Is Trade Facilitation The Right Direction To Go In Building Trade Capacity?

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B.Sc., University of British Columbia, 2004

RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

in the Department
of
Economics

SIMON FRASER UNIVERSITY
Fall 2005

APPROVAL

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Title of Project:	**Is Trade Facilitation The Right Direction To Go In Building Trade Capacity?**

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Date Approved: Thursday, December 1, 2005

ABSTRACT

This paper uses the gravity equation of international trade to study the relationship between trade facilitation commitments and trade flows using the OECD/WTO Trade Capacity Building - Trade Facilitation Database. In the analyses of 257 donor-recipients pairs, it is found that bilateral trade facilitation commitments are positively related, while multilateral sources are negatively related to exports from recipients to donors. These negative relationships for the multilateral institutions were found by using cross-sectional studies and are significant, for all but the World Customs Organization. From the first-differenced estimations, changes in exports from recipients to donors covariate positively with changes in the World Customs Organization trade facilitation commitments; the estimated effect is 0.23 percent to 0.41 percent increase in exports for every 10 percent increase in the World Customs Organization trade facilitation commitments. There is no evidence that changes in other trade facilitation sources will bring significant changes to bilateral trade.

Keywords: trade facilitation, gravity model, capacity building

DEDICATION

This paper is dedicated to my parents for their sacrifices, unconditional support and love throughout my academic career.

ACKNOWLEGDEMENT

I would like to thank my Advisory Committee members, Dr. Stephen Easton, Dr. David Jacks and Dr. Terry Heaps for their guidance.

I am grateful to Dr. Jane Friesen and Dr. Krishna Pendakur, who gave me invaluable advice during my graduate study.

I would also like to express my gratitude to Mr. Yuen Pau Woo and Mr. Nizar Assanie at the Asia Pacific Foundation of Canada for their inspiring introduction to the research in trade facilitation.

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ACRONYMS / ABBREVIATIONS

All TF	Trade facilitation commitments from all bilateral and multilateral donors
APEC	Asia-Pacific Economic Cooperation
CE	Customs environment
CEEC/NIS	Central and Eastern European Countries and the Newly Independent States of the Former Soviet Union
EB	E-business usage
EU	European Union
HICs	High income countries
LAIA	Latin American Integration Association
LAS	League of Arab States
LDCs	Least developed countries
LICs	Low income countries
LIMCs	Lower middle income countries
PE	Port efficiency
RE	Regulatory environment
TF All Bi	Trade facilitation commitments from all bilateral donors
TF All Multi	Trade facilitation commitments from all multilateral donors
TF Bi (D-to-R)	Trade facilitation commitments between specific pair of donor and recipient
TF EC	Trade facilitation commitments from the European Commission
TF Other Bi	Trade facilitation commitments from all bilateral donors minus trade facilitation commitments between specific pair of donor and recipient
TF Other Multi	Trade facilitation commitments from multilateral agencies other than the EC, UN, WCO and WCO
TF UN	Trade facilitation commitments from the United Nations
TF WCO	Trade facilitation commitments from the World Customs Organization
TF WTO	Trade facilitation commitments from the World Trade Organization

1. Introduction

International trade has become an integral part of most countries' everyday activities. For the communist countries that once operated closed economies, their markets have gradually opened up to foreigners. The best examples are China and the Former Soviet Union states. In recent years, China and the Eastern European countries are some of the fastest-growing economies in the world. According to the Pacific Economic Cooperation Council publication - the 2005-2006 Pacific Economic Outlook, China is expected to have an annual Gross Domestic Product (GDP) growth of about 8% in 2005 and 2006. This growth rate is predicted to be sustained for the next decade. The potentials of these economies are hard to project because there is still a lot to be learned about these new open economies. The disappearance of autarkic economies is no surprise because there is a net gain from trade, and it is possible to make all players better off by enlarging each player's consumption level.

As these countries and other emerging economies enter the world of international trade, there are many international rules and regulations with which they need to comply. While these countries are enjoying a higher living standard, there are also many other economies that have been stagnating for a long period of time. Examples are the least developed countries (LDCs) and the low income countries (LICs) in Africa and South Asia. Some of these stagnations may be attributed to political or social instability that makes doing businesses risky, or other man-made or natural disasters that destroy infrastructure. For example, Afghanistan has been in wars for many years. These wars not only create physical damages to the country, but also create an unsafe image for the country. Without a secure and infrastructure equipped economy, these countries can hardly attract investors. Another possible reason for not engaging in trading is that most goods produced by these LDCs and LICs, such as agricultural and manufacturing products, face high tariff rates. However, as reported by various organizations, procedural impediments can serve as stronger barriers to trade than tariffs in developing countries.[1] This can be good news for these stagnant economies. Even if developed

[1] APFC and The World Bank, Cutting Through Red Tape: New Directions for APEC's Trade Facilitation Agenda, (Novemeber 2000)

economies that use the tariff to protect their low-end industries may not easily reduce tariffs, the LDCs and LICs can still unilaterally reduce trade barriers by eliminating their own procedural impediments to trade. The lack of a trade facilitation structure also makes the potential gains of commitments to such an area high.

To build trade capacity, many multilateral trade institutions provide assistance of various forms to countries in transition, the LDCs and LICs. To trade internationally, there are internationally set rules and regulations to follow. Raising the standards of developing countries to meet international regulations can be considered as a trade facilitating procedure. Building the necessary infrastructure for transportation and communication can also be viewed as trade facilitating. Since it is a new area of research, there is no formal or universally-agreed definition of trade facilitation. Definitions used by some multilateral agencies can be found in Wilson, Mann and Otsuki (WMO) 2003. Trade facilitation is also a new item on the World Trade Organization (WTO) Ministerial Conference Agenda. It was first introduced as a separate entity for negotiations in the 1996 WTO Ministerial Conference at Singapore. According to the Organization for Economic Cooperation and Development (OECD) and the World Trade Organization (WTO) in 2005, the definition of trade facilitation is the "simplification and harmonization of international trade procedures related to the movement of goods across borders". "Trade procedures include the activities, practices and formalities involved in collecting, presenting, communicating and processing data and other information required for the movement of goods in international trade."[2]

More concretely, trade facilitation has been characterized by four areas of interest: port efficiency, customs environment, regulatory environment and service-sector infrastructure. Port efficiency addresses Article V of the General Agreement on Tariffs and Trade (GATT) – freedom of transit. Article V says that "freedom of movement through the territory of each contracting party is to be assured for goods (and their conveyances), which are destined to or come from any other contracting party. Such traffic must be allowed to move via the most convenient route; is to be exempted from

[2] Joint WTO/OECD Trade Capacity Building Database - 2005 Data Collection

customs or transit duties; and is to be free from unnecessary delays or restrictions."[3] The customs environment corresponds to GATT Article VIII – fees and formalities connected with importation and exportation. "Article VIII establishes that all fees and charges (other than duties) imposed on, or in connection with, import or export shall be limited to the approximate cost of services rendered, and shall not constitute indirect protection to domestic products or taxation for fiscal purposes."[4] The regulatory environment is related to GATT Article X - publication and administration of trade regulations. "Article X establishes two principles: First, all laws and regulations, judicial decisions and administrative rulings, etc., affecting imports and exports should be published; furthermore, they may not be enforced before official publication. Second, administration of these laws, regulations, etc., shall be uniform, impartial and reasonable."[5]

After 9 years of exploration, formulation and implementation in the area of trade facilitation, the preliminary results of international commitments to trade facilitation will be presented in the upcoming 6th WTO Ministerial Conference in Hong Kong (December 2005). The emerging attention to trade facilitation can be seen from the 197% (from 104 million USD to 309 million USD) increase in international commitments in this area between 2001 and 2003. This trend continues in 2004. With only partial 2004 data available as of October 2005, total commitment to trade facilitation sum to 343 million USD in 2004, which is over the total in 2003. These values are computed using the Trade Capacity Building - Trade Facilitation Database[6] launched jointly by the OECD and the WTO in November 2002. This database is constructed based on the trade facilitation definition given above, and it contains all commitments to trade facilitation from both bilateral and multilateral sources to recipients between 2001 and 2003 and partial commitments in 2004. This project also uses this Trade Facilitation Database to study the research question: Is trade facilitation the right direction to go in building trade

[3] Institute for Trade & Commercial Diplomacy at http://www.commercialdiplomacy.org/dictionaries.htm

[4] WTO at http://www.wto.org/english/thewto_e/whatis_e/eol/e/wto02/wto2_10.htm

[5] WTO at http://www.wto.org/english/thewto_e/whatis_e/eol/e/wto02/wto2_10.htm

[6]Joint WTO/OECD Trade Capacity Building Database Category 33121 - 2005 Data Collection at http://tcbdb.wto.org.

capacity? More specifically, would trade volume increase with trade facilitation commitments?

I propose using the gravity model, that is frequently used in studying bilateral trade, to test the hypothesis that trade facilitation projects can enhance trade between the country receiving and the country contributing to the building of trade capacity in the area of trade facilitation. The modified gravity model attempts to account for the variation in the bilateral trade flows by using trade facilitation contributions as an explanatory variable in addition to the classic variables in the gravity model such as distance between two countries, their GDP levels in actual value and in per capita terms, tariff levels, trade preferential arrangements and language barriers. My first set of regressions looks at the aggregate effects by using cross-sectional data, and my second set of regressions uses the panel feature of the data to look at the before and after effect and to accommodate the possibility of lagged response of trade flows to trade facilitation commitments.

Another feature of this data set is that, multilateral institutions are involved in about half of the records. Therefore, this gives an opportunity to examine the role of multilateral donors on bilateral trade flows. This report should provide a better insight about the significance of trade facilitation on trade than the previous works in this area because previous works used computed indices to proxy trade facilitation levels while this report employs real data to indicate improvement in trade facilitation.

The remainder of this paper is structured as follows: section 2 gives the history, derivation and the previous uses of the gravity model; section 3 introduces the trade facilitation data set; section 4 provides the framework for analyzing the trade facilitation data; section 5 reports and discusses the statistical findings; section 6 discusses the issues for future research; section 7 concludes.

2. Background on International Trade – Theories and Empirics

2.1 International Trade Theory

This report studies the relationship between trade flows and trade facilitation commitments. Trade facilitation commitments can be viewed as aid from various sources to improve trading environment in a recipient country. With these improvements, it is believed that trade flows will increase. In order to justify such belief, it is necessary to understand what the determinants of trade are. Theoretically, there are many factors that potentially shape the pattern of international trade. There are three major schools of thoughts regarding the three central questions in international trade: Why is there trade? Who would trade? And what is being traded?

