominence of the transactions of foreign affiliates of MNEs as a channel of international commerce between the U.S. and Canada in the aggregate manufacturing industry. Figure 5.1 displays two computed ratios over the period 1983-1996: The first ratio is the outward ratio computed by dividing the total local sales of foreign affiliates of U.S. MNEs in Canada to the total U.S. exports to Canada. The second ratio is the inward ratio computed by dividing the total local sales of foreign affiliates of Canadian MNEs in the U.S. relative to total U.S. imports from Canada[35]. Figure 5.1 shows that the total local sales of foreign affiliates of U.S. MNEs in Canada outweigh the total U.S. exports to Canada throughout the period 1983-1989. The U.S.-Canada outward ratio experiences a noticeable drop after 1989, the year CUSFTA came into implementation. The U.S.-Canada inward ratio is generally lower than the U.S.-Canada outward ratio. Figure 5.1 shows that the inward ratio does not display a distinctive drop after 1989 but after 1994, the year NAFTA came into implementation.

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[35] See data section (5.5) for details on the source and construction of the local sales of foreign affiliates of MNEs and cross-border trade values.

A *prima facie* explanation as to why the drop after 1989 is noticeable in the case of the U.S.-Canada outward ratio but it is not in the case of the U.S.-Canada inward ratio might be resting on two main points. First, the magnitude of the overall dismantlement of tariff barriers is higher at the Canadian border compared to the one occurred at the U.S. border[36]. Second, there are the market size considerations. It is expected that Canadian MNEs are relatively more driven by the market size considerations compared to the incentive to jump the border barriers when undertaking FDI in the larger U.S. market than do U.S. MNEs undertaking FDI in the smaller Canadian market. However, these two points do not stand for the observed distinctive decline after 1994 that characterizes the U.S.-Canada inward ratio but that does not characterize the U.S.-Canada outward ratio. In order to explain these patterns, the structure of the phase-outs featuring CUSFTA should be analyzed. It would be also important to disentangle the effects of the implementation of NAFTA *per se* from those resulting from the five years staged CUSFTA tariffs phase-outs on the drop of the inward ratio[37].

Figure 5.2 plots the U.S. outward ratio and the U.S. inward ratio with an aggregate of OECD countries[38]. For both the U.S.-OECD outward ratio and the U.S.-OECD inward ratio, sales of foreign affiliates of MNEs outweigh cross-border trade as a channel of reaching foreign markets. The generally higher levels of the U.S.–OECD inward ratio and the U.S.–OECD outward ratio compared to the U.S.–Canada inward ratio and the U.S.–Canada outward ratio are partially attributed to the geographical proximity and contiguity factors between the U.S. and Canada. The U.S.-OECD outward ratio does not exhibit a distinctive structural break. The U.S.-OECD inward ratio shows a particular increasing trend mainly between 1986 and 1990. While the regional integration agreement of the large U.S. with a partner one-tenth of its market size does not particularly convey the perception of a distinctive effect on the inward ratio, one can formulate a story that partially associates this observation to CUSFTA. One can speculate that firms of outsider countries have perceived the negotiations that have lead to CUSFTA as an initial step toward a "Fortress North-America" countering "Fortress

[36] See Head and Ries (1997) for a graphical illustration.

[37] Complete analysis should not exclude other potential macroeconomic factors (e.g. exchange rates) as potential explanatory factors.

Europe". This perception may have invoked modifications in the long-run strategies of foreign firms in accessing the North American market. If this is the case, a more noticeable effect is expected in the case of Canadian inward ratio with the outsiders as the Canadian CUSFTA partner weights ten times the Canadian economic size. An integral investigation of these speculations requires multivariate analyses. However, carrying out the multivariate analyses still await the availability and accessibility of datasets on the Canadian bilateral inward and outward transactions of foreign affiliates of MNEs.

The effects of CUSFTA might have been mitigated from causing a more caustic modification after 1989 due to the gradual adjustments that might have occurred by the negotiations and the announcements of CUSFTA. In other words, these adjustments might have started to occur prior to the implementation of CUSFTA and stretched over the subsequent years.

Changes in the ratio of total local sales of foreign affiliates of MNEs to total exports reflect the intensification in one channel of attaining foreign markets relative to the other. Hence, a decreasing trend reflects an intensification of exports relative to FDI whereas an increasing trend depicts the reverse. Intensification is not necessarily related to the substitution-complementarity relationships between cross-border trade and FDI that are widely analyzed in the empirical trade literature (e.g. Blonigen, 2001; Head and Ries, 2001b; Clausing, 2000b; Svensson, 1996). This literature identifies substitution (complementarity) between trade and FDI when the increase in the activity level of one channel lessens (stimulates) the activity level of the other channel, *ceteris paribus*. When intensification in exports is detected, this could be the outcome of a complementarity of less than one for one between cross-border trade and FDI.

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[38] The OECD countries used in the aggregation are: France, Germany, Japan, the Netherlands, Switzerland, and United Kingdom.

Figure 5.1: U.S.-Canada Outward and Inward Ratios in Manufacturing; 1983-96.

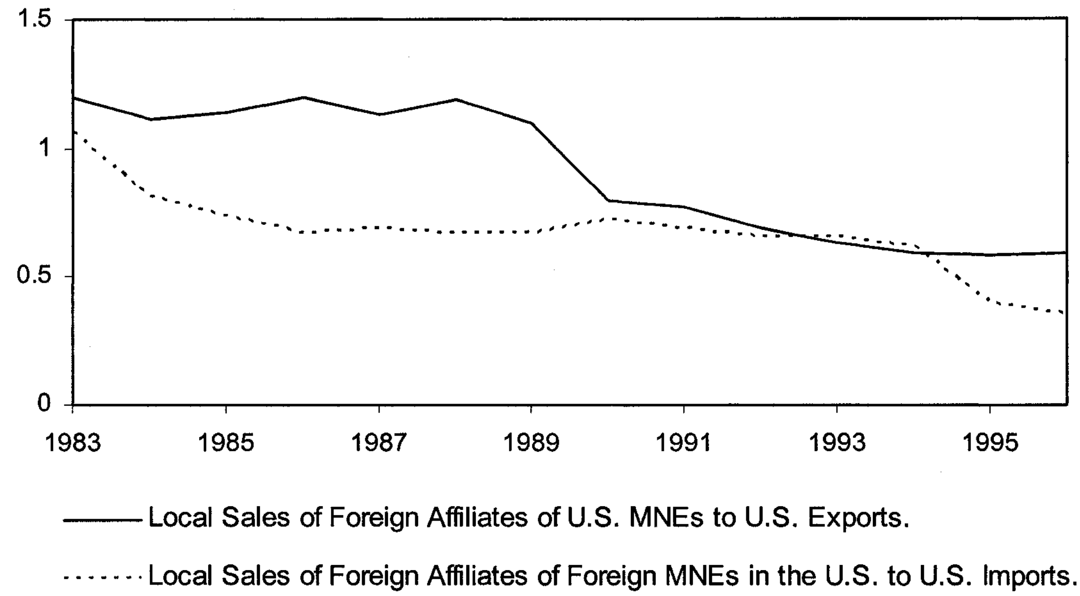
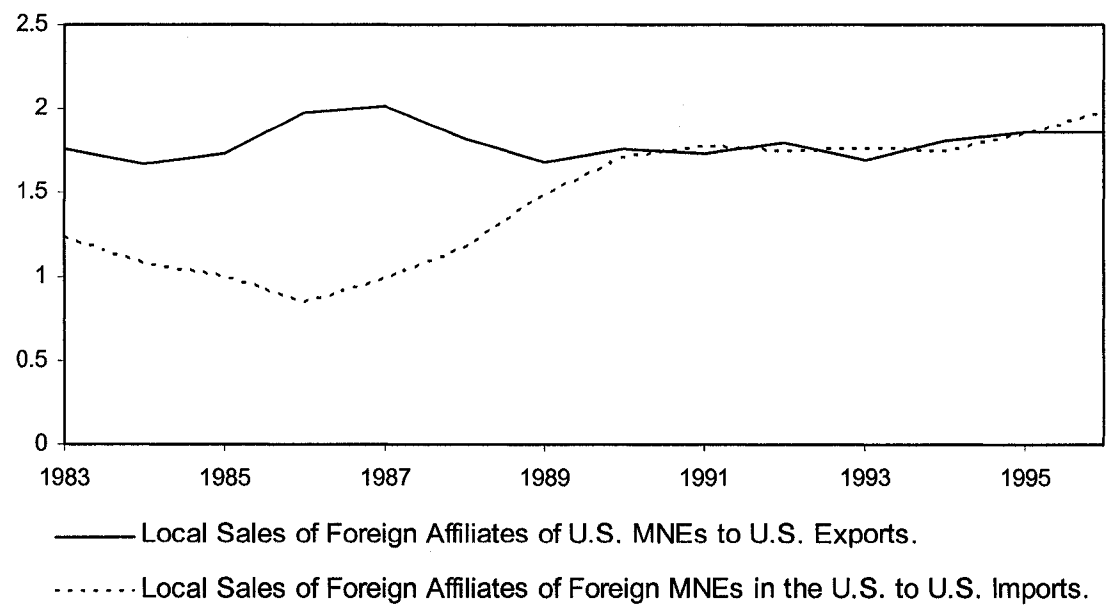


Figure 5.2: U.S.-OECD Outward and Inward Ratios in Manufacturing; 1983-96.



5.3 Descriptive Analysis

Due to data limitations, the empirical analysis of the effects of CUSFTA is conducted from the U.S. perspective using datasets spanning over the period 1983-1996 for the aggregate US-SIC manufacturing industry[39]. The empirical analysis has two objectives. The first objective is to examine the effects of CUSFTA on cross-border trade and transactions of foreign affiliates of MNEs using the ownership-basis gravity equation. The empirical application tests Kindelberger's (1966) hypothesis on whether trade creation and investment diversion occurs between the U.S. and Canada as a result of CUSFTA. The empirical application also tests the other Kindelberger's (1966) hypothesis on whether CUSFTA causes trade diversion and investment creation between the U.S. and the outsiders. The second objective is to assess the effects of CUSFTA on the U.S.-Canada economic integration and to examine whether CUSFTA has any effect on international commerce between the U.S. and the outsiders. Doing so will help to derive some welfare implications of CUSFTA from the U.S. perspective[40].

The effects of CUSFTA are examined by studying the evolvement of the barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce. The descriptive and empirical analyses consider the effective international current barriers relative to intranational barriers as defined in section 3.6. The effective international current barriers relative to intranational barriers take into consideration the direct liberalization effects of CUSFTA but also indirect effects of CUSFTA on the configuration of international commerce.

For illustration, Figure 5.3 displays the geometric mean of the effective current barriers in international commerce relative to barriers in intranational commerce between the U.S. and Canada for the aggregate US-SIC manufacturing industry over the period 1983-1996. Figure 5.3 shows a distinctive decline in the geometric mean of the effective current barriers in international commerce relative to barriers in intranational commerce between Canada and the U.S. following 1989, the year CUSFTA becomes effective[41,42].

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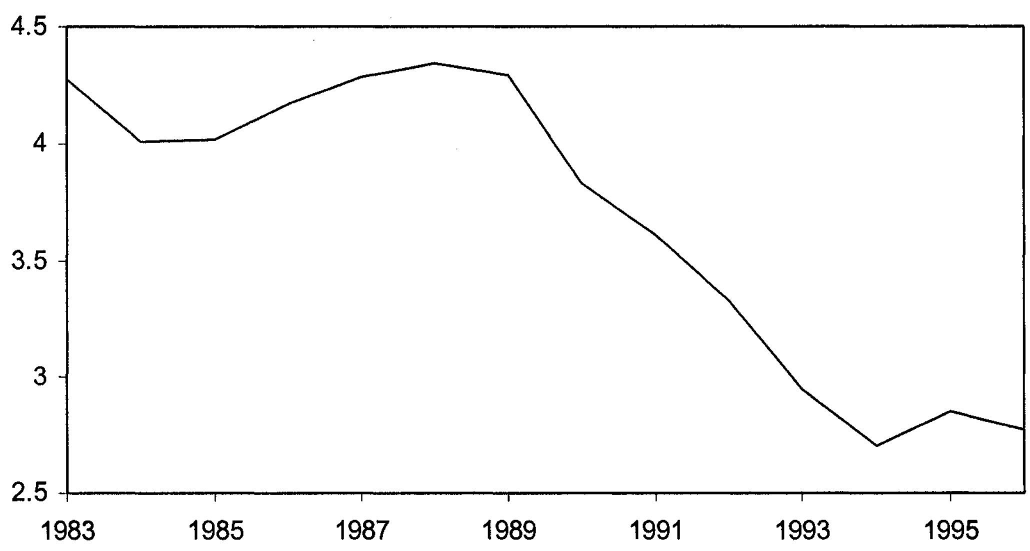
[39] See data section (5.5) for details on the source and construction of the datasets.
[40] In our analysis, NAFTA is viewed as an extension of the CUSFTA from the U.S.-Canada perspective.
[41] See data section (5.5) for details on the source and construction of the datasets.