Using the fundamental supply and demand model, the three doctrines model the demand side similarly as the aggregation of consumer preference from all over the world for different goods; however, their theories on the supply side differ. Among the three doctrines, the trade theory that has the longest history was developed by Ricardo in the early nineteenth century. The Ricardian trade model was based on the concept that relative cost differences among goods across countries arose from differences in the technology of production. In essence, if a country has a comparative advantage in the production of a commodity, it will produce and export this commodity until she reaches her capacity. Since this methodology relies on comparative advantage and not on absolute advantage, every country would produce at least one good according to the Ricardian model. Together with the supply and demand framework at the world level, as well as the domestic budget constraint – total income equals total expenditure – for each country, consumption and production decisions for each commodity are made simultaneously.

Another widely-adopted international trade model is the Heckscher-Ohlin model postulated by Heckscher and Ohlin in the 1930s. This model uses relative factor endowments to study the above three questions. Assuming that production of all goods requires only two factors of production - labour and capital, the pattern of international trade would be determined by the relative endowment of these factors as well as the

production technology of each good in each country. In other words, relatively labour-intensity commodities tend to be produced or exported from countries with relatively high labour-capital ratio.

The third type of model used to answer the three questions is essentially an extension of the Heckscher-Ohlin model, the specific factor model. This allows for the use of specific factors in various industries. For instance, all industries need labour as input, but not all industries rely on both capital and land – the specific factors. Using the Heckscher-Ohlin model argument, international trade pattern in the specific factor case would also be driven by the relative endowment of each type of specific factors.

From the theoretical point of view, these three models are equally popular in the field of international trade as they all have their own merits and are likely to shape trade pattern jointly. Empirically, the trade pattern – bilateral trade in particular – is studied extensively using the gravity model (Oguledo and MacPhee 1994).

2.2 Gravity Model

The gravity model earned its popularity in the study of bilateral trade flows since the 1960s after Tinbergen (1962), Poyhonen and Pulliainen (1963) and Linnemann (1966) applied such model to study trade pattern. The simplest form of the gravity model is:

$$X_{ij} = \beta o\ (Y_i)^{\beta 1}\ (Y_j)^{\beta 2} (D_{ij})^{\beta 3}\ u_{ij} \quad \ldots\ldots\ldots \quad (1a),$$ or in logarithmic form:

$$ln(X_{ij}) = b_o + \beta_1\, ln(Y_i) + \beta_2\, ln(Y_j) + \beta_3\, ln(D_{ij}) + ln(u_{ij}) \quad \ldots\ldots\ldots \quad (1b),$$

where X_{ij} is the value of the flow from country i to country j, Y_i (Y_j) is the GDP in i (j), D_{ij} is the distance between i and j, u_{ij} is a log-normally distributed error term ($\ln u_{ij} \sim N(0,\sigma_u)$), and the β's tell how trade flow and GDPs and distance are linked. It is believed and proven that GDPs are positively related, while distance is negatively related to trade flow. This belief first arose from an analogy with the gravity theory in physics, which states that the attraction between two masses grows as their masses increase and as the distance between them decreases. Because of this non-economic explanation, the gravity model has long been criticized. However, due to its high explanatory power, the model has continued to be one of the most frequently used tools to study trade patterns by researchers at all times. Today, the use of such model is subject to less criticism because

several economists like Anderson (1979) and Bergstrand (1985, 1989) built the gravity model based on economic models, and thus provided a more rigorous economic basis for the use and interpretation of the gravity model.

The rest of this section will present the history of the gravity model, followed by the theoretical framework for it, and then finally the various applications of the model, namely, preferential trade agreements, border effects and trade capacity assessments.

2.2.1 History of the Gravity Model

As early as the 1850s, the gravity model was used in social science studies of human interactions such as the pattern of migration. In the 1940s, economists and geographers started to recognize that there were potential benefits of collaborating with each other to their respective studies. A simple but relevant example, the Heckscher-Ohlin model requires knowledge about variation in endowment of different countries; geographers would be a good resource. The field "Economic Geography" or "Space Economy" was born, and "location theory" emerged. In 1954, Isard and Peck illustrated diagrammatically that trade flow and distance, and thus transport costs, are negatively related for both intra-national and international trade. They also provided an example that uses the traditional opportunity cost and comparative advantage concepts to show the direct relevance of relative geography due to the existence of transport costs in determining production location and trade pattern. In that same year, Isard outlined an "input-output analysis", which essentially modelled how national income is derived through the interaction of input and output markets in a multi-country and multi-commodity world. He then proposed the following trade-like relationship, which closely resembles the gravity model presented above.

$$ {}_iV_j = k\, Y_j / D_{ij}^{\alpha} \quad \ldots\ldots\ldots (2), $$

where ${}_iV_j$ is the "income potential produced by nation j upon nation i", Y_j is the "income of nation j", D_{ij} is the "average effective distance between nation i and j", k is "a constant similar to the gravitational constant", and α is "a constant power to which D_{ij} is raised".

Motivated by Isard and Peck's idea, Beckerman (1956) posed the research question: "What is the importance of distance in determining the pattern of Western

European trade?" He reached 4 major conclusions using summary statistics; countries near to one another traded markedly more, this was especially true for the less developed nations in Europe whose degree of diversity in terms of trading partner was relatively low; this tendency was less strong when three rather than two most important trade partners are considered; both exports and imports showed similar tendency; such tendency did not decline throughout the periods under study. He also made the following two inspiring points. "Since one country's imports are another country's exports the actual distribution of the first country's imports will depend on a mixture of two distance elements: (i) the relative distance of every other country to the given country, which will influence the import pattern of the given country in one way; and (ii) the relative distance of the given country to each other country, which will affect the export pattern of each other country and will thereby also have an effect on the import pattern of the given country." There may also exist "psychic distance", such as a language barrier. Therefore, one may need to consider concepts beyond physical bilateral distance to evaluate trade impediments.

The study of the distance term in the gravity model did not stop. Moneta (1959) found generally that the ratio of transportation cost to total cost of a commodity moves inversely with its value per ton. This finding is worth-noting because underdeveloped countries "are likely to trade low-valued commodities for high-valued commodity from" industrialized countries. The relatively high transport costs of the low-valued commodities could inhibit exports from the underdeveloped countries. This point on relatively high transport costs on underdeveloped countries' exports was echoed by Finger and Yeats (1976) in their study of the magnitudes of various trade protection measures. They found that the *protection* by transport costs is more than equal to the protection by tariffs. The implication therefore is that due to the nature of commodities exported by underdeveloped countries, even if the tariffs against these countries are low, exports may not significantly improve given the transport costs obstacle. Geraci and Prewo (1977) also extended the study on transport cost, noting that the commodity composition flowing between two countries is different in each direction. This suggests that using distance as a proxy for transport cost for both directions is inadequate in a pooling regression.

Year 1962 marked the first debut of the basic gravity model shown in equation (1). Tinbergen proposed using this model to study the structure of world trade. In fact, he also augmented the model with the Commonwealth and Benelux preferences dummies and the difference in agriculture land per capita (a proxy for endowment) to capture their effects on trade volume. In running the regression model for the 1958 bilateral world trade data, he found that all the regressors were statistically significant with their expected signs, and the explanatory power of the model was strikingly high, with the unadjusted R^2 being 0.84. Due to these encouraging results, many researchers followed suit even though there was no rigorous economic framework behind the use of the gravity model. Linnemann (1966) further developed the basic gravity model proposed by Tinbergen to a form that is used most often nowadays.

$X_{ij} = \beta o\ (Y_i)^{\beta 1}\ (Y_j)^{\beta 2}\ (N_i)^{\beta 3}\ (N_j)^{\beta 4}\ (D_{ij})^{\beta 5}\ u_{ij}$ ..... *(3a),* or in logarithmic form:

$ln(X_{ij}) = b_o + \beta_1 ln(Y_i) + \beta_2\ ln(Y_j) + \beta_3 ln(N_i) + \beta_4 ln(N_j) + \beta_5 ln(D_{ij}) + ln(u_{ij})$ ... *(3b),*

where the interpretations are the same as in equation (1) for the common terms, and N_i (N_j) is the population of nation i (j). In his study, as well as many other studies, population sizes have significant negative effect on trade flows. The economic intuition behind the sign of each explanatory variable will be discussed in more details in later sections. Similar to Tinbergen's model, Linnemann augmented his newly developed gravity model with three trade preferences, namely the Commonwealth, French and Belgian preferences. Again, Linnemann's model provided good fit for his 1958-1960 trade data, with all variables being statistically significant.

The gravity model had been used for more than a decade without any economic theories behind it; the next section will provide three economic derivations of this model.

2.2.2 Theoretical Framework for the Gravity Model

Anderson (1979) was the first one to provide a theoretical foundation for the gravity equation. A detailed derivation of the gravity model by Anderson can be found in the Annex. His derivation of the gravity model was based on the properties of the expenditure systems (basically income must equal sales) and the following assumptions in the perfect competition setting. His main assumptions used to derive the simplest form

of the gravity equation include identical homothetic Cobb-Douglas preferences in all countries (which give rise to identical expenditure functions), products are differentiated by place of origin as each country is completely specialized, and tariffs and transport costs are absent. By using a pure-expenditure system model, he found the following relationship: $X_{ij} = \beta o\ (Y_i)^{\beta 1}\ (Y_j)^{\beta 2}$. His argument was that each country spends the same portion of its income on country i's product (b_i). Thus, the imports of good i by country j is: $X_{ij} = b_i Y_j$. Country i's income equals to its sales: $Y_i = b_i \sum_j Y_j$. Thus, $X_{ij} = Y_i Y_j / \sum_j Y_j$.