Figure 5.4 to Figure 5.8 display the geometric mean of the effective current barriers in international commerce relative to barriers in intranational commerce between the U.S. and five major OECD commerce associates of the U.S.: France, Germany, Japan, The Netherlands and the United Kingdom, for the aggregate US-SIC manufacturing industry over the period 1983-1996, respectively. Unlike Figure 5.3, Figure 5.4 to Figure 5.8 do not exhibit distinctive breaks throughout the evolvement of the effective current barriers in international commerce relative to barriers in intranational commerce following 1989, the year CUSFTA becomes effective. The effects of CUSFTA on the effective current barriers in international commerce relative to barriers in intranational commerce between the U.S. and these five major OECD commerce associates might be minor due to the large U.S. economy relative to its CUSFTA partner. Using the same analogy, the effects of CUSFTA on the effective current barriers in international commerce relative to barriers in intranational commerce between Canada and these OECD countries are expected to be more prominent.

Figure 5.3: U.S.–Canada Geometric Mean of Effective Current Barriers in International Commerce Relative to Barriers in Intranational Commerce; 1983-96.



[42] Data on the aggregate total sales of foreign affiliates of MNEs from all sources in the OECD countries are not available. Therefore, the geometric means are measured in bilateral sense where the foreign affiliates of the other countries are treated as domestically owned firms.

Figure 5.4: U.S.–France Geometric Mean of the Effective Current Barriers in International Commerce Relative to Barriers in Intranational Commerce; 1983-96.

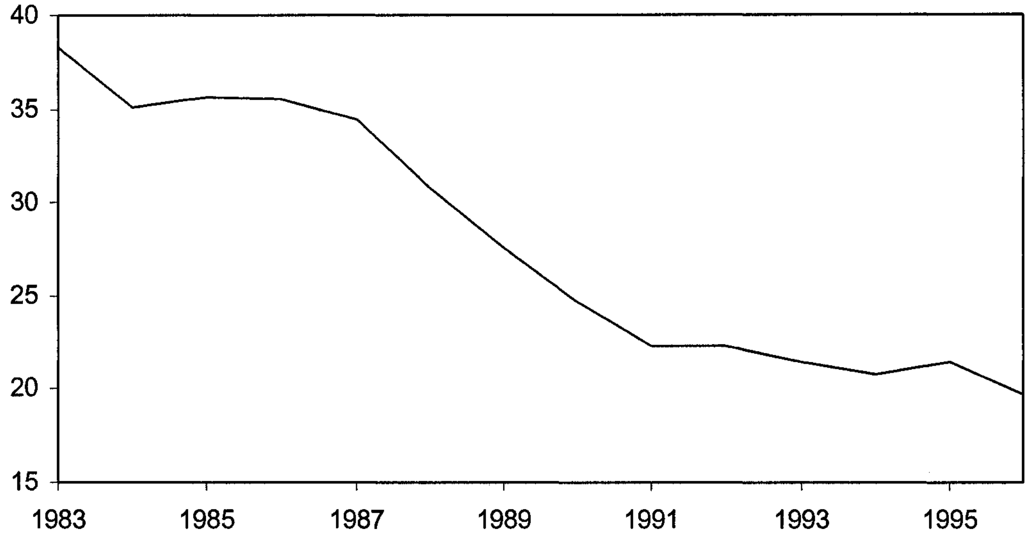


Figure 5.5: U.S.–Germany Geometric Mean of the Effective Current Barriers in International Commerce Relative to Barriers in Intranational Commerce; 1983-96.

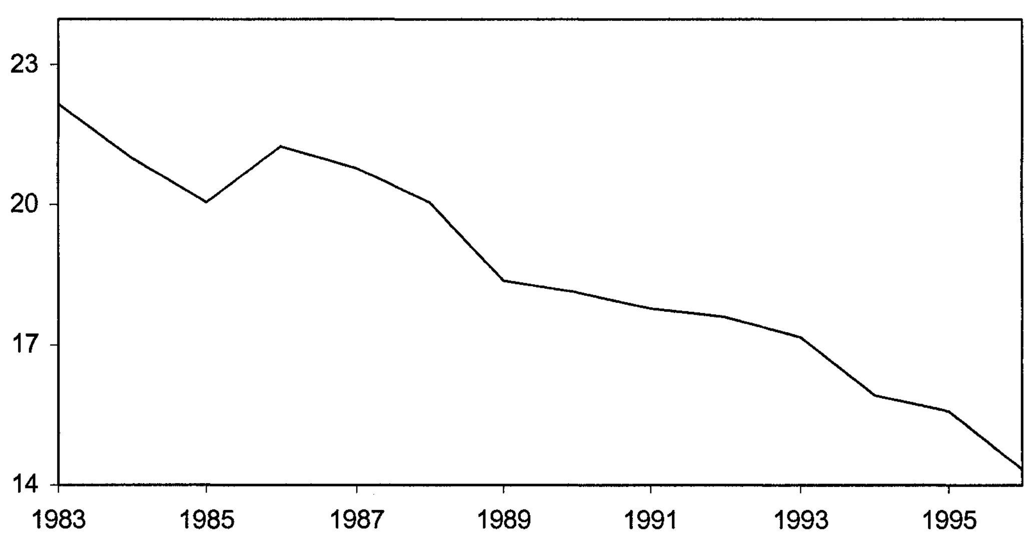


Figure 5.6: U.S.–Japan Geometric Mean of the Effective Current Barriers in International Commerce Relative to Barriers in Intranational Commerce; 1983-96.

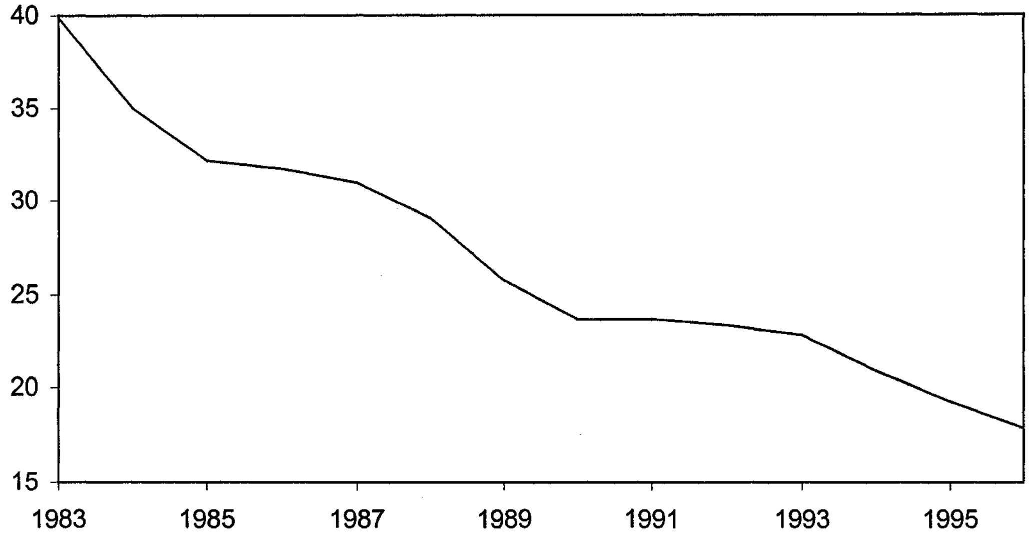


Figure 5.7: U.S.–The Netherlands Geometric Mean of the Effective Current Barriers in International Commerce Relative to Barriers in Intranational Commerce; 1983-96.

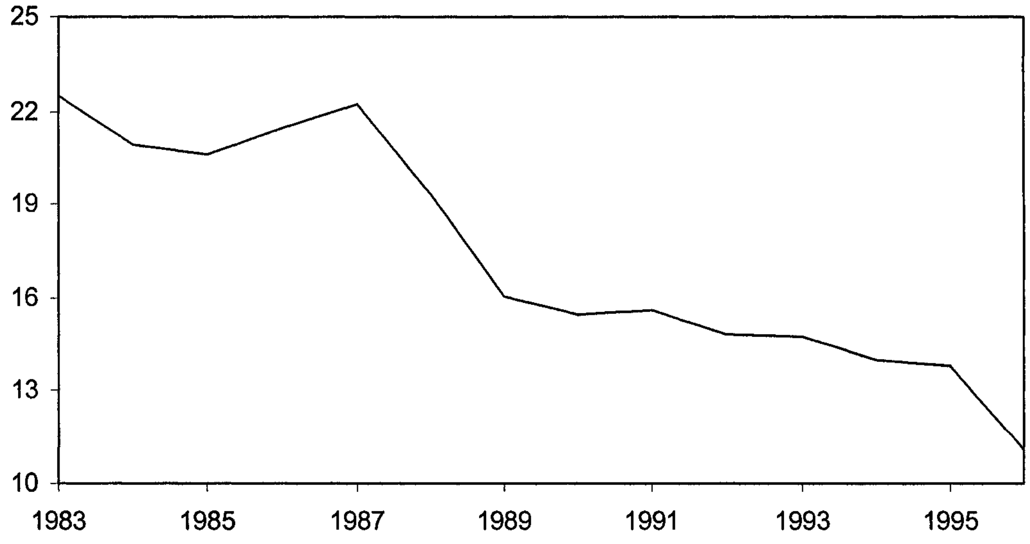
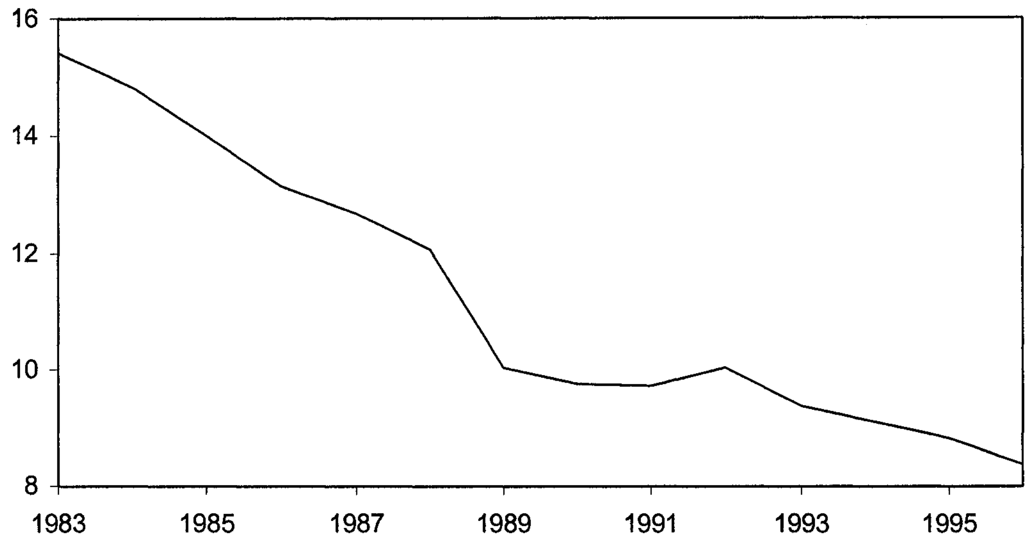


Figure 5.8: U.S.–U.K. Geometric Mean of the Effective Current Barriers in International Commerce Relative to Barriers in Intranational Commerce; 1983-96.



5.4 Empirical Specification

This section transfers the theoretical geometric mean of the effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce relative to barriers in intranational commerce (i.e. equations (3.38), (3.39), (3.41), respectively) into empirical equations that fulfill the objectives of this chapter. Let the year of implementation of CUSFTA (i.e. 1989) to define two sub-periods: pre-CUSFTA and post-CUSFTA. The effects of CUSFTA are examined by probing for the occurrence of structural breaks between the two sub-periods in the evolvement of the effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce relative to barriers in intranational commerce. The evolvement of the effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce relative to barriers in intranational commerce are represented through growth empirical specification.

The first objective of this chapter (i.e. to examine the effects of CUSFTA on cross-border trade and transactions of foreign affiliates of MNEs) is pursued by transferring the theoretical equations (3.38) and (3.39) into an empirical specification.