More realistically, he introduced a non-traded good sector, and assumed that traded and non-traded goods are weakly separable in the utility function such that the share of total trade expenditure of traded goods, with homotheticity, depends on traded goods prices only. For the importing country j, let θ_i be the share of j's expenditure on country i's tradeable good divided by total expenditure in j on tradeables and ϕ_j be the share of expenditure on all tradeables in total expenditure of country j. Then, j's demand for i's tradeables is given by: $X_{ij} = \theta_i \phi_j Y_j$, with the trade balance equation: $\phi_i Y_i = \theta_i (\sum_j \phi_j Y_j)$. By imposing:

$$\phi_i = F_i(Y_i, N_i) = \alpha o\ (Y_i)^{\alpha 1}\ (N_i)^{\alpha 2} \ldots\ldots \text{(4a)}, \textit{ and}$$

$$\phi_j = F_i(Y_j, N_j) = \beta o\ (Y_j)^{\beta 1}\ (N_j)^{\beta 2} \ldots\ldots \text{(4b)},$$

the gravity model becomes:

$$X_{ij} = k_o\ (Y_i)^{\alpha 1}\ (N_i)^{\alpha 2}\ (Y_j)^{\beta 1}\ (N_j)^{\beta 2}\ u_{ij} \quad \ldots\ldots\ldots \textit{(5a), or in logarithmic form:}$$

$$ln(X_{ij}) = k_1 + \alpha_1 ln(Y_i) + \alpha_2 ln(N_i) + \beta_1 ln(Y_j) + \beta_2 ln(N_j) + ln(u_{ij}) \quad \ldots\ldots\ldots \textit{(5b).}$$

Distance can easily be added to reflect transport costs. Assume that with transport costs T_{ij}, the value of exports from i to j becomes $X_{ij}\ T_{ij}$ instead of X_{ij}, then j's demand for i's tradeables becomes $X_{ij}\ T_{ij} = T_{ij}\ \theta_i\ \phi_j\ Y_j$, then the trade balance equation becomes: $\phi_i\ Y_i / T_{ij} = \theta_i (\sum_j \phi_j\ Y_j / T_{ij})$. Using distance as a proxy for transport costs:

$$T_{ij} = k_2\ d_{ij}^{\delta o} \quad \ldots\ldots\ldots \textit{(6)},$$

the gravity model becomes just like the one proposed by Linnemann (1966):

$$X_{ij} = k_o\ (Y_i)^{\alpha 1}\ (N_i)^{\alpha 2}\ (Y_j)^{\beta 1}\ (N_j)^{\beta 2}\ (d_{ij})^{\delta 1}\ u_{ij} \quad \ldots\ldots\ldots \textit{(7a), or in logarithmic form:}$$

$$ln(X_{ij}) = k_1 + \alpha_1 ln(Y_i) + \alpha_2 ln(N_i) + \beta_1 ln(Y_j) + \beta_2 ln(N_j) + \delta_1 ln(d_{ij}) + ln(u_{ij}) \quad \ldots\ldots \textit{(7b).}$$

Noting that Y/N = y, where y is the real per capita income, the gravity model can be re-written as:

$$X_{ij} = \gamma_0 (Y_i)^{\gamma 1} (y_i)^{\gamma 2} (Y_j)^{\gamma 3} (y_j)^{\gamma 4} (d_{ij})^{\gamma 5} u_{ij} \quad \ldots\ldots\ldots \text{(7c), or in logarithmic form:}$$

$$ln(X_{ij}) = \gamma_{00} + \gamma_1 ln(Y_i) + \gamma_2 ln(y_i) + \gamma_3 ln(yY_j) + \gamma_4 ln(y_j) + \gamma_5 ln(d_{ij}) + ln(u_{ij}) \quad \ldots\ldots \text{(7d),}$$

This summarizes the work by Anderson. In fact, a slight variation of Anderson's derivation was used by Thursby and Thursby (1987) and Oguledo and MacPhee (1994) to incorporate price levels of i and j as well as tariff rates between i and j. These can be done through modifying conditions (4a), (4b) and (6) to:

$$\phi_i = F_i(Y_i, N_i, P_i) = \alpha o (Y_i)^{\alpha 1} (N_i)^{\alpha 2} (P_i)^{\alpha 3} \ldots\ldots\ldots \text{(8a),}$$

$$\phi_j = F_i(Y_j, N_j, P_j) = \beta o (Y_j)^{\beta 1} (N_j)^{\beta 2} (P_j)^{\beta 3} \ldots\ldots\ldots \text{(8b), and}$$

$$T_{ij} = k_2 d_{ij}^{\delta o} (1+t_{ij})^{\delta 2} \quad \ldots\ldots\ldots \text{(9), respectively,}$$

where P_i (P_j) is country i's (j's) general price level, and t_{ij} is the ad valorem tariff imposed by j on i's imports, and T_{ij} should now be interpreted as the trade barrier or trade cost function as it no longer just reflects the transportation cost associated with trade. The gravity models (7a) and (7b) then become:

$$X_{ij} = k_4 (Y_i)^{\alpha 1} (N_i)^{\alpha 2} (P_i)^{\alpha 3} (Y_j)^{\beta 1} (N_j)^{\beta 2} (P_j)^{\beta 3} (d_{ij})^{\delta 3} (1+t_{ij})^{\delta 4} u_{ij} \quad \ldots\ldots\ldots \text{(10a),}$$

or in logarithmic form:

$$ln(X_{ij}) = k_5 + \alpha_1 ln(Y_i) + \alpha_2 ln(N_i) + \alpha_3 ln(P_i) + \beta_1 ln(Y_j) + \beta_2 ln(N_j) + \beta_3 ln(P_j) + \delta_3 ln(d_{ij}) + \delta_4 ln(1+t_{ij}) + ln(u_{ij}) \quad \ldots\ldots\ldots \text{(10b).}$$

In fact, in many studies, the basic gravity model is augmented with many other variables of the researchers' interests with the technique employed to include the tariff rates into the model. As a prelude, this method would also be applied to the trade facilitation commitments variables in the empirical study section to be followed.

For completeness, two other derivations of the gravity model would be presented briefly. Bergstrand (1985) built the generalized gravity model using Linnemann's "four-equation partial equilibrium model of export supply and import demand" under perfect competition. With constant-elasticity-of-substitution utility function and constant-elasticity-of-substitution production using a single factor, utility maximizers generate the bilateral aggregate import demands and profit maximizers generate the bilateral aggregate export supplies. Equilibrium for each commodity is defined by the intersection of its supply and demand. This generates a system of equations to be solved. With the small open-economy assumption and the identical utility and production functions across

countries assumption, Bergstrand's gravity equation has i's and j's GDPs and GDP deflators, i's export unit value index, j's import unit value index, exchange rate, distance, adjacency dummy and two preferences dummies (as proxies for tariff rates) as regressors to explain trade flow from i to j. This model is complicated by the endogenous price levels and the interactions between various types of elasticity of substitution.

In 1989, Bergstrand advanced to building the "gravity-type" model using the same framework that he used in 1985, but under different assumptions about the utility function and the production technology. In his 1989 derivation, the utility function used was the Cobb-Douglas-constant-elasticity-of-substitution-Stone-Geary utility function, and the production technology required two inputs instead of one. Under this setting, his gravity equation has i's and j's GDPs, per capita GDPs, aggregate wholesale price indices, j's exchange rate index, distance, adjacency dummy and three preferences dummies (as proxies for tariff rates) as regressors to explain trade flow from i to j. Having seen the basis of the gravity model under different conditions, the next section will look at a number of applications of the model.

2.2.3 Applications of the Gravity Model

The establishment of trading blocs has occurred throughout all regions of the world since the 1950s. Simply stated, the broad mission of most of these blocs is to increase trade among the partner countries. Balassa (1967) was interested in the effect of the European Common Market on "gross trade creation"; that is, on the increase in trade experienced by all of its members as a whole. Gross trade creation has two components: "trade creation", which is "the emergence of new flows of trade among the partner countries replacing domestic production", and "trade diversion", which is "the replacement of non-partner imports (low-cost products) by partner country imports (more costly products)". He concluded that there was evidence of trade creation but no evidence of trade diversion in aggregate.

Aitken (1973) gave a more detailed and systematic look at the "gross trade creation" problem in the context of the establishment of the European Economic Community (EEC) and the declaration of the European Free Trade Agreement (EFTA).

These two trade arrangements were modelled as dummy variables in his paper, where he used the gravity model in two ways. First, by estimating the gravity model for each year in the period of 1951 to 1967, the significance of the dummy variables was traced out. He found that 1959 and 1960 were the first year when the EEC and EFTA variables gained significance, respectively. Therefore, the "pre-integration period" was defined to be 1951 to 1958, and the "post-integration period" was defined to be 1959 to 1967. Next, based on the magnitude of the above dummy variables in the gravity model for each year, the size of gross trade creation could be found. However, there is a concern about interpreting this as growth because it is unreasonable to expect no growth in trade in the absence of the integration. Aitken tackled this problem by making a projection of trade flows under the scenario that no economic integration took place. Since 1958 was identified as the final year of no integration effect, the gravity model without the union dummy term was estimated using 1958 data. This model was then used to project the level of trade that was expected to prevail in the absence of trade integration in each subsequent year. The projected growth given by this model was compared against the estimated growth from above. He reported that the gross trade creation increased continuously since 1959, and the effect of the EEC on trade creation was substantially larger than that of the EFTA. However, this latter finding was only true for the aggregate, when countries were considered separately, the results diverged.

In 1976, Aitken revisited the gross trade creation topic, this time he examined the economic integration of certain African and European countries using the gravity model again. Due to many inherited differences between African countries and European countries, their trade flows were modelled separately. Both models used GDPs, distance and trade preferential dummies to form the gravity model; however, for the Europe-to-Africa flow model, there was an extra term, aid, which captured support provided by European countries to African countries. He found positive significance in both cases regarding the trade integration effects. Nevertheless, the aid from Europe was not significant, yet it is important to keep this term in the model because its absence from the model would create bias in the integration effect estimations in an upward manner.

Pelzman (1977) studied yet another economic integration event. The Council of Mutual Economic Assistance (CMEA), an organization that pulled together East

European countries, implemented a major reform between the period of 1954 and 1970. His research question is the same as that of Aitken's 1973 study, so he used the same framework to identify the first year when integration effect occurred and the same projection model method to isolate the share of bilateral trade growth attributed to "normal" economic growth. The additions provided by Pelzman were his analyses on disaggregated commodity trade flows. Similar to Aitken's, the pooled estimations showed strong effects for each variable, while the disaggregated estimations did not follow any specific pattern.

The impact of preferential trade agreements was one of the hottest topics and was examined extensively using the gravity model in the 1970s. Entering the 1980s, more attention was put on searching for a theoretical foundation for the gravity model as summarized in the previous subsection. In the era of 1990s, focus shifted to studying the impeding effect of national border on trade. One of the pioneers in this study is McCallum. His 1995 paper discussed how the Canada-U.S. border can shape trade patterns of the two countries. These two countries provide a good ground for studying trade because of their similarities in many aspects. Their history, culture, institution, language and geographical location with respect to other economies in the world are very similar.

His study departs from other international trade studies because not only did he consider trade between Canada and the U.S., he also looked at trade within each country. Using provincial-level and state-level data, he used the standard gravity model as in Equation (1) and added a dummy variable to indicate whether trade is within Canada or between the U.S. and Canada. His key result was that *ceteris paribus* inter-provincial trade is 22 times larger than cross-border trade with the U.S., and this result is statistically and economically significant. However, for the coastal provinces this factor is much lower, at around 6 to 8 times only. In addition, he attempted to incorporate comparative advantage or endowment factors into his analysis by adding into his model variables related to the share of primary-sector production and the share of manufacturing sector. His results correspond to the belief that trade is larger between economies when there are more structural differences in their production. He also found that distance as a proxy for transport cost has an estimated effect higher than that found in other international trade

studies. He explained that this could be due to differences in the mode of transportation between North America and the rest of the world, with the former using the more expensive land and air transport for within region trade and the latter using the cheaper water transport predominantly.