Let the percentage growth of the logarithmic value of the effective current barriers in cross-border trade and in transactions of foreign affiliates of MNEs relative to barriers in intranational commerce between the U.S. and country j and between time t and $t-1$ to be denoted by $G\left(\ln B_{USjt}^{E}\right)=\left(\frac{\ln B_{USjt}^{E}-\ln B_{USjt-1}^{E}}{\ln B_{USjt-1}^{E}}\right).100$ for $E=T,S$, respectively. The empirical equation is specified as

$$G\left(\ln B_{USjt}^{E}\right)=\alpha_0+\alpha_j+\alpha_t+\alpha_1 A^T+\alpha_2\tilde{A}^T+\alpha_3 A^S+\alpha_4\tilde{A}^S+\alpha_5 D^T+$$

$$\alpha_6\ln DISTB_{USj}+\alpha_7\ln DISTW_{US}+\alpha_8\ln DISTW_j+\mathrm{A}_9 X_{USt}+ \quad (5.1)$$

$$\mathrm{A}_{10}X_{jt}+\varepsilon_{USjt}^{\alpha}$$

where α_0 is the constant term; α_j is country j specific effect; α_t is the time specific effect; A^T is a dummy variable that takes the value of unity from 1989 onward for $E=T$; $\tilde{A}^T$ is a dummy variable that takes the value of unity from 1989 onward for the insider for $E=T$; A^S is a dummy variable that takes the value of unity from 1989 onward for $E=S$; $\tilde{A}^S$ is a dummy variable that takes the value of unity from 1989 onward for the insider for $E=S$; D^T is trade dummy variable that takes the value of unity when $E=T$; $\ln DISTB_{USj}$ is the bilateral distance between the U.S. and its commerce associate; $\ln DISTW_{US}$ and $\ln DISTW_j$ are the intranational distances of the U.S. and the U.S. commerce associates, respectively; X_{USt} and X_{jt} are vectors of covariates for the U.S. and for the U.S. commerce associate, respectively; and $\varepsilon_{USjt}^{\alpha}$ is the stochastic error term[43].

[43] In this empirical specification, the county fixed effect does not only capture the long standing unobserved country specific attributes but also the long standing unobserved bilateral attributes between the U.S and its commerce associate. Country specific attributes depict the long standing industrial structure, preference and evolvement patterns in the manufacturing industry of the country under consideration. The long standing bilateral attributes depict the historical economic linkages, social and geographical characteristics such as common language, business and social networks, contiguity and length of the shared borders. Egger and Pfaffermayer (2003) are among the first to explicitly employ the

The second objective of this chapter (i.e. to assess the overall effect of CUSFTA on economic integration) is pursued by transferring the theoretical equation (3.41) into an empirical specification. Let the percentage growth of the logarithmic value of the geometric mean of the effective current barriers in international commerce between the U.S. and country j, between time t and $t-1$, to be denoted by $G\left(\ln B_{USjt}^{C}\right)=\left(\frac{\ln B_{USjt}^{C}-\ln B_{USjt-1}^{C}}{\ln B_{USjt-1}^{C}}\right).100$. The empirical equation is specified as

$$G\left(\ln B_{USjt}^{C}\right)=\beta_0+\beta_j+\beta_t+\beta_1 A+\beta_2 \widetilde{A}+\beta_3 \ln DISTB_{USj}+\beta_4 \ln DISTW_{US}+ \beta_5 \ln DISTW_j+\mathrm{B}_6 X_{USt}+\mathrm{B}_7 X_{jt}+\varepsilon_{USjt}^{\beta} \tag{5.2}$$

where β_0 is the constant term; β_j is the country j specific effect; β_t is the time specific effect; A is a dummy variable that takes the value of unity from 1989 onward; $\widetilde{A}$ is a dummy variable that takes the value of unity from 1989 onward for the insider; $\ln DISTB_{USj}$, $\ln DISTW_{US}$ and $\ln DISTW_j$ are defined as before; X_{USt} and X_{jt} are defined as before; and $\varepsilon_{USjt}^{\beta}$ is the stochastic error term.

In the empirical specifications (5.1) and (5.2), the effects of CUSFTA are depicted as deviation in deviation in growth of U.S.-Canada effective current barriers relative to barriers in intranational commerce in the post-CUSFTA sub-period from growth in the pre-CUSFTA sub-period from the overall sample average. In other words, the empirical specifications (5.1) and (5.2) depict the effects of CUSFTA on the U.S.-Canada effective current barriers relative to barriers in intranational commerce.

One can consider alternative specifications where the effects of CUSFTA on the U.S.-Canada and U.S.-outsiders effective current barriers relative to barriers in intranational commerce are assessed. This is achieved by specifying the dummy variables A^T and A^S in equation (5.1) to take the value of unity from 1989 onward for

fixed bilateral effects of the trade associates in a conventional gravity equation setting. As in our dataset the U.S. is the hub of all the inward and outward transactions, the fixed bilateral effects are subsumed in the country specific effect.

the transactions between the U.S. and the outsiders when $E = T$ and $E = S$, respectively and by specifying the dummy variable A in equation (5.2) to take the value of unity from 1989 onward for the transactions between the U.S. and the outsiders. In this case the effects of CUSFTA are determined as deviation in growth of U.S.-Canada and U.S.–outsiders effective current barriers relative to barriers in intranational commerce in the post-CUSFTA sub-period from growth in the pre-CUSFTA sub-period, separately.

The first specification leads to more purified effects of CUSFTA on U.S.-Canada effective current barriers relative to barriers in intranational commerce. This is due to the fact that the effects of the overall patterns in growth of effective current barriers relative to barriers in intranational commerce are controlled. The second approach is applied to detect whether CUSFTA has any effect on U.S.-outsiders effective current barriers relative to barriers in intranational commerce.

5.5 Data Description

BEA is one of the very few institutions that systematically compile datasets on the operations of foreign affiliates of MNEs. BEA does so by conducting annual surveys on FDI in the U.S. (FDIUS) and U.S. FDI abroad (USFDIA). These surveys contain a list of operational and financial datasets and are readily accessible and comparable across years. There are two kinds of surveys conducted by BEA: benchmark surveys and sample surveys. Benchmark surveys cover the operations of all the foreign affiliates in the U.S. and all the U.S. persons who have operating affiliates' abroad[44]. Benchmark surveys are conducted in specific years. For all the remaining years, estimates are derived from sample surveys.

USFDIA datasets cover the operations of foreign affiliates with ownership greater than 10%. USFDIA datasets also cover the operations of the majority-owned foreign affiliates (MOFA) with ownership greater than 50%. FDIUS datasets attribute the ownership of the foreign affiliates of MNEs according to the ultimate beneficiary owner (UBO). UBO is defined as the ultimate party which does not encounter an

[44] The U.S. person is broadly defined to include any individual, corporation, branch, partnership, associated group, association, estate, trust, or other organization and any government (including any corporation, institution, or other entity or instrumentality of a government).

ownership greater than 50% by another party, as gradually proceeding through the ownership chain from the parent firm, inclusive. Hence, if no party other than the parent firm own more than 50%, UBO coincide with the nationality attributes of the parent firm. Bringing USFDIA and FDIUS to a closer equivalent standard is to make use of the MOFA datasets. Another reason to consider the latter is that MOFA reflects higher scale of direct involvement in production activities and therefore exhibits closer coherence to the theory[45].

The US-SIC system, initially adopted in reporting the industrial data, is superseded by the North American industry classification system (NAICS) in 1997 for FDIUS and in 1999 for USFDIA. When US-SIC system is in use, the datasets are presented in industrial categories spanning between 3-digits US-SIC to "super" 2-digits US-SIC. The latter consists of an aggregate of two 2-digits US-SIC categories. Yet, these datasets suffer from missing observations due to confidentiality confinements. These drawbacks become less accentuated the higher the scale of aggregation.

Through the years where US-SIC is adopted, the aggregate manufacturing industry defined in USFDIA and FDIUS datasets deviates from the aggregate manufacturing industry defined in US-SIC as the former excludes US-SIC category 29 (i.e. petroleum refining and related industries). In USFDIA and FDIUS datasets, US-SIC category 29 is classified under a separate category denoted as "Petroleum". Adding US-SIC category 29 to the aggregate manufacturing industry as defined in USFDIA and FDIUS datasets is hampered by the significant concealed observations. Meanwhile, through the years where NAICS is adopted, the aggregate manufacturing industry defined in USFDIA and FDIUS datasets coincides with the aggregate manufacturing industry defined in NAICS. The attempt to net NAICS petroleum manufacturing category (i.e. NAICS category 324, petroleum and coal products manufacturing) from the aggregate NAICS manufacturing industry is equivalently hampered by the concealed observations. Therefore, the period employed in this study is limited from the year 1983 up to the year 1996.

[45] Detailed datasets disentangling the ownership of FDI into the ownership by the source country, the ownership by the host country and the ownership by other foreign countries are more coherent with the theoretical requirement. Unfortunately, these highly specific datasets are not available.

Empirical application of the theory requires local sales of foreign affiliates of MNEs. USFDIA datasets provide a list of the local sales of foreign affiliates of MNEs. In FDIUS case, the total local sales of foreign affiliates of MNEs are determined by netting total exports of foreign affiliates of MNEs from total sales of foreign affiliates of MNEs[46].

Data on U.S. trade with OECD countries presented according to US-SIC system are comprised in Feenstra (1996, 1997) and Feenstra *et al.* (2002). Feenstra (1996, 1997) reports U.S. imports and exports at 4-digits US-SIC basis over the period 1972-1994[47]. Feenstra (1996, 1997) works is predicated on the original compilation provided by the Bureau of the Census. In this original set, data are disaggregated according to the Tariff Schedule of the United States Annotated (TSUSA) for U.S. imports and Schedule B for U.S. exports over the period 1972-1989. Starting from 1990, the original data is recorded according to the Harmonized System (HS) as mandated by the Omnibus Trade and Competitiveness Act of 1988. These data have endured extensive elaboration and are determined first in an import-based US-SIC format and then adjusted to the domestic US-SIC. Feenstra *et al* (2002) extend and update the datasets of Feenstra (1996, 1997). Feenstra *et al* (2002) report datasets on U.S. bilateral imports and exports on 4-digits US-SIC basis over the period 1989-2001[48]. The values of imports and exports in manufacturing are determined by aggregating throughout US-SIC manufacturing categories with US-SIC category 29 excluded. The values of aggregate inward international commerce are determined by summing the import values and the inward local sales of foreign affiliates of MNEs.

Intranational sales by firms headquartered in a given country are calculated by netting the total shipment (production) of that country from total exports and total sales of foreign affiliates of MNEs. The deviation from US-SIC becomes inevitable once data

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[46] FDIUS exports deviate from FDIUS sales to markets other than the U.S. since some of the latter are conducted without physical transport of goods from the U.S. to the destination countries.
[47] U.S.-SIC codes designate domestic U.S.-SIC as opposed to the import-based U.S.-SIC.
[48] As the products end use and the production process are both taken into consideration in US-SIC and as HS is a *commodity* classification system, some US-SIC industries cannot be readily reported. The missing US-SIC categories are dissolved into other reported US-SIC categories. Feenstra (1996, 1997) uses domestic production weights to disentangle the missing US-SIC categories. However, for the 73 missing 4–digits US-SIC, Feenstra et al. (2002) are unable to pursue the same strategy as data on domestic production are still not available for some years. Instead, Feenstra et al. (2002) report a table matching the excluded 4-digits US-SIC categories from their datasets and the 4-digits US-SIC categories of destination.

on shipments (production) are required. The shipments data of the manufacturing industry are compiled from OECD's Structural Analysis Industrial Database (STAN). The shipments datasets of the manufacturing industry are classified according to the international standard industrial classification-Revision 3 (ISIC-Rev.3).

To harmonize with the adopted definition of the manufacturing industry, ISIC-Rev.3 category 23 (i.e. coke, refined petroleum products and nuclear fuel) is net from ISIC-Rev.3 aggregate manufacturing industry. Total exports values of ISIC-Rev.3 aggregate manufacturing industry and ISIC-Rev.3 category 23 are also compiled from STAN. All the values are presented in national currencies. These values are converted into the U.S. dollar equivalence using annual exchange rates from OECD Economic Outlook.

A couple of caveats are to be mentioned about the datasets used in this chapter. First, data on shipments and transactions of foreign affiliates of MNEs are determined on an industrial basis where a given establishment is classified according to its primary activity. On the other hand, trade data are determined on commodity basis. Second, US-SIC and ISIC-Rev.3 do not show a perfect match in different categories. This caveat is mitigated by the high scale of aggregation adopted in this chapter.

Unbalanced datasets for the aggregate manufacturing industry covering 14 OECD countries are constructed. Datasets for six of these OECD countries span the period 1983-1996 while datasets for the remaining OECD countries span the period 1987-1996[49].

The approach of Head and Mayer (2000, 2002) in measuring distance (as described in equation (4.9) of Chapter 4 is adopted in this chapter. The market size of the country of consumption is proxied by GDP values. GDP values are collected from OECD Economic Outlook. On the other hand, the supply size of the country of production is proxied by the value added of the aggregate manufacturing industry as defined in this chapter. The value added data are collected from STAN. Proxy of productivity of the aggregate manufacturing industry is constructed by dividing the value added of the aggregate manufacturing industry by the total employment-full time

[49] The OECD countries with datasets spanning over the period 1983-1996 are: Canada, France, Germany, Japan, the Netherlands and the United Kingdom. The OECD countries with datasets spanning the period 1987-1996 are: Australia, Austria, Belgium + Luxembourg, Denmark, Finland, Italy, Spain and Sweden.

equivalence of the aggregate manufacturing industry. The total employment-full time equivalence are compiled from STAN. While the units of measurement of the total employment-full time equivalence differ across countries, employing the growth version of this proxy will overcome this deficiency[50].