Anderson and Wincoop (2003) revisited McCallum's research question and innovatively added an extra factor which they called the "multilateral resistance", which refers to the average trade barrier facing an individual country as whole. They asserted that "the more resistant to trade with all others a region is, the more it is pushed to trade with a given bilateral partner." This moves the analysis of international trade beyond just considering the bilateral distance and tariff barriers. In fact, this multilateral resistance term captures the belief Beckerman had in 1956 that multilateral standing is as important as bilateral relationship in shaping trade pattern (see section 1.2.1. – History of the Gravity Model). After including the multilateral resistance term, they found the ratio of inter-provincial trade to province-to-state trade is only 10.5 as supposed to 16.5, which was obtained by applying McCallum's methodology. For the U.S. data, the ratio of inter-state trade to state-to-province trade is equal to 1.6 using McCallum's methodology and 2.6 with the multilateral resistance term. These results can be explained by the relative small size of the Canadian economy and the dominating role of the U.S. in the world's economy. For Canada, due to the existence of trade barrier to trading with other economies, it would be relatively cheaper for Canada to trade with the U.S.; therefore, Canada would trade more with the U.S. in this more complex world. However, for the U.S., the multilateral trade barrier would enhance inter-state trade because it has the self-sufficient capability. This exercise points to the necessity of acknowledging the presence of other trading partners when estimating the effect of a national border on trade flows. For a small open economy, failure to take this fact into account is very likely to overestimate the resistance of border to trade.

The last set of applications of the gravity model to be discussed is on assessing the effect of trade facilitation on trade; this is highly relevant to the empirical section of this paper, which is also aiming at estimating the trade facilitation effects on trade. For now, a review of the previous works in this area will be provided; compare and contrast will be covered in the empirics section. As mentioned before, trade facilitation is a fairly

new concept in the sense that it was recognized as a separate entity by multilateral organizations only in 1996. Therefore, empirical studies on it are very limited and are mostly undertaken by international organizations. Both of the two research papers cited below are by Wilson, Mann and Otsuki (2003, 2005).

The paper published in 2003 focuses on bilateral trade in the Asia-Pacific region between 1989 and 2000. Since there does not exist direct measure of trade facilitation on its own, the authors created 4 indices for each Asia-Pacific countries as of 1999 or 2000 using various survey data to capture the 4 major aspects of trade facilitation of the 21 Asia-Pacific Economic Cooperation (APEC) countries. The 4 indices are at-the-border elements: customs environment (CE) and port efficiency (PE), and the behind-the-border elements: regulatory environment (RE) and e-business usage (EB). Customs environment measures direct customs costs and administrative transparency of customs and border crossings. Port efficiency measures the quality of water ports and air ports infrastructure. Regulatory environment measures the transparency of government policy and approach to regulations. E-business usage measures the quality of the networking and communication infrastructure. These indicators were constructed using cross-country survey data on business and policy climate. Information was taken from the Global Competitiveness Report, 2000, the World Competitiveness Yearbook, 2000 and the Maritime Transport Costs and Port Efficiency. The advantage of using such indices is that it forms a basis for cross-country comparison of each measure. The relative rankings tell which countries and areas need more resources and how resources can be allocated to arrive to the most efficient outcome. Their study is a cross-sectional one because the invariant trade facilitation measures do not allow for panel analysis. Their customized gravity equation takes the following form:

$$\begin{aligned} ln(X_{ij}^t) = {} & \alpha_1 ln(Y_i^t) + \alpha_2 ln(y_i^t) + \alpha_3 ln(Y_j^t) + \alpha_4 ln(y_j^t) + \alpha_5 ln(1+t_{ij}^t) + \alpha_6 ln(d_{ij}) \\ & + \beta_1 ln(PE_j) + \beta_2 ln(CE_j) + \beta_3 ln(RE_j) + \beta_4 ln(EB_j) \\ & + \gamma_1 D_{NAFTA} + \gamma_2 D_{ASEAN} + \gamma_3 D_{LAIA} \\ & + \gamma_4 D_{ENG} + \gamma_5 D_{CHN} + \gamma_6 D_{SPN} + \gamma_7 D_{ADJ} + e_{ij}^t \quad \ldots\ldots\ldots (11), \end{aligned}$$

where i denotes exporter, j denotes importer, t denotes year, α's, β's and γ's are coefficients, X_{ij} is the value of export from i to j, Y is GNP, y is per capita GNP, t_{ij} is the tariff rate imposed by j on i, d is distance, and PE, CE, RE and EB are the four indicators

introduced above. Several dummy variables are also included for the recipients. D_{NAFTA}, D_{ASEAN} and D_{LAIA} are 3 dummy variables for trade preferences. D_{ENG}, D_{CHN} and D_{SPN} are 3 dummy variables for the English, Chinese and Spanish languages respectively. D_{ADJ} is the adjacency dummy. Finally, e is the disturbance term defined to be: $e_{ij}^{t} = Ex + Yr + \varepsilon_{ij}^{t}$, where Ex is the fixed effect for exporter, Yr is the fixed effect for time and ε_{ij}^{t}, is assumed to follow a normal distribution with zero mean.

The coefficients β's measure how elastic trade from i to j is with respect to each trade facilitation indicator. Their results are consistent with the expected results. PE, CE and EB are all significant and positive, while RE is significant in a negative manner. Based on the magnitudes of the β's, a 1% increase in the port efficiency index would give rise to the largest improvement in trade than the improvement from the same increase in other indices. Relaxing regulations gives the second largest improvement, followed by increasing E-business usage and then lastly by improving customs environment. However, one problem with the indicators is that they are time-invariant in the model. Their values reflect 1999 or 2000 trade facilitation status, but one would expect advancement in the course of the 11 years under study. Additionally, as the authors pointed out, it is not adequate to just look at the increase in trade flow because there are costs associated with the implementation of trade facilitation procedures. Improving facilities at ports can be very costly, while making changes to customs procedures may be more affordable. Therefore, it may be harder to create an increase in the port efficiency index, but the opposite may be true for the customs environment index. Moreover, it is important to include any indirect gains as well because an improved trade environment in one country benefits all the countries that trade with this country. To conclude, the cost-and-benefit approach should be employed to design a trade facilitation strategy that is the most efficient; that is, one that will create the largest net gain. Nevertheless, this model provides some insights about what the benefits could be and allows for comparisons between trade facilitation measures and other trade policy measures such as tariffs. It is postulated that a country can unilaterally improve its trade capacity to mitigate the effect of tariffs imposed by other countries, which can potentially be hard to eliminate without engaging in costly lobbying.

The second research paper on trade facilitation in 2005 by these same authors used the same framework to extend their analysis to global trade between 75 countries. Since more countries are involved, there are more limitations to acquiring the necessary data. They relied on a smaller set of survey data to create their trade facilitation indicators and only analyzed 2000 and 2001 trade flows. Another major difference from the previous study is the authors looked into both importers' and exporters' indices; that is, in this more recent paper, exporter's port efficiency, regulatory environment and service sector infrastructure (formerly termed as e-business usage) indices are also included in the gravity equation, while the exporter fixed effect is eliminated. More trade preferential arrangements and language dummies are included as the focus moved from APEC countries to countries worldwide.

Their results for the indicators all have the expected signs and are generally significant. Trade flow is the most elastic with respect to the service sector infrastructure indicator; a 1% increase in this index of the exporter is associated with a 2% increase in its export. This could be a very good news because this area is perhaps the least complicated to improve in the sense that it does not require government intervention or change in legislation. They also found that exporters' indices play a more important role (that is more significant economically) than importers' indices. They explained that this is related to having more developing countries (South) than developed countries (North) in their set, and that the pattern of trade is mainly South-to-North. To further their analysis on this point, they performed separate regressions for South-to-North trade (exports from South to North) and South-to-South trade (exports between South countries). In the South-to-North case, the only importers' indicator that is significant at the 5% level is the service sector infrastructure indicator. The tariffs imposed on the exporting countries are not significant. That means tariff is not a significant barrier to trade in the South-to-North direction. Last but not least, the importance of exporters' indicators generally increased compared to the pooled regression. However, the story is quite different for the South-to-South trade, where tariffs can effectively deter exports from other developing countries, and the regulatory environment of the importing countries can also significantly change the pattern of trade. One thing in common with

the South-to-North trade is that the influences of exporters' indices are still strong than importers' indices.

Another innovation of this 2005 paper is the inclusion of the interaction effects between the port efficiency indicators and countries' geographical characteristics, such as being adjacent, landlocked, or an island. This inclusion is motivated by the difference in their accessibility. One problem with their approach is that they did not have a strong theory on what the expected results should be for the various interaction terms, so their results may be contrary to general believes and hard to interpret. Nonetheless, the interaction effects are something that is worth thinking about in future research.

3. Data and Exploratory Analysis

The innovation of this paper is the use of the Trade Capacity Building - Trade Facilitation data set. This survey-based data set is available at the WTO/OECD Trade Capacity Building Database Category 33121. This is a very new database, which has been maintained since November 2002. This database is constructed based on the trade facilitation definition given earlier in the introductory section. That is, any "simplification and harmonization of international trade procedures related to the movement of goods across borders" can be classified as a trade facilitating activity. This database contains all commitments to trade facilitation from both bilateral and multilateral sources to recipients between 2001 and 2003 and partial commitments in 2004. Some donors have not completely reported their 2004 trade facilitation projects to the OECD/WTO as of October 2005. Bilateral donors include Australia, Austria, Canada, Finland, France, Germany, Italy, Japan, Korea, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom (UK) and the United States (US). The major multilateral donors include the European Commission (EC), Asian Development Bank (AsDB), International Development Association (IDA), International Monetary Fund (IMF), World Trade Organization (WTO) and World Customs Organization (WCO). There are 168 recipients; most recipients are underdeveloped or developing countries.

Each record has the following fields: reporter name, donor name, implementing country, recipient name, year of commitment, start date and end date of the project, value

of commitment in US dollars (USD) in thousands, type of flow, project title and project description. Reporter is the country or organization reporting the project. Donor name is the provider of the fund of the project. Implementing country is the country that actually provides physical assistance or hosts the trade facilitation activity. This field is particularly relevant when the donor is a multilateral agency or finances its own trade facilitation project; that is, the donor is also the recipient. Recipient name is the country benefitting from the project. Some of the funds have not been allocated to any particular country; these will show up in this recipient field as unallocated or unspecified. Year of commitment refers to the year in which funds were allocated. Start date and end date tell the duration of the project. Value of commitment in USD is how much money is put into the trade facilitation project. Type of flows tells how a project is funded. There are three types of flows: grants, loans and self-financed. Based on the project titles and project descriptions, some projects have multiple recipients. This is particularly true for seminars and training sessions.