5.6 Empirical Results

One main comprehendible benefit of employing panel data is that the effects of RIAs can be determined by contrasting the post-RIA status to the pre-RIA status. Some analyses have found positive and significant effects on dummy variables for two future RIA insiders long before RIA was implemented (e.g. Eichengreen and Irwin, 1995). Eichengreen and Irwin (1998) argue that these outcomes reflect long standing trade-related historical factors. Therefore, ambiguity arises on whether the relatively higher trade between RIA insiders is indeed attributed to the implementation of RIA *per se*[51].

Another comprehendible benefit of employing panel data is the one associated with Frankel's (1997) observation. In the context of the conventional gravity equation, Frankel (1997) notices that the outcome from cross-sectional estimation of the effects of RIAs on trade for each year may yield significant fluctuation across the years that, in some cases, their interpretation become difficult. Frankel (1997) suggests the use of the panel data that "forcibly smoothes out some of the variation". In one way, Frankel's (1997) suggestion is associated with our view that the panel datasets might potentially absorb the lagged adjustments that precede or follow the implementation of RIAs and the temporary shocks.

The results from the empirical equation (5.1), which tests whether trade creation (or diversion) and investment diversion (or creation) between the insiders has occurred due to CUSFTA in the aggregate manufacturing industry, are illustrated in Table 5.1.

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[50]In an empirical specification that contains country fixed effects, the disparity in units of measurements of total employment-full time equivalence are absorbed by the country fixed effects when the proxy of productivity of the aggregate manufacturing industry are employed.
[51]A growing literature deals with the endogeneity of RIA in the sense that countries are more likely to form RIA with higher bilateral trade (e.g. Haveman and Hummels, 1998; Soloaga and Winters, 2001; Magee, 2003). This chapter does not deal with this issue leaving its investigation for future work.

Table 5.1: Empirical Results of the Effects of CUSFTA on Trade and Sales of Foreign Affiliates between Insiders for the Aggregate Manufacturing Industry.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
				CUSFTA Insider Dummy Variables				
$\widetilde{A}^T$ (Trade)	-5.637[a]	-5.302[a]	-5.394[a]	-5.398[a]	-5.534[a]	-6.004[a]	-9.931[a]	-8.406[a]
	(1.048)	(1.032)	(1.021)	(1.023)	(1.033)	(1.003)	(1.080)	(1.281)
$\widetilde{A}^S$ (Sales)	0.062	0.397	0.304	0.297	0.163	-0.326	0.624	-0.953
	(1.048)	(1.032)	(1.021)	(1.025)	(1.034)	(1.005)	(1.082)	(1.278)
				CUSFTA Overall Sample Dummy Variables				
A^T (Trade)	0.319	±	±	±	±	0.152	±	±
	(0.425)					(0.498)		
A^S (Sales)	-0.390	±	±	±	±	-0.615	±	±
	(0.425)					(0.491)		
$D^T(CA)$ (Trade)								-1.803
								(1.787)
$D^S(CA)$ (Sales)								1.298
								(1.799)
D^T	0.143	0.143	0.143	0.129	0.135	0.068	0.221	0.626
	(0.501)	(0.468)	(0.463)	(0.481)	(0.481)	(0.489)	(0.503)	(0.535)
$\ln DISTB_{USj}$	-0.664	±	±	±	±	-0.923[b]	±	-0.817
	(0.433)					(0.416)		(0.895)
$\ln DISTW_j$	0.376[B]	±	±	±	±	0.429[a]	±	0.350
	(0.166)					(0.160)		(0.237)
$G(\ln Y_{jt})$			-0.216	-0.214	-0.211	-0.054	-0.224	-0.143
			(0.144)	(0.146)	(0.146)	(0.132)	(0.152)	(0.137)
$G(\ln E_{jt})$			0.776[a]	0.767[a]	0.155	-0.052	-0.140	0.048
			(0.271)	(0.281)	(0.678)	(0.545)	(0.709)	(0.627)

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. ± indicates that the variable is dropped due to perfect collinearity.

Table 5.1-*Continued.*

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
$G(\ln Y_{USt})$			±	±	±	-0.051	±	±
						(1.303)		
$G(\ln E_{USt})$			±	±	±	-5.877[a]	±	±
						(2.039)		
$G(\ln PR_{jt})$				0.004	0.002	0.020	-0.006	0.005
				(0.034)	(0.034)	(0.033)	(0.036)	(0.034)
$G(\ln PR_{USt})$				±	±	0.628	±	±
						(0.593)		
$G(ER_{USjt})$					-0.058	-0.058	-0.078	-0.053
					(0.058)	(0.046)	(0.061)	(0.053)
N	300	300	300	300	300	300	300	300
Adj R^2	0.101					0.202		
R^2 (w)		0.274	0.296	0.296	0.296		0.394	0.403
R^2 (b)		0.006	0.005	0.005	0.005		0.492	0.604
F		6.38	6.26	5.91	5.91		8.64	
Wald χ^2								193.88

Notes: Standard errors are in parentheses. [a, b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. ± indicates that the variable is dropped due to perfect collinearity.

Column (i) of Table 5.1 presents the results of a parsimonious specification of equation (5.1) that does not control for time or country fixed effects nor for the covariates defined by X_{USt} and X_{jt}. The results indicates negative and highly significant coefficient of $\widetilde{A}^T$ and non-significant coefficient of $\widetilde{A}^S$. Column (ii) of Table 5.1 presents the results of two-way error component model (i.e. employing time and country fixed effects) with no control for the covariates defined by X_{USt} and X_{jt}. Compared to the results displayed in column (i), the results in column (ii) show a slight modification in the value of the coefficient of $\widetilde{A}^T$ while the coefficient of $\widetilde{A}^S$ remains non-significant.

Column (iii) of Table 5.1 displays the results of the two-way error component model when adding the percentage growth of the logarithmic values of the market size and supply size of the U.S. commerce associates between time t and $t-1$ denoted by $G(\ln GDP_{jt})$ and $G(\ln VA_{jt})$, respectively [52]. The results show that the magnitude of the coefficient of $\tilde{A}^T$ is slightly modified, remaining negative and highly significant while the coefficient of $\tilde{A}^S$ remains non-significant.

Productivity is a determinant element of the effective fractions and hence of the values of the effective current barriers. Therefore, in order to isolate the effects of CUSFTA, controlling the changes of productivity in a panel data framework is required. Column (iv) of Table 5.1 displays the results when augmenting the specification adopted in column (iii) by the percentage growth of the logarithmic values of productivity in the aggregate manufacturing industry of the U.S. commerce associate between time t and $t-1$ denoted by $G(\ln PR_{jt})$[53]. Column (iv) shows that the initial results are not altered.

A potential macro-economic factor that might have affected the results is the local currency valuation *vis-à-vis* the U.S. dollar. The effects of the exchange rates appreciation/depreciation are well documented in the literature. As an illustration, depreciation in the foreign currency renders the ownership of capital abroad more attractive. Column (v) of Table 5.1 displays the results when augmenting the specification adopted in column (iv) by the percentage growth of exchange rates of the local currency *vis-à-vis* the U.S. dollar standardized at their 1987 values between time t and $t-1$ denoted by $G(ER_{USjt})$. Column (v) shows that the initial results are not subjected to major modifications.

Column (vi) of Table 5.1 displays the results of the pooled version of the specification adopted in column (v) of Table 5.1 (i.e. with no control for time fixed effects and country fixed effects). A slight increase in the absolute value of the coefficient of $\tilde{A}^T$ is noticed. The coefficient of $\tilde{A}^S$ remains non-significant.

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[52] The growth of the logarithmic values of the market size and supply size between time t and $t-1$ of the U.S. are absorbed by the time fixed effects.

[53] The growth of logarithmic value of the productivity for the U.S. between time t and $t-1$ is absorbed by the time fixed effects.

One additional concern that might have affected the results is the prominence of the cross-country vertical linkages of MNEs within RIA area. The non-account for the vertical linkages of MNEs might have camouflaged potential net investment creation effects of CUSFTA. The following illustrative example clarifies this suggestion. Consider an *ex-ante* RIA setting, where the value of the total downward sales of foreign affiliate of a given firm headquartered in insider A in the other insider B be denoted by S. Let the value of S to be composed of the *in situ* valued added in insider B, the value of intermediate goods outsourced domestically in insider B and the value of intermediate goods exported by the parent firm headquartered in insider A. let the latter be denoted by x. Consider now the *ex-post* RIA setting with the firm under consideration opting to switch from FDI to cross-border trade in reaching the market of insider B. In this case, the recorded drop in the sales of foreign affiliate of the firm under consideration is S. However, the *real* drop in the sales of the foreign affiliate is determined by $S-x$. In other word, the real drop in the sales of the foreign affiliate is milder than the recorded drop. The availability of data on imports of the foreign affiliates provides the opportunity to deal with this concern. Column (vii) of Table 5.1 display the results of the specification adopted in column (v) of Table 5.1 when netting the sales of the foreign affiliates by the value of their imports. The coefficient of $\widetilde{A}^T$ increases in its absolute value and keeps being negative and significant at 1% level. The coefficient of $\widetilde{A}^S$ remains non-significant.

Finally, the case where the coefficients of $\widetilde{A}^T$ and $\widetilde{A}^S$ are determined by exclusively contrasting the post-CUSFTA status of the insider to a pre-CUSFTA status of the insider is examined. For this purpose, the specification adopted in column (vii) of Table 5.1 is considered with the following modifications. A hybrid of random country specific effect and fixed time specific effect is adopted. In addition, Canada dummy variables for trade and for sales of foreign affiliates are employed and denoted by $D^T(CA)$ and $D^S(CA)$, respectively. The results are reported in column (viii) of Table 5.1 showing that the previously derived inferences are not altered[54].

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[54] Various sets of regressions are performed in specifications where A^T and A^S are defined as a dummy variables that take the value of unity form 1989 onward for the transactions between the U.S. and the outsiders when $E=T$ and $E=S$, respectively. In order to avoid the perfect collinearity effect on the

The negative and significant coefficient of $\widetilde{A}^T$ is interpreted as a reflection of the trade creation effect of CUSFTA. On the other hand, the non-significance of the coefficient of $\widetilde{A}^S$ is not necessarily interpreted as implying that CUSFTA has no effect on transactions of foreign affiliates of MNEs. The value of coefficients of $\widetilde{A}^T$ and $\widetilde{A}^S$ are the net outcome of both direct and indirect effects of CUSFTA on the modes of international commerce between the insiders. The direct effects are mainly described through the absolute magnitudes of liberalization in cross border trade and FDI. In addition to the prominent liberalization in cross-border trade through reduction of tariff and non-tariff barriers, CUSFTA includes liberalization provisions that facilitate the operation of the foreign affiliates from insider sources. For example, CUSFTA eliminates most of the trade related investment measures (TRIMs) and ensures national treatment and extensions of right-of-establishment. The indirect effects of CUSFTA are expressed through the modification in the initial configuration of the U.S.-Canada international commerce. These modifications occurs as a result of the changes in the relative attractiveness of each mode of international commerce for a given firm headquartered in one insider in reaching the market of the other insider brought about by CUSFTA. The relatively higher magnitude of cross-border trade liberalization compared to FDI liberalization may have acted as a diverting force from investing abroad and hence might have offset the absolute effects of FDI liberalization. In this case, these offsetting effects could be translated into non-significance of CUSFTA on sales of foreign affiliates in the empirical outcome.

The results from equation (5.2), which examines the effects of CUSFTA on the aggregate international commerce between the insiders in the aggregate manufacturing industry (i.e. assesses the overall effect of CUSFTA on economic integration between the insiders in the aggregate manufacturing industry), are illustrated in Table 5.2. Columns throughout Table 5.2 follow the equivalent sequence of specifications as in Table 5.1.

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coefficients of A^T and A^S when adopting a specification with fixed country specific effects, a specification with random country specific effect is adopted. The results (not reported) indicate that the previously derived inferences from Table 5.1 are maintained. The coefficients of A^T and A^S are not significant implying a non-significant net effect of CUSFTA on the transactions between the U.S. and the outsiders.

Table 5.2: Empirical Results of the Effects of CUSFTA on the Economic Integration between Insiders for the Aggregate Manufacturing Industry.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	CUSFTA Insider Dummy Variables							
$\tilde{A}$ (Com.)	-5.542[a]	-4.914[a]	-4.853[a]	-4.935[a]	-4.989[a]	-4.360[a]	-3.798[a]	-3.927[a]
	(1.281)	(0.123)	(1.236)	(1.242)	(1.249)	(1.107)	(1.146)	(1.137)
	CUSFTA Overall Sample Dummy Variables							
A (Com.)	0.531	±	±	±	±	-0.025	±	±
	(0.413)					(0.542)		
$D(CA)$								-0.876
								(2.129)
$\ln DISTB_{USj}$	-0.807	±	±	±	±	-0.762	±	-1.077
	(0.599)					(0.516)		(1.171)
$\ln DISTW_j$	0.524[b]	±	±	±	±	0.532[b]	±	0.577
	(0.241)					(0.211)		(0.313)
$G(\ln Y_{jt})$			-0.185	-0.139	-0.139	0.087	-0.100	0.017
			(0.210)	(0.214)	(0.218)	(0.182)	(0.201)	(0.184)
$G(\ln E_{jt})$			0.690[c]	0.522	0.036	-0.191	-0.055	0.268
			(0.394)	(0.445)	(0.991)	(0.747)	(0.914)	(0.818)
$G(\ln Y_{USt})$				±	±	-0.326	±	±
						(1.781)		
$G(\ln E_{USt})$				±	±	-7.375[b]	±	±
						(3.175)		
$G(\ln PR_{jt})$				0.037	0.035	0.047	0.035	0.037
				(0.046)	(0.046)	(0.037)	(0.043)	(0.039)
$G(\ln PR_{USt})$				±	±	1.514[c]	±	±
						(0.772)		
$G(ER_{USjt})$					-0.047	-0.034	-0.050	-0.012
					(0.085)	(0.063)	(0.078)	(0.068)

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. ± indicates that the variable is dropped due to perfect collinearity.

Table 5.2-*Continued.*

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
N	150	150	150	150	150	150	150	150
$Adj\ R^2$	0.108					0.198		
R^2(w)		0.346	0.362	0.366	0.367		0.336	0.331
R^2(b)		0.168	0.169	0.156	0.129		0.040	0.367
F		5.00	5.00	4.32	4.06		3.55	
$Wald\ \chi^2$								64.20

Notes: Standard errors are in parentheses. [a, b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. ± indicates that the variable is dropped due to perfect collinearity.

Column (i) of Table 5.2 displays the results of a parsimonious specification of equation (5.2) that does not control for time or country fixed effects nor for the covariates defined by X_{USt} and X_{jt}. Column (ii) of Table 5.2 displays the results of two-way error component model (i.e. employing time and country fixed effects) with no control for the covariates defined by X_{USt} and X_{jt}. In both cases, the results indicate negative and highly significant coefficient of $\widetilde{A}$. This result is interpreted as substantial effect of CUSFTA in promoting further economic integration between U.S. and Canada.

Column (iii) of Table 5.2 displays the results of the two-way error component model specification when adding $G(\ln GDP_{jt})$ and $G(VA_{jt})$. Column (iv) of Table 5.2 displays the results when augmenting the specification adopted in column (iii) by $G(\ln PR_{jt})$. In both cases, the initial results are not altered. Column (v) of Table 5.2 displays the results when augmenting the specification adopted in column (iv) by $G(ER_{US\$jt})$. Again, the initial results remain robust. Column (vi) of Table 5.2 displays the results of the pooled version of the specification adopted in column (v) of Table 5.2 with no major changes.

As in the previous case, there might be concerns over the prominence of the vertical linkages of MNEs within RIA area in driving the results. This point is clarified by the following example built on the previous illustrative setup. In an *ex-ante* RIA setting, the total recorded international commerce of a given firm headquartered in insider A with insider B is $S + x$. Consider now an *ex-post* RIA setting with the firm under consideration opting to switch from FDI to cross-border trade in reaching the market of insider B. The value of international commerce becomes $\tilde{x} \geq S$. However, $\tilde{x}$ may not be necessarily higher than $S + x$, especially in the case of high initial vertical linkage of the firm under consideration. In other words, there is a concern of double count in trade attributed to these vertical linkages.

Column (vii) of Table 5.2 display the results of the specification adopted in column (v) of Table 5.2 when netting the sales of the foreign affiliates by the value of their imports. The coefficient of $\tilde{A}$ increases in its absolute value and keeps being negative and significant at 1% level.

Finally, the case where the coefficient of $\tilde{A}$ is determined by exclusively contrasting the post-CUSFTA status of the insider to a pre-CUSFTA status of the insider is examined. The specification adopted in column (vii) of Table 5.2 is considered with the following modifications. A hybrid of random country specific effect and fixed time specific effect is adopted. In addition, Canada dummy variable, denoted by $D(CA)$, is employed. The results are reported in column (viii) of Table 5.2 showing that the previously derived inferences remain robust[55].

5.7 Concluding Remarks

In this chapter, the theoretical effective current barriers in cross-border trade, transactions of foreign affiliates and aggregate international commerce are exploited to examine the effects of CUSFTA. This chapter deals with two defects associated with the previous literature that examines the effects of RIAs using the conventional gravity equation. The first defect is that previous literature utilizes the conventional gravity

[55]Various sets of regressions are performed in specifications where A is defined as a dummy variable that takes the value of unity form 1989 onward for the transaction between the U.S. and the outsiders. In order to avoid the perfect collinearity effect on the coefficients of A when adopting a specification with fixed country specific effects, a specification with random country specific effect is adopted. The results (not reported) indicate that the previously derived inferences from Table 5.2 are maintained. The coefficient of A is not significant implying a non-significant net effect of CUSFTA on international commerce between the U.S. and the outsiders.

equation that does not encompasses the transactions of foreign affiliates of MNEs (i.e. the operational aspect of FDI). The second defect is that the effects of RIA are not determined by contrasting the post-RIA status to a pre-RIA status. Eichengreen and Irwin (1995) display illustrations where insiders trade more with each other than the average sample long before RIA is implemented. The first defect is tackled through the exploitation of the ownership-basis gravity equation. The second defect is tackled by contrasting the post-CUSFTA status to the pre-CUSFTA status in a panel data setting.

The results highlight the trade creation effect of CUSFTA between the U.S and Canada in the aggregate manufacturing industry. However, the results do not detect any significant effect of CUSFTA on the transactions of foreign affiliates from one insider source to another insider destination. In other words, there is no empirical evidence on the occurrence of FDI diversion between insiders due to CUSFTA. The non-detection of any effect of CUSFTA on the transactions of foreign affiliates is interpreted as being the net outcome of offsetting effects. The relatively higher magnitude of cross-border trade liberalization compared to FDI liberalization may have acted as a diverting force from investing abroad and hence might have offset the absolute effects of FDI liberalization. The empirical results also indicate that CUSFTA has significant effect in promoting further economic integration between the U.S. and Canada in the aggregate manufacturing industry. The results do not show any significant effect of CUSFTA on cross-border trade, transactions of foreign affiliates and aggregate international commerce between the U.S. and CUSFTA outsiders. These results are suggestive in terms of the positive welfare implications of CUSFTA for the U.S. in the aggregate manufacturing industry.

CHAPTER VI
SUMMARY AND CONCLUSIONS

6.1 Summary

International commerce in goods and services is channeled via cross-border trade and transactions of foreign affiliates of MNEs. Transactions of foreign affiliates of MNEs represent the operational aspect of FDI. Previous literature derives the gravity equation from theoretical frameworks that adopt the location-basis approach in recording transactions as being international. Therefore, previous literature does not encompass the transactions of foreign affiliates of MNEs. This fact casts skepticism on the results and interpretations derived from the empirical application of the conventional gravity equation.

Recognizing FDI in the theoretical derivation of the gravity equation is conveniently conducted by adopting the ownership-basis approach in recording transactions as being international. Building on the basic theoretical setup of Helpman et al. (2004), this study develops an ownership-basis gravity equation that encompasses both channels of international commerce and allows for the non-engagement in any form of international commerce. In the basic theoretical setup, the occurrence of FDI is determined through the proximity-concentration trade-off hypothesis. In other words, FDI is viewed as cross-border horizontal fragmentation of production.

The ownership-basis gravity equation is exploited to construct theoretical indices measuring the effective current barriers in cross-border trade; transactions of foreign affiliates of MNEs and aggregate international commerce. These theoretical indices are empirically convenient in tracking the evolvement of the effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and international commerce.

A final exploitation of the ownership-basis theoretical setup is to study the implications on the home market effect phenomenon. This study shows that the home market effect persists for two different criteria: the location-basis criterion and the ownership-basis criterion. The location-basis home market effect implies that an increase in the relative market size of one country induces more than one for one increase in the share of production *within* the national border of that country from global production. On the other hand, the ownership-basis home market effect implies that an increase in the relative market size of one country induces more than one for one increase in the production share of firms headquartered in that country from global production.

This study associates the theoretical section with empirical applications. Compiling data on transactions of foreign affiliates of MNEs is a daunting task. The availability of data on transactions of foreign affiliates of MNEs constitutes one of the major limitations encountered throughout the empirical analyses in this study. Some of the datasets on transactions of foreign affiliates of MNEs are concealed due to confidentiality issues and they are hard to obtain.

There are two empirical applications in this study. The first empirical application consists of applying the ownership-basis gravity equation to estimate the magnitude of the border effects. In the presence of FDI, the concept of border effect is redefined as the barriers separating the producers of one country from the consumers of another country rather than the barriers at the national border. The magnitude of the ownership-basis border effects is determined as a weighted average of the three various types of policy-related barriers encountered in international commerce: policy barriers in cross-border trade, policy barriers associated with the transactions of foreign affiliates of MNEs and an implicit prohibitive policy barriers associated with the non-engagement in any form of international commerce. The weights are determined by the current policy-related configuration of international commerce. One additional feature of the ownership-basis border effects is that it captures, beside the policy barriers that have operational aspects, the policy barriers that have fixed cost aspects. This fact is clear in our model as the policy barriers of fixed cost aspects constitute one of the basic determinants of the current configuration of international commerce. The policy barriers of fixed cost aspects are particularly important in reflecting the effects of the direct restrictions on the foreign ownership of capital.

The first empirical application is conducted for the aggregate manufacturing industry, for a set of destination OECD countries reporting data on the inward activities of foreign affiliates of MNEs for the year 1999 from all the OECD source countries. The selection of the datasets and the year are largely dictated by the availability of data on transactions of foreign affiliates of MNEs. Our empirical analysis shows that the magnitude of the border effects when using the conventional gravity equation instead of the ownership-basis gravity equation is overestimated. Interestingly, the coefficients capturing FDI barriers show significantly higher magnitudes compared to those capturing cross-border trade barriers. These results are suggestive in the following sense. While the main focus of initial multilateral and bilateral agreements is the lessening of the cross-border trade policy barriers, it seems that more opportunity are still to be exploited by lessening FDI policy barriers in operational aspects and fixed cost aspects. Hence, these results describe suggestive potential direction for the ongoing and future multilateral and bilateral agreements.

The second empirical application exploits the theoretical effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce to investigate the effects of CUSFTA in the aggregate manufacturing sector. Compared to the previous literature that investigates the effects of RIAs using the conventional gravity equation, the empirical analysis in this study is original in three main aspects. First, it is the first to exploit a theoretical gravity equation that simultaneously encompasses the various channels of international commerce in conducting descriptive and empirical evaluations of the effects of RIAs. Second, it analyzes the effects of CUSFTA by contrasting the post-CUSFTA status to the pre-CUSFTA status. This approach is urged by some empirical findings showing that two RIA insiders trade more with each other than do two RIA-unrelated countries long before RIA is implemented (e.g. Eichengreen and Irwin, 1995). Third, to our knowledge, it is the first empirical application to scrutinize Kindleberger (1966) hypotheses on the occurrence of trade creation versus investment diversion between the insiders and trade diversion versus investment creation between an outsider and an insider due to RIA.

The empirical and descriptive analyses of the effects of CUSFTA rely on datasets covering the transactions of foreign affiliates of MNEs provided by the Bureau of Economic Analysis (BEA). These datasets cover the operations of foreign affiliates of foreign MNEs in the U.S. and the operations of foreign affiliates of U.S. MNES abroad. Hence, throughout the empirical analysis, the U.S. is the hub in the inward and outward international transactions.

The results highlight the trade creation effect of CUSFTA between the U.S and Canada in the aggregate manufacturing industry. However, the results do not detect any significant effect of CUSFTA on sales of foreign affiliates from one insider source to another insider destination. In other words, there is no empirical evidence on the occurrence of FDI diversion between insiders due to CUSFTA. The non-detection of any effect of CUSFTA on sales of foreign affiliates is interpreted as being the net outcome of offsetting effects. The relatively higher magnitude of cross-border trade liberalization compared to FDI liberalization may have acted as a diverting force from investing abroad and hence might have offset the absolute effects of FDI liberalization. The empirical results also indicate that CUSFTA has significant effect in promoting further economic integration between the U.S. and Canada in the aggregate manufacturing industry. Finally, the results do not show any significant effect of CUSFTA on cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce between the U.S. and CUSFTA outsiders. These results are suggestive in terms of positive welfare implications of CUSFTA for the U.S. in the aggregate manufacturing industry.

6.2 Future Work

In this study, the ownership-basis gravity equation is derived from a modified version of the conventional new trade theory framework based on differentiated goods and increasing return to scale. The modification of the conventional new trade theory framework is attributed to the recognition of FDI and to the non-engagement in any form of international commerce. In this study, the occurrence of FDI is explained through the proximity-concentration trade-off hypothesis as it is compatibly embraced in the new trade theory framework. Compelling exercises would be to derive the ownership-basis gravity equation from alternative trade theory frameworks such as the classical comparative cost advantage trade theory (i.e. Ricardian theory), neoclassical comparative cost advantage trade theory (i.e. Heckscher-Ohlin theory) and imperfect competition framework with homogeneous goods (i.e. reciprocal dumping framework) (Brander, 1981; Brander and Krugman, 1983).