In total there are 1644 records, 730 records are financed through grant by bilateral donors; 688 records are financed through grant by multilateral donors; 56 records are loan and self-financed projects. The remaining 170 records have not been allocated to any particular recipients. Of all the trade facilitation commitments allocated to a known recipient from 2001 to 2004 (720.1 million USD), 54.5% came from multilateral donors (393.1 million USD). Table 1 and Figure 1 in the Appendix show these results. The commitments to trade facilitation increased significantly during the four-year period. There was a close to 200% (from 104 million USD to 309 million USD) increase in international commitments between 2001 and 2003. This trend continues to year 2004; with only partial data available as of October 2005, total commitments to trade facilitation in 2004 sum to 343 million USD, which is over the total in 2003. Table 2 and Figure 2 illustrate these results. The next two tables, Table 3 and Table 4 break down trade facilitation commitments by income group and region. These classifications into income and region are the OECD/WTO classifications. This breakdown is partly interesting because one would expect the less wealthy parts of the world to receive more assistance. However, this does not seem to be the case; the lower middle income countries (LMICs) and the Central and Eastern European Countries and the Newly

Independent States of the Former Soviet Union (CEEC/NIS) received the majority of the funding. Table 3 computes the average value of project for each income group. The average value is close to 1 million USD in the CEEC/NIS, while it is only 0.37 million USD in the LDCs. On average, a country belonging to the CEEC/NIS income group receives 11.6 million USD in trade facilitation, while a country in the LDCs classification only gets allocated 2.4 million USD. Figure 3 shows the trends in different regions. It seems that the LDCs and LICs began to catch up with the other income groups starting 2003. Table 4 computes similar figures for regions. Europe stands out as having the highest average value of projects of approximately 2 million USD per project, as well as having the highest average trade facilitation commitments per country (24 million USD). North Africa, which has four LMICs and one high income country (HIC), is ranked second in both categories. Thus, both results suggest that trade facilitation procedures are not necessarily focused on the LDCs and LICs. However, it is hard to judge whether it is equitable to provide more funds to the LMICs than the LDCs and LICs because the LDCs and LICs may enjoy a higher marginal benefit than the LMICs for the same amount of funding. This may be analogous to the Solow Growth Model, which says growth during a period when the economy is not very developed is faster than during a period when the economy is well-developed. As a country is already engaging at a high level of trade, relatively more trade facilitation effort must be made in order to create more trade. On the contrary, relatively less effort may be needed to motivate more trade for countries that were not trading a lot previously.

Table 5 and Figure 4 show the distribution of funds in each year. Each year most recipients received 5000 USD to 20000 USD of trade facilitation funding. That means most of the trade facilitation projects were small in scale. There seemed to be more large-scale projects in 2003 and 2004 than in 2001 and 2002; the number of recipients receiving above 5 million USD in 2003 and 2004 more than doubled that in 2001 and 2002. Going from 2001 to 2002, there was a large increase in the number of recipients; the number of beneficiary countries jumped from 88 to 157. This reflects the increasing importance of trade facilitation. Having only partial 2004 data is likely to be the reason for the drop in the number of recipients in 2004.

On the donor side, it is interesting to look at whether donors have regional focus when making trade facilitation commitments. It is not unreasonable to expect a bilateral donor to focus on helping countries that are geographically close because trade facilitation procedures are assumed to benefit donors indirectly as well, and such benefits may be more readily realized if there is less distance barrier. On the other hand, for multilateral donors, their objectives may be different from that of bilateral donors. Multilateral organizations may have a more thorough understanding of "which country is lacking what", and thus can prioritize and balance these needs more efficiently. Table 6 and Figure 5 show which regions received assistance from a few major bilateral donors, namely Australia, Japan, France, Canada and the US. Canada, Japan and Australia seem to agree with the above hypothesis on regional concentration. More than half of Canada's commitments went to South America. Asia as a whole consumed more than 80% of Japan's commitments. Australia only assisted three regions – Far East Asia, North and Central America and Oceania. Note also that over 80% of Oceania funding came from Australia. The US being the largest bilateral donor had quite a diverse portfolio, except it did not make commitments to Oceania. For the main multilateral donors on the other hand, the EC and WCO behaved like bilateral donors. Table 7 and Figure 6 illustrate how the main multilateral donors allocated their funds. It is not surprising that 70% of EC's resources (310 million USD) went to European countries and CEEC/NIS; this can explain the results seen in Table 3 and Table 4. However, the focus on South Saharan African countries by the WCO is phenomenal. This regional focus of the WCO suggests that customs environment may have significantly improved in South Saharan African countries. The WTO had a diverse portfolio like the US; however, more weights (approximately 40%) are put on South Saharan African countries.

After a brief examination of the trade facilitation data, I now return to my research question: Is trade facilitation the right direction to go in building trade capacity? Would trade volume between each pair of donor and recipient - in particular exports from recipient to donor - increase with trade facilitation commitments? This data set on trade facilitation maintained by the OECD/WTO fits my topic perfectly because it identifies donor, recipient and value commitment to trade facilitation. The amounts committed to trade facilitation can be viewed as improvements in trading environment. In WMO 2003

and 2005, they used trade facilitation indices to estimate the effect of trade facilitation on trade flows. The weakness of their methodology is that there were no variations in their trade facilitation indices over time. Any change in trade flows between a particular pair of countries cannot be attributed to different levels of trade facilitation indices because these indices are the same over time in their framework. Unlike WMO, this paper utilizes the panel feature of the trade facilitation data set to generate variation in trade facilitation level. For each donor-recipient pair, I construct for each year how many funds were provided from this donor to this recipient (TF Bi D-to-R), how many funds were provided from other bilateral donors to this recipient (TF Other Bi), how many funds were provided from various multilateral donors - EC, the United Nations, WCO, WTO and others, and how many commitments were made through loans or self-financed. A positive commitment would be interpreted as an improvement in trade facilitation.

To use the gravity model, data on bilateral trade flows, GDP, per capita GDP, tariff rates and distance are needed from 2000 to 2004. The data on bilateral trade flows are gathered from the United Nations Statistics Division – Commodity and Trade Database (COMTRADE), volumes are in million nominal USD. Data on GDP and per capita GDP come from the International Monetary Fund (IMF). The IMF database has nominal, real and purchasing-power-parity adjusted GDP (PPP GDP) and per capita GDP. Real values refer to 1990 USD. GDP deflator and purchasing-power-parity US dollar exchange rate are also available from the IMF database. The use of real GDP and PPP GDP eliminates the effect of inflation on trade volume and takes into account differences in general price level in different countries. Tariff rates are from the World Bank division of the United Nations Conference on Trade and Development (UNCTAD) under the World Development Indicator category. Tariff rates for 2004 are not available yet. It will be assumed that there was no change in tariff rates between 2003 and 2004. Tariff rates for some years were also missing for some countries; the tariff rates for the missing years will be assumed to be the same as in the previous year. For some countries, tariff rates were completely missing for all years. In this case, the regional average tariff will be used. For instance, if country A exports to country B, but the tariff rate imposed on A by B is not known; if country A is in region C, the tariff rate imposed on country A will be taken to be the average tariff rate imposed on all other countries in region C. Distance

between each donor-recipient pair calculated using the "great circle distance between capital cities" method come from two sources http://www.macalester.edu/research/economics/page/haveman/trade.Resources/Data/ Gravity/dist.txt and www.indo.com/distance. Besides the above variables, trading blocs or trade preferential arrangements and language are often put into the gravity model as well; therefore, I will also investigate the most commonly included trading blocs and languages. The Asia-Pacific Economic Cooperation (APEC), Latin American Integration Association (LAIA), League of Arab States (LAS) and European Union (EU) will be considered. The Central Intelligence Agency (CIA) World FactBook provides the list of members of each of these groups at http://www.cia.gov/cia/publications/factbook/index.html. From the same source, which country uses English, French, Spanish and Arabic as their primary language can also be identified .

Due to data unavailability and some recipients did not receive funding from bilateral donors, the number of recipients included in the study is 128 and the number of bilateral donors included in the study is 14. In total there are 257 donor-recipient pairs in the analysis. Provided each pair has data for 5 years, from 2000 to 2004, there are 1285 records in total. Details on how the trade facilitation commitments and all other variable are incorporated into the regression framework are provided in the next sections on empirical strategies and empirical results.

4. Empirical Strategies

My specification of the gravity model to study the effect of trade facilitation on bilateral trade is built on Linnemann's model (1966) (Equation 7c):

$$X_{ij} = \gamma_0 (Y_i)^{\gamma 1} (y_i)^{\gamma 2} (Y_j)^{\gamma 3} (y_j)^{\gamma 4} (d_{ij})^{\delta 5} u_{ij.}$$

However, the trade barrier function - Equation (9) - would not only depend on distance, but also on tariff and the trade facilitation supports provided by the trading partner and other bilateral and multilateral sources. If, for two trading partners i and j, country j is a donor country and country i is a recipient country of trade facilitation commitments, then Equation (9) becomes:

$$T_{ij} = G_{ij}(d_{ij}, t_{ij}, TF\$_{ij}, TF\$B_i, TF\$M_i)$$
$$= a_0 (d_{ij})^{a0} (1+t_{ij})^{a1} (TF\$_{ij})^{a3} (TF\$B_i)^{a4} (TF\$M_i)^{a5} \ldots\ldots\ldots (12).$$

Contrary to distance and tariff, which is positively related to the trade barrier function, trade facilitation commitments - $TF\$_{ij}$, $TF\$B_i$ and $TF\$M_i$ - should be negatively related to the trade barrier function because the purpose of these commitments is to facilitate trade, which can be thought of as to reduce trade barrier. Thus, coefficients a3 to a5 should be negative. This modification (12) gives rise to the following "gravity-type" equation used in this paper:

$$X_{ij}^t=\alpha_0^t(Y_i^t)^{\alpha 1}(Y_j^t)^{\alpha 2}(y_i^t)^{\alpha 3}(y_j^t)^{\alpha 4}(TF\$_{ij}^t)^{\beta 1}(TF\$B_i^t)^{\beta 2}(TF\$M_i^t)^{\beta 3}(d_{ij})^{\delta 1}(1+t_{ij}^t)^{\delta 2}u_{ij}^t \quad \text{(13a)},$$

or in logarithmic form:

$$\begin{aligned} ln(X_{ij}^t) =& \alpha_{00}{}^t+\alpha_1 ln(Y_i^t)+\alpha_2 ln(Y_j^t)+ \alpha_3 ln(y_i^t)+\alpha_4 ln(y_j^t) \\ &+\beta_1 ln(TF\$_{ij}^t)+ \beta_2 ln(TF\$B_i^t) + \beta_3 ln(TF\$M_i^t) \\ &+\delta_1 ln(d_{ij}) +\delta_2 ln(1+t_{ij}^t)+ln(u_{ij}^t) \quad \text{(13b)}. \end{aligned}$$

where t denotes year, the constant term is allowed to vary for different years to capture aggregate economic shock for a given year; that is, time is treated as a fixed effect; X_{ij} is the value of the flow from country i (recipient) to country j (donor); Y_i (Y_j) is the GDP in i (j), y_i (y_j) is the per capita GDP in i (j); $TF\$_{ij}$, $TF\$B_i$ and $TF\$M_i$ are the trade facilitation commitments received by i from j, the trade facilitation commitments to i from other bilateral sources and the trade facilitation commitments to i from multilateral sources, respectively; d_{ij} is the distance between i and j; t_{ij} is the ad valorem tariff imposed by j on i's exports; u_{ij}, the disturbance term, is assumed to be log-normally distributed ($\ln u_{ij}^t \sim N(0, \sigma_u)$). This equation estimates the behaviour of i's (recipient) exports to j (donor). Changing X_{ij} to X_{ji} (i's imports from j) and t_{ij} to t_{ji} (ad valorem tariff imposed by i on imports from j) of Equation (13) gives the behaviour of i's imports from j. However, this direction of flows would not be considered in this paper because the concern is on the exports of the recipient countries.