In the case of the Ricardian framework, the occurrence of FDI could be explained through a modified version of the proximity-concentration trade-off hypothesis with firms assumed to be heterogeneous with respect to their productivity attribute. In this case, the comparative cost advantage can be depicted by the boundary of the productivity distribution. Employing a Heckscher-Ohlin framework to derive the ownership-basis gravity equation requires an alternative explanation of the occurrence of FDI as the proximity concentration trade-off hypothesis might not be harmonically enclosed. In this case, a modified version of the Mundell (1957) theory to explain the occurrence of FDI is suggested. The outcomes of these exercises become particularly compelling once theoretically and empirically distinguishing features across the ownership-basis gravity equations derived from different theoretical background are detected.

A wide range of empirical application of the ownership-basis gravity equation at various levels of aggregation awaits the availability and accessibility of datasets covering the activities of foreign affiliates of MNEs. On the other hand, completing the full set of bilateral commerce between the OECD countries is not feasible at this time as some OECD countries do not collect datasets on the activities of foreign affiliates of MNEs neither from the inward direction nor from the outward direction. However, the datasets used in this study can be enlarged to include more destination countries by conducting some approximation. For example, missing data on exports conducted by foreign affiliates of MNEs of a given source country located in a given destination country can be filled out using the ratio of total sales to exports of foreign affiliates of MNEs of a "twin" source country located in the same destination country.

The re-evaluation of the McCallum's Canada-U.S. border effects using the ownership-basis gravity equation requires datasets on the transactions of foreign affiliates of MNEs compiled at the Canadian province-U.S. state levels. While these highly detailed datasets might not be available soon, an assessment of FDI stock of a given province in a given state and the projection of the outcome of this assessment to generate datasets on the transactions of foreign affiliates allow to perform this task. In general, given the limitations on the availability of datasets on the activities of foreign affiliates of MNEs, it seems that data-generating approximations are needed.

The follow-up step associated with the analyses of the effects of CUSFTA on the effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce is to cover disaggregated sectoral levels. It would be interesting to investigate the effects of CUSFTA in some sectors that are expected to be particularly less affected by CUSFTA as compared to other sectors (e.g. the transportation sector as it is initially liberalized due to the 1956 Auto Pact agreement). While the required datasets to carry out such analysis are compiled by BEA, their availability is hindered by the confidentiality issues.

Once datasets at sufficiently disaggregated level becomes available, empirical analyses that assess the determinants of the effective current barriers in cross-border trade, transactions of foreign affiliates of MNEs and aggregate international commerce become intriguing.

It is important to mention that complete analysis of the effects of CUSFTA in the aggregate manufacturing sector requires data on the transactions of foreign affiliates of MNEs in Canada and the transactions of foreign affiliates of Canadian MNEs abroad. These datasets are not yet available.

Finally, this study does not claim that it has integrally covered the analysis of the location-basis home market effect and the ownership-basis home market effect phenomena. Yet, this study provides a basic starting point for future theoretical research and empirical applications. Empirically detecting the phenomenon of the ownership-basis home market effect requires datasets covering the bilateral and aggregate inward and outward transactions of foreign affiliates of MNEs at sufficiently high level of industrial disaggregation. Analyzing the occurrence of the location-basis home market effect and the ownership-basis home market effect phenomena in different theoretical frameworks that encompass the activities of foreign affiliates of MNEs is a pre-eminent future work.

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APPENDIX

Table A.1-Sales of Foreign Affiliates, Imports and Share of Sales of Foreign Affiliates from Total International Commerce (Million of U.S. Dollars).

Destination-Source	*FAS*	*IMP*	$\frac{FAS}{FAS+IMP}$
Finland-Finland	41971	-	1
France-France	319198	-	1
Japan-Japan	2111827	-	1
The Neth.-The Neth.	10997	-	1
Poland-Poland	46150	-	1
Portugal-Portugal	33382	-	1
Sweden-Sweden	49851	-	1
Finland-U.S.	1040	2311	0.31
Finland-Canada	39	140	0.22
Finland-Mexico	0	27	0.00
Finland-Japan	402	1976	0.17
Finland-Korea	0	284	0.00
Finland-Australia	0	44	0.00
Finland-New Zealand	0	10	0.00
Finland-Austria	49	330	0.13
Finland-Belgium	31	766	0.04
Finland-Denmark	906	781	0.54
Finland-France	148	1308	0.10
Finland-Germany	294	4746	0.06
Finland-Greece	0	52	0.00
Finland-Ireland	262	336	0.44
Finland-Italy	28	1162	0.02
Finland-The Neth.	854	1183	0.42
Finland-Portugal	0	147	0.00
Finland-Spain	0	411	0.00
Finland-Sweden	936	3281	0.22
Finland-U.K.	369	1900	0.16
Finland-Czech Rep.	0	190	0.00
Finland-Hungary	0	125	0.00
Finland-Iceland	0	9	0.00
Finland-Norway	709	671	0.51
Finland-Poland	0	152	0.00
Finland-Slovak Rep.	0	55	0.00
Finland-Switzerland	741	473	0.61
Finland-Turkey	0	79	0.00

Source: Organization for Economic Cooperation and Development (OECD).

Table A.1- *Continued.*

Destination-Source	*FAS*	*IMP*	$\frac{FAS}{FAS+IMP}$
France-U.S.	40984	25103	0.62
France-Canada	2283	1406	0.62
France-Mexico	17	518	0.03
France-Japan	4178	10449	0.29
France-Korea	171	1935	0.08
France-Australia	70	268	0.21
France-New Zealand	146	215	0.40
France-Austria	584	2422	0.19
France-Belgium	11363	20354	0.36
France-Denmark	249	2075	0.11
France-Finland	1245	2382	0.34
France-Germany	18665	49576	0.27
France-Greece	0	373	0.00
France-Ireland	1024	5025	0.17
France-Italy	9760	27653	0.26
France-The Neth.	19231	13336	0.59
France-Portugal	36	3121	0.01
France-Spain	12054	19190	0.39
France-Sweden	4510	4351	0.51
France-U.K.	18482	22231	0.45
France-Czech Rep.	0	1067	0.00
France-Hungary	0	1412	0.00
France-Iceland	0	118	0.00
France-Norway	1021	999	0.51
France-Poland	0	1378	0.00
France-Slovak Rep.	0	523	0.00
France-Switzerland	15690	6864	0.70
France-Turkey	0	1814	0.00
Japan-U.S.	34044	58128	0.37
Japan-Canada	792	5458	0.13
Japan-Mexico	0	1097	0.00
Japan-Korea	52	15143	0.00
Japan-Australia	83	5018	0.02
Japan-New Zealand	0	1427	0.00
Japan-Austria	0	801	0.00

Source: Organization for Economic Cooperation and Development (OECD).

Table A.1- *Continued.*

Destination-Source	*FAS*	*IMP*	$\frac{FAS}{FAS + IMP}$
Japan-Belgium	198	1745	0.10
Japan-Denmark	59	1873	0.03
Japan-Finland	3	751	0.00
Japan-France	15087	5844	0.72
Japan-Germany	2928	11235	0.21
Japan-Greece	0	80	0.00
Japan-Ireland	1512	2910	0.34
Japan-Italy	2	4939	0.00
Japan-The Neth.	1994	1599	0.55
Japan-Portugal	0	138	0.00
Japan-Spain	0	1118	0.00
Japan-Sweden	979	2390	0.29
Japan-U.K.	1661	5699	0.23
Japan-Czech Rep.	0	85	0.00
Japan-Hungary	0	285	0.00
Japan-Iceland	0	154	0.00
Japan-Norway	3	1054	0.00
Japan-Poland	0	76	0.00
Japan-Slovak Rep.	0	20	0.00
Japan-Switzerland	2302	3312	0.41
Japan-Turkey	0	98	0.00
The Neth.-U.S.	18100	15494	0.54
The Neth.-Canada	96	746	0.11
The Neth.-Mexico	0	225	0.00
The Neth.-Japan	529	7610	0.07
The Neth.-Korea	0	1623	0.00
The Neth.-Australia	75	222	0.25
The Neth.-New Zealand	0	58	0.00
The Neth.-Austria	44	1004	0.04
The Neth.-Belgium	1494	13927	0.10
The Neth.-Denmark	326	1218	0.21
The Neth.-Finland	593	1466	0.29
The Neth.-France	1274	9290	0.12
The Neth.-Germany	2136	26914	0.07
The Neth.-Greece	0	134	0.00

Source: Organization for Economic Cooperation and Development (OECD).

Table A.1- *Continued.*

Destination-Source	*FAS*	*IMP*	$\frac{FAS}{FAS+IMP}$
The Neth.-Ireland	537	3194	0.14
The Neth.-Italy	128	4204	0.03
The Neth.-Portugal	0	777	0.00
The Neth.-Spain	58	2944	0.02
The Neth.-Sweden	760	4546	0.14
The Neth.-U.K.	4102	14084	0.23
The Neth.-Czech Rep.	0	608	0.00
The Neth.-Hungary	0	1172	0.00
The Neth.-Iceland	0	143	0.00
The Neth.-Norway	96	1088	0.08
The Neth.-Poland	0	1087	0.00
The Neth.-Slovak Rep.	0	202	0.00
The Neth.-Switzerland	1608	2474	0.39
The Neth.-Turkey	0	916	0.00
Poland-U.S.	1836	1498	0.55
Poland-Canada	12	144	0.08
Poland-Mexico	0	35	0.00
Poland-Japan	4	907	0.00
Poland-Korea	1435	1164	0.55
Poland-Australia	15	17	0.47
Poland-New Zealand	0	6	0.00
Poland-Austria	497	845	0.37
Poland-Belgium	224	1329	0.14
Poland-Denmark	927	775	0.54
Poland-Finland	153	813	0.16
Poland-France	2510	3049	0.45
Poland-Germany	5478	11409	0.32
Poland-Greece	8	54	0.13
Poland-Ireland	3	232	0.01
Poland-Italy	1393	4164	0.25
Poland-The Neth.	5186	1588	0.77
Poland-Portugal	1	131	0.01
Poland-Spain	295	955	0.24
Poland-Sweden	599	1392	0.30
Poland-U.K.	561	2000	0.22

Source: Organization for Economic Cooperation and Development (OECD).

Table A.1- *Continued.*

Destination-Source	*FAS*	*IMP*	$\frac{FAS}{FAS+IMP}$
Poland-Czech Rep.	22	1362	0.02
Poland-Hungary	0	578	0.00
Poland-Iceland	0	3	0.00
Poland-Norway	237	297	0.44
Poland-Slovak Rep.	0	516	0.00
Poland-Switzerland	881	653	0.57
Poland-Turkey	16	145	0.10
Portugal-U.S.	713	985	0.42
Portugal-Canada	33	62	0.35
Portugal-Mexico	0	17	0.00
Portugal-Japan	133	1075	0.11
Portugal-Korea	170	409	0.29
Portugal-Australia	0	21	0.00
Portugal-New Zealand	0	13	0.00
Portugal-Austria	5	239	0.02
Portugal-Belgium	218	1254	0.15
Portugal-Denmark	197	234	0.46
Portugal-Finland	14	284	0.05
Portugal-France	689	4201	0.14
Portugal-Germany	2057	5818	0.26
Portugal-Greece	10	48	0.17
Portugal-Ireland	2	268	0.01
Portugal-Italy	155	3059	0.05
Portugal-The Neth.	285	1810	0.14
Portugal-Spain	1088	9327	0.10
Portugal-Sweden	30	530	0.05
Portugal-U.K.	89	2389	0.04
Portugal-Czech Rep.	0	106	0.00
Portugal-Hungary	0	58	0.00
Portugal-Iceland	1	92	0.01
Portugal-Norway	17	407	0.04
Portugal-Poland	0	40	0.00
Portugal-Slovak Rep.	0	10	0.00
Portugal-Switzerland	203	387	0.34
Portugal-Turkey	0	175	0.00

Source: Organization for Economic Cooperation and Development (OECD).

Table A.1- *Continued.*

Destination-Source	FAS	IMP	$\frac{FAS}{FAS+IMP}$
Sweden-U.S.	9798	3804	0.72
Sweden-Canada	158	267	0.37
Sweden-Mexico	0	20	0.00
Sweden-Japan	110	1954	0.05
Sweden-Korea	0	322	0.00
Sweden-Australia	0	73	0.00
Sweden-New Zealand	0	29	0.00
Sweden-Austria	187	643	0.22
Sweden-Belgium	118	2538	0.04
Sweden-Denmark	1494	3929	0.28
Sweden-Finland	2716	3486	0.44
Sweden-France	1014	4013	0.20
Sweden-Germany	1320	11009	0.11
Sweden-Greece	0	93	0.00
Sweden-Ireland	16	1004	0.02
Sweden-Italy	9	2076	0.00
Sweden-The Neth.	754	4837	0.13
Sweden-Portugal	0	421	0.00
Sweden-Spain	0	1026	0.00
Sweden-U.K.	1827	6402	0.22
Sweden-Czech Rep.	0	307	0.00
Sweden-Hungary	0	216	0.00
Sweden-Iceland	22	19	0.54
Sweden-Norway	2201	3421	0.39
Sweden-Poland	0	670	0.00
Sweden-Slovak Rep.	0	56	0.00
Sweden-Switzerland	1947	1084	0.64
Sweden-Turkey	0	188	0.00

Source: Organization for Economic Cooperation and Development (OECD).