The focus of this study is on the β coefficients, which try to estimate the effect of trade facilitation commitments on trade flows. It is postulated that the β's should be positive because the introduction or reform of trade facilitation procedures is to enhance trade. This also follows directly from the fact that trade facilitation commitments are inversely related to the trade barrier function and the trade barrier function is also inversely related to trade flows. The other variables in Equation (13) capture other influences on trade flows. By Anderson's derivation of the gravity equation, the GDP

terms represent the demand and supply of tradeables. The larger the GDP of the exporter is, the larger the supply of tradeable goods. This is intuitive because a large economy is associated with high production capability, which in turns increases export capability. The larger the GDP of the importing country is, the larger the demand for tradeable good. Therefore, the level of trade should be increasing in both GDPs; that means both α_1 and α_2 are expected to have a positive sign. For the per capita GDP terms, they are often used as indicator of the level of development of the two economies. Some researchers use per capita GDPs as a proxy for productivity (Anderson and Van Wincoop 2003). When a country is more developed, it becomes more specialized and thus more productive. This links highly specialized and high per capita income together. With higher production of fewer goods, such country would need to purchase from foreign countries items that it does not produce enough for domestic consumption. Therefore, per capita GDP should be positively related to trade flows (Frankel and Wei 1995 and Cyrus 2002). This suggests both α_3 and α_4 are anticipated to have a positive sign. For the distance (d_{ij}) and tariff (t_{ij}) variables, their coefficients δ_1 and δ_2 should unambiguously be negative because they impede trade by creating more costs. This completes the augmentation of the basic gravity model with the trade facilitation commitments.

In today's literature, most uses of the gravity model would also include dummy variables for trade preferential arrangements and primary language variables. These variables acknowledge the qualitative aspects of trading partners. In earlier empirical works, researchers either only included trading blocs or tariff rates to capture trade preferences. However, there exists studies that show both tariffs and trading blocs are significantly related to bilateral trade flows (Oguledo and MacPhee 1994). Since trade preferential arrangements may be correlated with tariff rates, they must both be taken into account in the estimation to create unbiased results. For the language spoken variables, they can be related to trade volume because communication is an important aspect for trade to take place. Intuitively, if a country operates using a language that is universally recognized such as English, then there will be less of a barrier to trade. Language variables can also be used as proxies for culture background and colonial ties. For instance, French is the official language of the African countries that were once the

French colonies. With these extensions, the new specification of my gravity model in logarithmic form is:

$$\begin{aligned} ln(X_{ij}^t) = {} & \alpha_{00}{}^t + \alpha_1 ln(Y_i^t) + \alpha_2 ln(Y_j^t) + \alpha_3 ln(y_i^t) + \alpha_4 ln(y_j^t) \\ & + \beta_1 ln(TF\$_{ij}^t) + \beta_2 ln(TF\$B_i^t) + \beta_3 ln(TF\$M_i^t) \\ & + \gamma_1 D_{APEC} + \gamma_2 D_{LAIA} + \gamma_3 D_{LAS} + \gamma_5 D_{EU} \\ & + \gamma_6 D_{English} + \gamma_7 D_{French} + \gamma_8 D_{Spanish} + \gamma_9 D_{Arabic} \\ & + \delta_1 ln(d_{ij}) + \delta_2 ln(1+t_{ij}^t) + ln(u_{ij}^t) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (14). \end{aligned}$$

This equation pools data for four years since 2001, the year when trade facilitation efforts were first made, to do a cross-sectional estimation. The resulting estimations would tell how each variable is correlated with bilateral trade flow between a donor and a recipient of trade facilitation commitments. Focus will be put on the exports from the recipient to the donor because one of the broader goals of facilitating trade is to help the recipients to climb up the income ladder by expanding their trade capacity. If recipients can sell their products abroad more after the improvement in trade facilitation, we are one step closer to this goal.

Usually a cross-sectional analysis can provide insights about association between variables. It is possible that the association is capturing the natural trends of the dependent and the independent variables. This motivates the use of the first-differenced estimation method, which helps to detrend the data. This methodology requires data for more than one period because it looks at changes. In the trade facilitation context, the first-differenced estimator would test whether changes in bilateral trade flows can be explained by changes or additions in trade facilitation commitments. Taking the difference of Equation (14) for two different periods, t and t-1, would give the first-differenced equation:

$$\begin{aligned} \triangle_t ln(X_{ij}) = {} & \triangle_t \alpha_{00} + \alpha_1 \triangle_t ln(Y_i) + \alpha_2 \triangle_t ln(Y_j) + \alpha_3 \triangle_t ln(y_i) + \alpha_4 \triangle_t ln(y_j) \\ & + \beta_1 \triangle_t ln(TF\$_{ij}) + \beta_2 \triangle_t ln(TF\$B_i) + \beta_3 \triangle_t ln(TF\$M_i) \\ & + \delta_2 \triangle_t ln(1+t_{ij}) + \triangle_t ln(u_{ij}) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (15), \end{aligned}$$

where $\triangle_t$ is the change between period t-1 and t, for t=2001,2002,2003,2004. Note that the time invariant terms such as trading blocs, languages and distance drop out of the first-differenced equation. This equation allows for fluctuations in year-to-year macroeconomic shocks, national output, per capita income and trade facilitation

commitments from all sources. The results of this estimation equation should provide some hints to the central question of this paper. If changes in bilateral trade flows and changes in trade facilitation commitments are positively related, then it can be said with more confidence that there is evidence that improvement in trade facilitation creates more trade between donor and recipient, and thus trade facilitation efforts do help to build trade capacity in the recipient countries.

The last estimation to be performed in this paper is motivated by the possibility of lagged response of bilateral trade to trade facilitation commitments. Changes can take time to implement sometimes; therefore, commitments made in a particular year may not take effects immediately, it may require a few years for the full effects to be realized. To acknowledge this possibility, the first-differenced equation introduced above would be used, but $\triangle_t$ would be replaced by $\triangle_{2004\text{-}2000}$ (abbreviated as $\triangle_{t5}$); that is, the first difference is calculated for a longer period of time, with 2000 being the starting point – the pre-trade-facilitation time point, and 2004 being the ending point – the post-trade-facilitation time point.

$$\triangle_{t5} ln(X_{ij}) = \triangle_{t5} \alpha_{00} + \alpha_1 \triangle_{t5} ln(Y_i) + \alpha_2 \triangle_{t5} ln(Y_j) + \alpha_3 \triangle_{t5} ln(y_i) + \alpha_4 \triangle_{t5} ln(y_j)$$
$$+ \beta_1 \triangle_{t5} ln(TF\$_{ij}) + \beta_2 \triangle_{t5} ln(TF\$B_i) + \beta_3 \triangle_{t5} ln(TF\$M_i)$$
$$+ \delta_2 \triangle_{t5} ln(1+t_{ij}) + \triangle_{t5} ln(u_{ij}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (16),$$

In this case, commitments to trade facilitation in all years are considered jointly. This methodology will be referred to as the five-year-period first-differenced estimation equation henceforth. Estimation results of all three strategies will be presented next.

5. Empirical Results

5.1 Cross-Sectional Regression

This sub-section reports the results for the cross-sectional regressions of Equation (14) outlined in the Empirical Strategies section using the Ordinary Least Squares method (OLS). The data used here are real variables and have been adjusted for purchasing-power-parity. I will begin estimating the earliest form of the gravity equation used by

Tinbergen, to check if my data set can produce similar results. That is, the first estimation will only use national income and distance as regressors. Then, the basic model will be augmented by including the per capita income, tariff, trading blocs and languages. Table 8 shows the results of each of these estimations. The last set of estimations in this sub-section is the key estimation and it is shown in Table 9; it will include all the trade facilitation variables into the gravity model.

The second column of Table 8 confirms that the gravity model fits my bilateral trade data set well; the portion of variation in bilateral trade that can be explained by income and distance is 67%. Economic conditions in 2004 seemed to be significantly better than 2000. Exports from recipients to donors were 65% (exp(0.507)=1.65) more in 2004 compared to 2000. Similar to other trade studies, there is evidence that higher incomes are associated with higher level of trade, and distance also significantly reduces trade volume. Recipient's exports are found to be elastic with respect to the recipient's GDP; this result is also consistent with other studies. This exercise is mainly used as a check for the suitability of applying the gravity model to my particular sample of trading partners (donor-recipient pairs). The results support such application.

The fourth column of Table 8 shows the most commonly used gravity model in the literature. It incorporates the per capita income, tariff, trade preferential arrangements and language variables. The adjusted R^2 remains high at 0.73, meaning that these newly added variables are useful. Income and distance are still significant with the expected signs. The income level of the recipient has a positive and statistically significant effect on trade; a 10% increase in recipient's per capita GDP is associated with a 3% increase in its exports. However, the donors' per capita GDP does not have much impact on how much the recipients export to them. This could be explained by the fact that all these donors are wealthy developed countries, the variation in income level is trivial. Tariff on recipients' exports affects trade negatively but not in a significant manner. This corresponds to what WMO reported in their 2005 trade facilitation paper, where they found that South-to-North trade is not significantly affected by tariff. Next, recipient countries that use English or Spanish tend to trade significantly more, but recipient countries that use French or Arabic tend to trade significantly less, than countries that use other languages. This also agrees with WMO findings. Lastly, for the trading blocs,

countries belonging to the Asia-Pacific Economic Cooperation (APEC) and League of Arab States (LAS) groups trade significantly (about 3.7 times) more than countries not belonging to these groups. The result for APEC may be explained by the rapid growth in the Asian economy, but the reason for the LAS result is less clear.