Table A.2-Sensitivity Analysis, Country Specific Magnitude of the Border Effects.

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(ii)		(iii)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}
D_{ij}^{X}, D_{ij}^{I}	-2.172[a]	-5.654[a]	-2.201[a]	-5.735[a]	-2.232[a]	-5.810[a]	-2.325[a]
(FIN)	(0.645)	(1.309)	(0.662)	(1.357)	(0.679)	(1.408)	(0.733)
D_{ij}^{X}, D_{ij}^{I}	-1.507[b]	-2.811[b]	-1.516[a]	-2.732[b]	-1.528[a]	-2.645[b]	-1.937[a]
(FRA)	(0.615)	(1.259)	(0.586)	(1.211)	(0.557)	(1.166)	(0.700)
D_{ij}^{X}, D_{ij}^{I}	-1.094	-7.141[a]	-1.114	-7.123[a]	-1.133	-7.092[a]	-1.124
(JPN)	(0.727)	(1.486)	(0.727)	(1.405)	(0.636)	(1.331)	(0.827)
D_{ij}^{X}, D_{ij}^{I}	2.150[a]	-0.276	2.107[a]	-0.270	2.061[a]	-0.264	0.757
(NDL)	(0.643)	(1.309)	(0.637)	(1.309)	(0.629)	(1.308)	(0.731)
D_{ij}^{X}, D_{ij}^{I}	-4.150[a]	-8.129[a]	-4.167[a]	-8.188[a]	-4.187[a]	-8.249[a]	-4.554[a]
(POL)	(0.620)	(1.287)	(0.634)	(1.329)	(0.647)	(1.371)	(0.705)
D_{ij}^{X}, D_{ij}^{I}	-2.520[a]	-7.919[a]	-2.573[a]	-7.928[a]	-2.625[a]	-7.940[a]	-2.690[a]
(PRT)	(0.654)	(1.331)	(0.673)	(1.383)	(0.691)	(1.437)	(0.744)
D_{ij}^{X}, D_{ij}^{I}	-1.608[a]	-4.160[a]	-1.622[a]	-4.123[a]	-1.639[a]	-4.090[a]	-2.009[a]
(SWE)	(0.624)	(1.266)	(0.628)	(1.287)	(0.631)	(1.308)	(0.709)
$\ln DIST_{ij}$	-1.101[a]	-0.559[a]	-1.093[a]	-0.554[a]	-1.085[a]	-0.551[a]	-1.101[a]
	(0.091)	(0.193)	(0.088)	(0.189)	(0.086)	(0.186)	(0.103)

Notes: Standard errors are in parentheses. [a, b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table A.2-*Continued.*

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(ii)		(iii)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}
$CONT_{ij}$	0.432[b]	1.655[a]	0.400[c]	1.669[a]	0.370[c]	1.676[a]	0.432[c]
	(0.219)	(0.445)	(0.217)	(0.446)	(0.215)	(0.446)	(0.249)
$LANG_{ij}$	-0.488	0.123	-0.459	0.096	-0.433	0.073	-0.488
	(0.303)	(0.618)	(0.299)	(0.617)	(0.296)	(0.616)	(0.344)
MR		0.793[a]		0.819[a]		0.844[a]	
		(0.185)		(0.189)		(0.192)	
BE (FIN)	8.517		8.779		9.061		10.224
BE (FRA)	3.549		3.514		3.474		6.935
BE (JPN)	2.980		3.038		3.098		3.077
BE (NDL)	0.107		0.111		0.116		0.469
BE (POL)	62.276		63.405		64.683		94.995
BE (PRT)	12.378		13.046		13.744		14.729
BE (SWE)	4.630		4.679		4.740		7.452
N	203	203	203	203	203	203	203
R^2	0.932	0.987	0.932	0.901	0.933	0.986	0.901
RMSE	0.549	1.116	0.549	0.672	0.547	1.137	0.672

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table A.2-*Continued.*

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(iv)		(v)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM^{lb}_{ij}
D^X_{ij}, D^I_{ij}	-2.172[a]	-5.654[a]	-2.172[a]	-5.297[a]	-2.172[a]	-5.409[a]	-2.325[a]
(FIN)	(0.645)	(1.309)	(0.645)	(1.320)	(0.645)	(1.303)	(0.733)
D^X_{ij}, D^I_{ij}	-1.507[b]	-2.811[b]	-1.507[b]	-2.864[b]	-1.507[b]	-2.698[b]	-1.937[a]
(FRA)	(0.615)	(1.259)	(0.615)	(1.268)	(0.615)	(1.253)	(0.700)
D^X_{ij}, D^I_{ij}	-1.094	-7.141[a]	-1.094	-7.318[a]	-1.094	-6.944[a]	-1.124
(JPN)	(0.727)	(1.486)	(0.727)	(1.494)	(0.727)	(1.481)	(0.827)
D^X_{ij}, D^I_{ij}	2.150[a]	-0.276	2.150[a]	-0.417	2.150[a]	-0.032	0.757
(NDL)	(0.643)	(1.309)	(0.643)	(1.3016)	(0.643)	(1.306)	(0.731)
D^X_{ij}, D^I_{ij}	-4.150[a]	-8.129[a]	-4.150[a]	-7.723[a]	-4.150[a]	-8.608[a]	-4.554[a]
(POL)	(0.620)	(1.287)	(0.620)	(1.288)	(0.620)	(1.288)	(0.705)
D^X_{ij}, D^I_{ij}	-2.520[a]	-7.919[a]	-2.520[a]	-7.779[a]	-2.520[a]	-7.813[a]	-2.690[a]
(PRT)	(0.654)	(1.331)	(0.654)	(1.340)	(0.654)	(1.325)	(0.744)
D^X_{ij}, D^I_{ij}	-1.608[a]	-4.160[a]	-1.608[a]	-4.187[a]	-1.608[a]	-3.978[a]	-2.009[a]
(SWE)	(0.624)	(1.266)	(0.624)	(1.274)	(0.624)	(1.261)	(0.709)
$\ln DIST_{ij}$	-1.101[a]	-0.559[a]	-1.101[a]	-0.514[a]	-1.101[a]	-0.634[a]	-1.101[a]
	(0.091)	(0.193)	(0.091)	(0.193)	(0.091)	(0.193)	(0.103)

Notes: Standard errors are in parentheses. [a, b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table A.2-*Continued.*

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(iv)		(v)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}
$CONT_{ij}$	0.432[b]	1.655[a]	0.432[b]	1.573[a]	0.432[b]	1.634[a]	0.432[c]
	(0.219)	(0.445)	(0.219)	(0.448)	(0.219)	(0.435)	(0.249)
$LANG_{ij}$	-0.488	0.123	-0.488	0.175	-0.488	0.016	-0.488
	(0.303)	(0.618)	(0.303)	(0.622)	(0.303)	(0.616)	(0.344)
MR		0.793[a]		1.123[a]		0.701	
		(0.185)		(0.304)		(0.143)	
BE(FIN)	8.517		8.409		8.447		10.224
BE(FRA)	3.549		3.588		3.461		6.935
BE(JPN)	2.980		2.981		2.979		3.077
BE(NDL)	0.107		0.108		0.105		0.469
BE(POL)	62.276		61.709		62.714		94.995
BE(PRT)	12.378		12.370		12.372		14.729
BE(SWE)	4.630		4.639		4.565		7.452
N	203	203	203	203	203	203	203
R^2	0.932	0.987	0.932	0.987	0.932	0.987	0.901
$RMSE$	0.549	1.116	0.549	1.116	0.549	1.111	0.672

Notes: Standard errors are in parentheses. [a, b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table A.2-*Continued.*

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(vi)		(vii)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}
D_{ij}^{X}, D_{ij}^{I}	-2.172[a]	-5.654[a]	-2.213[a]	-5.982[a]	-2.251[a]	-6.426[a]	-2.325[a]
(FIN)	(0.645)	(1.309)	(0.645)	(1.309)	(0.645)	(1.309)	(0.733)
D_{ij}^{X}, D_{ij}^{I}	-1.507[b]	-2.811[b]	-1.633[a]	-3.225[a]	-1.745[a]	-3.742[b]	-1.937[a]
(FRA)	(0.615)	(1.259)	(0.615)	(1.259)	(0.615)	(1.259)	(0.700)
D_{ij}^{X}, D_{ij}^{I}	-1.094	-7.141[a]	-1.102	-7.436[a]	-1.109	-7.849[a]	-1.124
(JPN)	(0.727)	(1.486)	(0.727)	(1.486)	(0.727)	(1.486)	(0.827)
D_{ij}^{X}, D_{ij}^{I}	2.150[a]	-0.276	1.587[b]	-1.127	1.228[c]	-1.891	0.757
(NDL)	(0.643)	(1.309)	(0.643)	(1.309)	(0.643)	(1.309)	(0.731)
D_{ij}^{X}, D_{ij}^{I}	-4.150[a]	-8.129[a]	-4.267[a]	-8.534[a]	-4.372[a]	-9.044[a]	-4.554[a]
(POL)	(0.620)	(1.287)	(0.620)	(1.287)	(0.620)	(1.287)	(0.705)
D_{ij}^{X}, D_{ij}^{I}	-2.520[a]	-7.919[a]	-2.565[a]	-8.252[a]	-2.609	-8.701[a]	-2.690[a]
(PRT)	(0.654)	(1.331)	(0.654)	(1.331)	(0.654)	(1.331)	(0.744)
D_{ij}^{X}, D_{ij}^{I}	-1.608[a]	-4.160[a]	-1.724[a]	-4.564[a]	-1.828[a]	-5.073[a]	-2.009[a]
(SWE)	(0.624)	(1.266)	(0.624)	(1.266)	(0.624)	(1.267)	(0.709)
$\ln DIST_{ij}$	-1.101[a]	-0.559[a]	-1.101[a]	-0.559[a]	-1.101[a]	-0.559[a]	-1.101[a]
	(0.091)	(0.193)	(0.091)	(0.193)	(0.091)	(0.193)	(0.103)

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table A.2-*Continued.*

	Ownership-Basis Gravity Equation						CGE
	SURE		SURE		SURE		OLS
	(i)		(vi)		(vii)		(1)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}
$CONT_{ij}$	0.432[b]	1.655[a]	0.432[b]	1.655[a]	0.432[b]	1.655[a]	0.432[c]
	(0.219)	(0.445)	(0.219)	(0.445)	(0.219)	(0.445)	(0.249)
$LANG_{ij}$	-0.488	0.123	-0.488	0.123	-0.488	0.123	-0.488
	(0.303)	(0.618)	(0.303)	(0.618)	(0.303)	(0.618)	(0.344)
MR		0.793[a]		0.793[a]		0.793[a]	
		(0.185)		(0.185)		(0.185)	
BE (FIN)	8.517		8.934		9.357		10.224
BE (FRA)	3.549		4.252		5.039		6.935
BE (JPN)	2.980		3.004		3.027		3.077
BE (NDL)	0.107		0.192		0.280		0.469
BE (POL)	62.276		70.339		78.477		94.995
BE (PRT)	12.378		12.963		13.549		14.729
BE (SWE)	4.630		5.296		5.988		7.452
N	203	203	203	203	203	203	203
R^2	0.932	0.987	0.932	0.987	0.932	0.987	0.901
RMSE	0.549	1.116	0.549	1.116	0.549	1.116	0.672