The first set of estimations in Table 9a shows the effects of the nine trade facilitation commitment variables. The donor-to-recipient commitment (TF Bi D-to-R) is marginally insignificant at the 5% level. A 10% increase in the trade facilitation commitment from a donor to a recipient would increase exports from this recipient to this donor by 0.2%. For other bilateral sources (TF Other Bi), the effect on the trade between any given pair of trading partner is significant. A 10% increase in other bilateral trade facilitation commitments would increase trade by 0.3%. For the multilateral commitments, sources are divided into the European Commission (TF EC), United Nations Development Account (TF UN), World Customs Organization (TF WCO) and World Trade Organization (TF WTO) and other multilateral sources (TF Other Multi). This classification is based upon two criteria. First is their importance in terms of amount of commitments and second is their relevance to trade issues. The EC and UN satisfy the first criterion, and the WCO and WTO satisfy the second. It shows that multilateral sources are related negatively to exports from recipients to donors, and these negative relationships are significant except for WCO. This might be a good example of a regression showing association rather than effect. It seems more reasonable to interpret the negative signs for the multilateral commitments as "more multilateral commitments are spent on relatively low-trade-exposure countries" than as "the more multilateral commitments are made, the less trade there will be from recipients to donors". The different results found for the two types of donors may not be as surprising as it seems because the goals of multilateral agencies may be different from the goals of bilateral donors, with the former trying to promote equity around the world and the lateral focusing more on their own national interests. Lastly, the loan and the self-financed commitments are both insignificant. The adjusted R^2 for this model is 0.74, and the estimates of the other variables are robust to the addition of the trade facilitation variables. Note that, this regression is run for year 2001 to 2004 because trade facilitation commitments only started in 2001.

Column five of Table 9a aggregates all the bilateral trade facilitation commitments into a single variable to show the total bilateral effect (TF All Bi). This new variable has a positive and significant effect on trade. The estimate shows that a 10% increase in bilateral commitments as a whole is associated with a 0.4% increase in recipient-to-donor trade. The estimates of the other variables virtually do not change under this modification. Table 9b is a continuation of Table 9a. The first set of regression in Table 9b is a duplication of column two and three of Table 9a for comparison purposes. Column four of Table 9b aggregates all the bilateral trade facilitation commitments into a single variable (TF All Bi) and all the multilateral trade facilitation commitments into another variable (TF All Multi). The results say that a 10% increase in the overall level of bilateral commitments is associated with a 0.4% increase in bilateral trade, and a 10% higher in the overall level of multilateral commitments are related to a trade volume that is 0.6% lower. Both results are statistically significant. Column six further aggregates the bilateral and multilateral commitments into one entity (All TF). However, the positive effect of the bilateral commitments and the negative effect of the multilateral commitments seem to have cancelled each other out that the net effect is insignificant. Again with these modifications, the estimates for the other variables remain quite stable. Although it is hard to establish causal relationship here, it is clear that trade facilitation commitments are related to trade in some way. This corresponds to what WMO found when they used trade facilitation indices to measure the level of trade facilitation across countries. Based on the above results, it appears that combining all the bilateral commitments into one variable is plausible because there does not seem to have much gain in distinguishing between the two. On the other hand, it may be better and useful to keep each multilateral source of commitments separately because of their very different nature and scope. This scheme of using a single bilateral commitments variable and several multilateral commitments variables will be used in the next part – the first-differenced estimation.

Often in doing cross-sectional regressions, one may worry about the error terms not being homoskedastic. Two proposals are suggested here to address this concern. First is to use the White hetero-robust standard errors instead of the OLS standard errors. These are shown next to the OLS standard errors (column 4 and 7) in Table 9a. The

significance of the trade facilitation variables, as shown by the asterisks beside the robust standard errors estimates, does not change significantly. This implies that the above results are robust. The second proposal is to use the weighted least squares (WLS) method, which is commonly used in econometric studies to handle heteroskedastic data. The weights to be used here are the population size of the recipient countries (Frankel and Wei 1993). Variance of errors is assumed to vary inversely with population size; therefore, more weights would be given to countries with a larger population. Results for this WLS estimation are shown in Table 10. In general, the results are similar to that in Table 9a. The coefficient of the bilateral commitments (TF Bi D-to-R) drops from 0.021 to 0.014, while that of the other bilateral commitments (TF Other Bi) rises from 0.031 to 0.036; both terms become more statistically significant in the WLS estimation. For the aggregate bilateral commitments (TF All Bi), there is a drop from 0.040 to 0.032. In both bilateral commitments specifications, the UN commitments become insignificant. WCO commitment is still insignificant but in the WLS regression, it takes a positive value. While loan remains insignificant, self-financed trade facilitation commitments become significantly negative. This suggests that countries that have not been engaging in much trade tend to finance trade facilitation projects themselves. As mentioned before the donor and recipient of a self-financed project are the same country. Some developing countries may see the need to engage in trade facilitating activities; however, due to lack of expertise perhaps, they must acquire expertise from developed countries or multilateral agencies to implement the trade facilitation projects for them.

In reviewing the gravity models used by other researchers, different units of account were used. Some used nominal values (Bergstrand 1985), some used real values (WMO 2003, 2005) and some used nominal values but also include price indices (Thursby and Thursby 1987). In table 11, I re-estimated Equation (14) using nominal values, real values based on 1990 USD and nominal values adjusted for purchasing-power-parity (PPP), standard errors shown are the hetero-robust standard errors. These three estimations are to be compared to the first set of estimates in Table 9a. These estimates vary somewhat from the estimates using real PPP values. In particular, the bilateral and the WTO commitments become insignificant in all cases. The magnitude of other variables also changes by a considerable amount. It seems like the real values

estimates depart from the real PPP estimates by the most, followed then by the nominal values. The nominal PPP values seem to give the closest results to the estimates using the real PPP values. This suggests that the metric choice may change one's results, so one must be aware of such possibility. Ideally, the real PPP values should be used because it eliminates the effect of inflation and incorporates the differences in price level across nations. Therefore, the remaining analyses will be performed on the real PPP values.

5.2 First-Differenced Estimations

As mentioned before, trends may obscure the cross-sectional estimates, this section attempts to remedy this drawback of the cross-sectional estimations. Equation (15) in the Empirical Strategies section is the equation to be estimated here. The first difference is calculated based on annual data. Since there are four years of trade facilitation commitments, there are in total four differences for each donor-recipient pair if data are available. The estimation results are provided in Table 12. The second column was obtained using OLS, the fourth column gives the White hetero-robust standard errors and the fifth column shows the WLS estimation. Before going through each of the trade facilitation variables in detail, it is noted that the robust standard error are very close to the standard error produced by OLS. However, due to the differencing, a large portion of the variation in the variables has been cancelled out. This results in a small R^2 of 0.15 for the OLS first-differenced estimation. The WLS method, again using recipient's populations as the weights, improves the explanatory power of the model by about 25%. These phenomena on R^2 are not unexpected as explained above, thus, this statistic is only reported for completeness.

From the OLS estimation, most variables do not significantly influence changes in exports in a statistical sense. For the year-to-year economic fluctuations, only the fixed effects between year 2003 and 2004 differ by a significant amount. The aggregate shock experienced in 2004 on top of the aggregate shock experienced in 2003 is positively affecting trade flows from recipients to donors. This shock in 2004 is estimated to increase exports from recipients to donors by 11% (exp(0.107)=1.11) from the level of

exports in 2003. Focusing back to the trade facilitation variables, there is evidence that the investments made by WCO in trade facilitation paid off. A 10% increase in WCO commitment is related to 0.27% increase in recipients' exports to donors. Although this number is small numerically, it can quite potentially be translated into large increase in exports because by looking at Table 7, WCO only made a total of 378,110 USD commitments to trade facilitation. This amount can easily be doubled, and thus produce a 2.7% increase in exports from recipients to donors. Based on the robust standard error, the combined commitments of multilateral agencies (TF Other Multi), besides those explicitly included institutions, also have similar positive effect on trade as WCO although the evidence is not as strong. All other trade facilitation variables do not seem to have any effect on exports according to this OLS estimation.

Using the WLS method, so that more weights are given to the larger countries, the estimates should be more efficient than the OLS estimates. The results obtained with WLS indeed fit more comfortably with the general belief. A higher increase in the recipient's per capita income would induce a higher increase in exports. This seems to agree with the saying that richer countries tend to trade more (Cyrus 2002). Donor's economic factors do not seem to have much impact on the pattern of change in recipients' exports. In this estimation, an increase in the tariff rate on recipients' exports has the expected negative effect. This effect is also a significant one. A 1% increase in tariff rate will inhibit exports from recipients by 2.72%. Comparing the results for the "generic" gravity variables in the two estimation methods shows a large degree of discrepancy. However, for the trade facilitation variables, the two methods give rather similar results. In particular, the significance found in OLS for the WCO commitments appears in WLS as well, with a comparable magnitude of 0.023. In WLS, WTO commitments would marginally (with a p-value of 0.088) decrease exports by a very small and possibly negligible amount (1% increase in WTO commitment would give rise to a 0.003% decrease in exports). The commitments from other multilateral sources would not significantly alter exports pattern in this case, the same is true for bilateral commitments. As an additional remark, for this first-differenced estimation methodology, I also checked the different specifications of the bilateral and multilateral commitments as in Table 9. When bilateral (TF Bi D-to-R) and other bilateral commitments (TF Other

Bi) enter into the equation separately, the same results are observed – particularly the effect of WCO commitments remains strong. All forms of aggregation between and within bilateral and multilateral commitments would produce insignificant estimates because they are likely to cancel out each other's effect.

Now compare the first-differenced results with the cross-sectional regressions from before. The positive shock in 2004 shows up in both estimations. Among the multilateral donors, WCO is the only one that is not significantly negatively correlated with trade in the cross-sectional analyses and it also is the only one that is clearly positively correlated with trade in the first-differenced analyses. This can be considered as an informal qualitative cross-check or confirmation procedure. To summarize, the lesson learned from this first-differenced estimation is that changes in exports from recipients to donors covariate positively with changes in WCO trade facilitation efforts.

The last equation to be estimated is Equation (16), the five-year-period first-differenced estimation equation. By allowing for a longer response period – five years, this may be able to capture the longer term and cumulative effects of trade facilitation efforts if they exist. Since this equation is merely a slight variation of Equation (15), the same procedures will be used to perform the estimations – OLS, OLS with hetero-robust standard errors and WLS with population size of recipient countries as weights. The estimation results are tabulated in Table 13. The most remarkable result in Table 13 perhaps is the strong impeding effect of tariff on trade over the 5-year period of study, with a 5.53% decrease in recipients' exports for every 1% increase in tariff against imports from recipients. The second observation is that the R^2 is significantly higher in the 5-year-period first-differenced estimation. With OLS, the proportion of variation in changes in exports that can be explained by the variables listed is 0.37; with WLS, this proportion jumps up to 0.70, which is considered to be quite high for first-differenced estimations. However, this is by no means a "standard" first-differenced estimation.