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table A.2-*Continued.*

	Ownership-Basis Gravity Equation						CGE	
	SURE		SURE		SURE		OLS	OLS
	(i)		(viii)		(xi)		(2)	(3)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}	COM_{ij}^{lb}
D_{ij}^X, D_{ij}^I	-2.172[a]	-5.654[a]	-2.693[a]	-5.814[a]	-1.176[b]	-5.094[a]	-2.844[a]	-1.328[c]
(FIN)	(0.645)	(1.309)	(0.670)	(1.291)	(0.681)	(1.375)	(0.762)	(0.775)
D_{ij}^X, D_{ij}^I	-1.507[b]	-2.811[b]	-1.478[b]	-2.750[b]	-0.699	-2.348[b]	-1.907[b]	-1.128
(FRA)	(0.615)	(1.259)	(0.651)	(1.264)	(0.635)	(1.295)	(0.740)	(0.722)
D_{ij}^X, D_{ij}^I	-1.094	-7.141[a]	-1.100	-6.969[a]	0.257	-6.321[a]	-1.126	0.229
(JPN)	(0.727)	(1.486)	(0.786)	(1.524)	(0.800)	(1.632)	(0.895)	(0.910)
D_{ij}^X, D_{ij}^I	2.150[a]	-0.276	1.805[a]	-0.364	2.401[a]	-0.088	0.413	1.008
(NDL)	(0.643)	(1.309)	(0.673)	(1.300)	(0.654)	(1.323)	(0.765)	(0.744)
D_{ij}^X, D_{ij}^I	-4.150[a]	-8.129[a]	-4.157[a]	-8.065[a]	-3.588[a]	-7.907[a]	-4.559[a]	-3.992[a]
(POL)	(0.620)	(1.287)	(0.656)	(1.295)	(0.636)	(1.307)	(0.746)	(0.723)
D_{ij}^X, D_{ij}^I	-2.520[a]	-7.919[a]	-2.223[a]	-7.649[a]	-0.402	-6.766[a]	-2.390[a]	-0.571
(PRT)	(0.654)	(1.331)	(0.710)	(1.373)	(0.744)	(1.502)	(0.808)	(0.847)
D_{ij}^X, D_{ij}^I	-1.608[a]	-4.160[a]	-1.695[a]	-4.131[a]	-0.689	-3.639[a]	-2.095[a]	-1.090
(SWE)	(0.624)	(1.266)	(0.659)	(1.270)	(0.650)	(1.312)	(0.749)	(0.739)
$\ln DIST_{ij}$	-1.101[a]	-0.559[a]	-0.973[a]	-0.528[a]	-1.038	-0.549[a]	-0.973[a]	-1.038
	(0.091)	(0.193)	(0.092)	(0.183)	(0.087)	(0.182)	(0.105)	(0.099)

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table A.2-*Continued.*

	Ownership-Basis Gravity Equation						CGE	
	SURE		SURE		SURE		OLS	OLS
	(i)		(viii)		(xi)		(2)	(3)
	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	IMP_{ij}	FAS_{ij}	COM_{ij}^{lb}	COM_{ij}^{lb}
$CONT_{ij}$	0.432[b]	1.655[a]	0.519[b]	1.625[a]	0.346	1.600[a]	0.518[b]	0.346
	(0.219)	(0.445)	(0.231)	(0.446)	(0.224)	(0.451)	(0.263)	(0.254)
$LANG_{ij}$	-0.488	0.123	-0.641[c]	0.068	-0.474	0.116	-0.641[c]	-0.475
	(0.303)	(0.618)	(0.320)	(0.621)	(0.304)	(0.617)	(0364)	(0.346)
MR		0.793[a]		0.770[a]		0.805[a]		
		(0.185)		(0.184)		(0.186)		
BE (FIN)	8.517		14.151		3.179		17.183	3.774
BE (FRA)	3.549		3.424		1.687		6.731	3.090
BE (JPN)	2.980		2.996		0.772		3.085	0.795
BE (NDL)	0.107		0.148		0.084		0.661	0.364
BE (POL)	62.276		62.613		35.691		95.533	54.138
BE (PRT)	12.378		9.196		1.493		10.918	1.770
BE (SWE)	4.630		5.009		1.893		8.124	2.973
N	203	203	203	203	203	203	203	203
R^2	0.932	0.987	0.925	0.987	0.932	0.987	0.927	0.933
$RMSE$	0.549	1.116	0.578	1.116	0.551	1.113	0.657	0.627

Notes: Standard errors are in parentheses. [a], [b] and [c] denotes significance at 1, 5 and 10 percent level, respectively. CGE stands for conventional gravity equation. FIN, FRA, JPN, NDL, POL, PRT and SWE stand for Finland, France, Japan, The Netherlands, Poland, Portugal. Sweden.

Table A.3- Alternative Distance Measures (Kilometers).

	Head and Mayer Distance	Wei Distance	Head and Mayer Effective Distance
Finland-Finland	200	218	67
France-France	409	278	161
Japan-Japan	392	231	83
The Neth.-The Neth.	80	77	51
Poland-Poland	244	210	125
Portugal-Portugal	214	114	23
Sweden-Sweden	281	252	99
Finland-U.S.	7668	6626	7544
Finland-Canada	6561	6611	6526
Finland-Mexico	9593	9861	9581
Finland-Japan	7676	7830	7670
Finland-Korea	7120	7071	7115
Finland-Australia	14849	15211	14815
Finland-New Zealand	16839	17363	16835
Finland-Austria	1602	1438	1584
Finland-Belgium	1707	1652	1697
Finland-Denmark	992	885	974
Finland-France	2152	1911	2124
Finland-Germany	1435	1475	1398
Finland-Greece	2545	2465	2529
Finland-Ireland	2094	2029	2087
Finland-Italy	2246	2203	2215
Finland-The Neth.	1568	1506	1557
Finland-Portugal	3383	3363	3365
Finland-Spain	3027	2952	2988
Finland-Sweden	605	398	525
Finland-U.K.	1851	1827	1842
Finland-Czech Rep.	1387	1300	1371
Finland-Hungary	1587	1458	1570
Finland-Iceland	2338	2425	2331
Finland-Norway	882	791	856
Finland-Poland	1109	911	1071
Finland-Slovak Rep.	1453	1424	1435
Finland-Switzerland	1922	1859	1909
Finland-Turkey	2476	2143	2450
France-U.S.	7457	5838	7227
France-Canada	6454	6005	6327
France-Mexico	9276	9207	9264
France-Japan	9803	9726	9797
France-Korea	9226	8981	9220

Source: Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Table A.3- *Continued.*

	Head and Mayer Distance	Wei Distance	Head and Mayer Effective Distance
France-Australia	16513	16975	16465
France-New Zealand	18894	19264	18891
France-Austria	976	1035	921
France-Belgium	526	262	379
France-Denmark	1196	1028	1151
France-Finland	2152	1911	2124
France-Germany	790	440	682
France-Greece	1928	2099	1891
France-Ireland	1024	778	949
France-Italy	892	1110	713
France-The Neth.	661	428	556
France-Portugal	1339	1453	1289
France-Spain	959	1055	817
France-Sweden	1616	1546	1551
France-U.K.	750	343	599
France-Czech Rep.	1037	885	996
France-Hungary	1265	1247	1234
France-Iceland	2468	2235	2436
France-Norway	1615	1343	1544
France-Poland	1352	1368	1318
France-Slovak Rep.	1248	1095	1213
France-Switzerland	474	436	406
France-Turkey	2478	2256	2413
Japan-U.S.	10286	10856	10194
Japan-Canada	9756	10358	9599
Japan-Mexico	11099	11312	11045
Japan-Korea	952	1157	844
Japan-Australia	7827	7831	7790
Japan-New Zealand	9182	9576	9173
Japan-Austria	9111	9141	9107
Japan-Belgium	9371	9463	9368
Japan-Denmark	8651	8703	8648
Japan-Finland	7676	7830	7670
Japan-France	9803	9726	9797
Japan-Germany	9086	9298	9080
Japan-Greece	9364	9518	9360
Japan-Ireland	9575	9599	9572
Japan-Italy	9711	9869	9706
Japan-The Neth.	9229	9303	9226
Japan-Portugal	11035	11156	11027

Source: Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Table A.3- *Continued.*

	Head and Mayer Distance	Wei Distance	Head and Mayer Effective Distance
Japan-Spain	10685	10777	10671
Japan-Sweden	8227	8181	8217
Japan-U.K.	9436	9574	9432
Japan-Czech Rep.	8935	9082	8932
Japan-Hungary	8944	9059	8940
Japan-Iceland	8760	8808	8755
Japan-Norway	8333	8417	8321
Japan-Poland	8599	8591	8594
Japan-Slovak Rep.	8860	9104	8856
Japan-Switzerland	9559	9681	9555
Japan-Turkey	8718	8959	8708
The Neth.-U.S.	7282	5866	7082
The Neth.-Canada	6237	5988	6143
The Neth.-Mexico	9153	9229	9147
The Neth.-Japan	9229	9303	9226
The Neth.-Korea	8680	8573	8678
The Neth.-Australia	16227	16658	16187
The Neth.-New Zealand	18385	18867	18382
The Neth.-Austria	865	935	853
The Neth.-Belgium	161	173	141
The Neth.-Denmark	587	623	575
The Neth.-Finland	1568	1506	1557
The Neth.-France	661	428	556
The Neth.-Germany	379	174	282
The Neth.-Greece	2090	2163	2082
The Neth.-Ireland	824	757	816
The Neth.-Italy	1175	1298	1093
The Neth.-Portugal	1820	1862	1795
The Neth.-Spain	1501	1481	1447
The Neth.-Sweden	1009	1129	952
The Neth.-U.K.	468	360	436
The Neth.-Czech Rep.	770	709	749
The Neth.-Hungary	1146	1146	1140
The Neth.-Iceland	2045	2023	2043
The Neth.-Norway	984	916	937
The Neth.-Poland	987	1094	966
The Neth.-Slovak Rep.	1059	987	1049
The Neth.-Switzerland	602	628	596
The Neth.-Turkey	2485	2210	2445

Source: Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Table A.3- *Continued.*

	Head and Mayer Distance	Wei Distance	Head and Mayer Effective Distance
Poland-U.S.	8085	6855	7926
Poland-Canada	7005	6926	6942
Poland-Mexico	9995	10191	9987
Poland-Japan	8599	8591	8594
Poland-Korea	7971	7754	7966
Poland-Australia	15289	15608	15245
Poland-New Zealand	17654	17914	17652
Poland-Austria	549	557	493
Poland-Belgium	1060	1161	1042
Poland-Denmark	702	669	652
Poland-Finland	1109	911	1071
Poland-France	1352	1368	1318
Poland-Germany	698	966	609
Poland-Greece	1535	1600	1509
Poland-Ireland	1784	1827	1771
Poland-Italy	1197	1319	1151
Poland-The Neth.	987	1094	966
Poland-Portugal	2621	2760	2599
Poland-Spain	2166	2293	2110
Poland-Sweden	848	809	791
Poland-U.K.	1426	1452	1407
Poland-Czech Rep.	387	517	303
Poland-Hungary	520	547	468
Poland-Iceland	2716	2773	2707
Poland-Norway	1164	1062	1112
Poland-Slovak Rep.	395	530	324
Poland-Switzerland	1007	1140	986
Poland-Turkey	1691	1386	1632
Portugal-U.S.	7005	5425	6723
Portugal-Canada	6132	5731	5949
Portugal-Mexico	8663	8684	8655
Portugal-Japan	11035	11156	11027
Portugal-Korea	10498	10433	10492
Portugal-Australia	17625	18191	17573
Portugal-New Zealand	19539	19335	19537
Portugal-Austria	2195	2299	2168
Portugal-Belgium	1684	1711	1658
Portugal-Denmark	2401	2478	2381
Portugal-Finland	3383	3363	3365

Source: Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Table A.3- *Continued.*

	Head and Mayer Distance	Wei Distance	Head and Mayer Effective Distance
Portugal-France	1339	1453	1289
Portugal-Germany	2022	1892	1984
Portugal-Greece	2839	2854	2827
Portugal-Ireland	1567	1640	1539
Portugal-Italy	1854	1864	1818
Portugal-The Neth.	1820	1862	1795
Portugal-Spain	680	501	565
Portugal-Sweden	2822	2991	2787
Portugal-U.K.	1621	1583	1584
Portugal-Czech Rep.	2292	2245	2270
Portugal-Hungary	2471	2471	2452
Portugal-Iceland	2915	2953	2904
Portugal-Norway	2717	2740	2680
Portugal-Poland	2621	2760	2599
Portugal-Slovak Rep.	2483	2354	2461
Portugal-Switzerland	1634	1627	1606
Portugal-Turkey	3518	3237	3476
Sweden-U.S.	7441	6323	7290
Sweden-Canada	6348	6335	6295
Sweden-Mexico	9357	9598	9348
Sweden-Japan	8227	8181	8217
Sweden-Korea	7683	7445	7674
Sweden-Australia	15385	15609	15348
Sweden-New Zealand	17390	17739	17383
Sweden-Austria	1228	1242	1195
Sweden-Belgium	1152	1284	1104
Sweden-Denmark	450	524	230
Sweden-Finland	605	398	525
Sweden-France	1616	1546	1551
Sweden-Germany	929	1119	827
Sweden-Greece	2353	2408	2335
Sweden-Ireland	1549	1631	1523
Sweden-Italy	1833	1980	1772
Sweden-The Neth.	1009	1129	952
Sweden-Portugal	2822	2991	2787
Sweden-Spain	2487	2597	2427
Sweden-U.K.	1293	1438	1256
Sweden-Czech Rep.	1009	1054	968

Source: Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Table A.3- *Continued.*

	Head and Mayer Distance	Wei Distance	Head and Mayer Effective Distance
Sweden-Hungary	1315	1319	1292
Sweden-Iceland	2047	2138	2042
Sweden-Norway	503	418	423
Sweden-Poland	848	809	791
Sweden-Slovak Rep.	1176	1244	1152
Sweden-Switzerland	1423	1547	1382
Sweden-Turkey	2453	2173	2421

Source: Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).