With OLS, the changes in exports over a five-year period are related positively to changes in EC's trade facilitation commitments. This is a weak relationship, and cannot be stated with a high degree of confidence when WLS estimation is used. However, trade facilitation commitments financed through loan by the recipients themselves do show some positive influence on their exports to donors, and this result is robust across

estimation procedures. With WLS, the results for WCO and WTO commitments found in the one-year-period first-differenced estimations appear in the 5-period difference as well. The size of the effects gets magnified considerably in the 5-year-period difference. For WCO, the 1-year-period effect is 0.023 and the 5-year-period effect is 0.041. For WTO, the 1-year-period effect is -0.003 and the 5-year-period effect is -0.034. From a brief look at the project description available in the trade facilitation database, WCO tends to participate in more actual fieldwork, such as visiting and assessing facilities; its scope is also very wide, its projects involve all four sub-categories of trade facilitation – customs environment, port efficiency, regulatory environment and service infrastructures – implemented in various forms. They organize practical training sessions, workshops and seminars. The robust positive effects on trade attributable to WCO commitments may be a result of their ability to deliver the suitable form of assistance to the beneficiary countries. WTO, on the other hand, mostly gives seminars and seldom provides other forms of assistance. This may partly explain the negative relationship observed. However, there might be many other policies and shocks that took place during the 5 years, and that their effects might not have been properly controlled for in the estimation. One must exercise caution when interpreting the results. Lastly, it is useful to look at how much change in trade is realized after improvement in trade facilitation. It is found that the total increase in trade would be 361 million USD.

This completes the quantitative analysis section of this paper. The trade facilitation database used in this paper is very rich in qualitative terms because it contains project descriptions. These project descriptions provide a channel for a deeper understanding of this relatively new field of trade facilitation. The next section would give a more thorough direction on how this data set can be further utilized and what the other issues are regarding trade facilitation.

6. Future Research

Trade facilitation, being a very young area of research, has a long way to grow. The OECD/WTO Trade Capacity Building - Trade Facilitation Database provides useful information for exploration. Not only does this database show how much aid was given by whom to whom, most of its projects are also accompanied by a description outlining what type of work has actually been done. One can make use of these descriptions to classify projects into the four categories of trade facilitation and then estimate how trade flows respond to improvement in each of these categories. This exercise has strong policy relevance because negotiations on trade facilitation commitments are likely to continue in the foreseeable future. It is important that these resources are put into their best possible use and are distributed equitably.

In this paper, only the increment in trade facilitation and bilateral trade resistance are considered. Ideally, one would want to control for the multilateral trade resistance that a country faces as in Anderson and Wincoop (2003) and the trade facilitation status when evaluating the effects of increment in trade facilitation. When a country is already operating at a reasonable level of trade facilitation, any additional commitment to trade facilitation may not create much impact on trade. One the other hand, if the initial level of trade facilitation is low, a small increment in trade facilitation may lead to enormous increase in trade. However, finding a good measure of the initial trade facilitation level may be a difficult task because using survey data like WMO may result in selection bias. There will be less data or even no data for countries that trade very little, and thus it will be more difficult to assess the actual level of trade facilitation for these countries.

Another extension of this project can be to look beyond trade between each pair of donor and recipient of trade facilitation commitments. One can study whether the exports of a recipient to all of its trading partners or the total exports of a recipient experienced an increase after the implementation of certain trade facilitating procedures. The main reason for limiting this paper to the donor-recipient trade is that bilateral donors are likely to have stronger ties to their choice of recipients than other countries that they did not assist. Any gain in trade due to increment in trade facilitation should be more pronounced between donor-recipient pairs, and thus more easily identified.

Another possible stream of research is to assess the results and usefulness of the previously implemented trade facilitation procedures. Using trade volume as an instrument to evaluate the effectiveness of these projects is one strategy. Other method to appraise trade facilitation projects is to review surveys on trade facilitation performance submitted by recipients, reporting countries or observers. However, these surveys have not yet been publicized or done extensively; this form of assessment may not be feasible at this time.

7. Conclusion

This project investigates whether trade facilitation efforts can help the less developed and the developing countries to engage in more trade. In particular, can trade facilitation commitments from bilateral and multilateral sources successfully build trade capacity in these countries such that they can integrate themselves into the world of trade? The relationship between trade facilitation and trade capacity is connected or linked through trade volume. If trade originating from a country became more frequent after it received some aid in trade facilitation, this would be considered as a success in building trade capacity via trade facilitation activities or programs. By using the OECD/WTO Trade Capacity Building - Trade Facilitation Database that contains bilateral and multilateral commitments to promoting trade facilitation in less developed countries between 2001 and 2004, a few models have been estimated to examine the effects of such commitments on trade flows. The cross-sectional analyses reveal that bilateral commitments are significantly positively correlated with exports from a recipient to its donor. For the multilateral commitments, this relationship is found to be negative. With the first-differenced estimator, there is evidence that WCO commitments are trade facilitating. Its effect on trade is estimated at 0.23% to 0.41% increase in recipient-to-donor trade for every 10% increase in WCO commitments. Finally, this project only looked at a few aspects of the relationship between trade facilitation and trade. There are many areas remained to be studied. Undoubtedly, more and more information will become available in this field, and this will allow for more detailed analyses to be done in the future.

Appendix A – Detailed Derivation of the Gravity Equation

As introduced in the literature review section, Anderson (1979) was the first one to provide a theoretical framework for the gravity equation. This annex will show how Anderson derived the gravity equation using the trade-share-expenditure system model.

Assume that all countries have a traded good sector and a non-traded good sector and the utility function is a weakly-separable one: u=u(g(traded goods), non-traded goods), where the function g(traded goods) is Cobb-Douglas in its argument. This property allows for the maximization of the utility from traded goods to subject to the budget constraint for traded goods only. This in turn gives j's demand for i's tradeable good (i exports to j):

$M_{ij} = \theta_i \phi_j Y_j$ ..... (A.1), where

$$\theta_i = \frac{\text{j's total expenditure on i's tradeable good}}{\text{j's total expenditure on all tradeable goods}} \quad \text{..... (A.2)}$$

$$\phi_j = \frac{\text{j's total expenditure on all tradeable goods}}{\text{j's total expenditure}} = F(Y_j, N_j) \text{..... (A.3).}$$

Y_j is the importing country's national income. By Chenery (1960), ϕ_j can be well-explained by income (Y) and population (N).

With balanced trade,

$Y_i \ \phi_i = \theta_i (\sum_j \phi_j Y_j)$ ..... (A.4).

That is, the value of imports of i and domestic tradeable purchases must equal to the value of exports of i and domestic tradeable sales. Substituting (A.4) into (A.1):

$$M_{ij} = \frac{Y_i \ \phi_i Y_j \ \phi_j}{(\sum_j \phi_j Y_j)} = \frac{Y_i \ \phi_i Y_j \ \phi_j}{(\sum_i \sum_j M_{ij})} \quad \text{..... (A.5).}$$

If, as a result of long-term capital account transactions, which is a function of Y_i and N_i, $m_i=m(Y_i, N_i)$, the trade balance condition changes, then (A.4) becomes:

$Y_i \ \phi_i \ m_i = \theta_i (\sum_j \phi_j Y_j)$ ..... (A.6).

Under this circumstance, (A.5) can be re-written as:

$$M_{ij} = \frac{m_i Y_i \phi_i Y_j \phi_j}{(\sum_i \sum_j M_{ij})} \quad \ldots\ldots (A.7).$$

Since $\sum_i \sum_j M_{ij} = (\sum_j \phi_j Y_j)$ by (A.1), (A.7) can be estimated by:

$$M_{ij} = \frac{m_i Y_i \phi_i Y_j \phi_j}{(\sum_j \phi_j Y_j)} U_{ij} \quad \ldots\ldots (A.8),$$

where U_{ij} is a log-normal disturbance, where $E(\ln(U_{ij}))=0$.

By imposing a log-linear form on both m and ϕ:

$$m_i (Y_i, N_i) = k_m (Y_i)^{m1} (N_i)^{m2} \quad \ldots\ldots (A.9),$$

$$\phi_i (Y_i, N_i) = k_\phi (Y_i)^{\phi 1} (N_i)^{\phi 2} \quad \ldots\ldots (A.10),$$

and substituting (A.9) and (A.10) into (A.8), the following is obtained:

$$M_{ij} = k' \, k_m \, k_\phi^2 (Y_i)^{m1+\phi 1+1} (N_i)^{m2+\phi 2} (Y_j)^{\phi 1+1} (N_j)^{\phi 2} U_{ij} \quad \ldots\ldots (A.11).$$

This is the same as Equation (5) in the main text.

To realistically estimate trade flows, it is necessary to extent (A.11) to include flows of many goods between countries, tariffs and transport costs. The following derivation illustrates this extension using identical preferences for traded goods across countries and goods in the same commodity class are differentiated by place of origin. Tariffs and transport costs increase the landed value of i's good when it arrives at the importing country (j). Let τ_{ijk} be the adjustment factor for i's exports of good k to country j, and M_{ijk} be the value of flows of k from i to j evaluated at the exporter's port before shipment. Thus, the landed value at country j of good k from country i equals to $M_{ijk} \tau_{ijk}$. With identical preferences for traded goods, the propensity to good k from country i, $\theta_{ik}(\tau_j)$ depends on (τ_j) which is a vector representing resistance to trade imposed by j due to either geography or trade policy on different goods from different origins. This gives a more complicated version of (A.1):

$$M_{ijk} \tau_{ijk} = \theta_{ik}(\tau_j) \phi_j Y_j \quad \ldots\ldots (A.12).$$

Aggregating across commodity to get the aggregate flow M_{ij}:

$$M_{ij} = \sum_k M_{ijk} = \phi_j Y_j (\sum_k (1/\tau_{ijk}) \theta_{ik}(\tau_j)) \quad \ldots\ldots (A.13).$$

With balanced trade,

$$Y_i \phi_i m_i = \sum_j M_{ij} = \sum_j \phi_j Y_j (\sum_k (1/\tau_{ijk}) \theta_{ik}(\tau_j)) \quad \ldots\ldots (A.14).$$

Assuming that the adjustment factor τ_{ijk} increases with distance between i and j and is the same for all commodities, $\tau_{ijk} = f(d_{ij})$, then (A.13) becomes:

$M_{ij} = (\sum_k \theta_{ik})\ (\phi_j Y_j / d_{ij})\ U_{ij}$ ..... (A.15), with an extra disturbance term appended. Combining (A.14) and (A.15) gives:

$$M_{ij} = \frac{m_i Y_i\ \phi_i Y_j\ \phi_j}{(\sum_j \phi_j Y_j)} \cdot \frac{1}{f(d_{ij})} \cdot \left(\sum_j \frac{Y_j \phi_j}{\sum_i Y_j \phi_j} \cdot \frac{1}{f(d_{ij})} \right)^{-1} U_{ij} \ldots \text{(A.16)}.$$

The term inside the inverse bracket takes into account that the distance from i to other countries can influence trade between i and j. However, Anderson suggested that the efficiency gain by including this complex term in the estimation may not outweigh the bias created if such term is omitted. Therefore, it will be omitted. Further assume that $f(d_{ij})$ also has a log-linear form like m and ϕ, $f(d_{ij})=k_d\ (d_{ij})^{\delta}$. The standard gravity equation, Equation (7), is revealed.

$$M_{ij} = k_0\ k_m\ k_\phi^2\ (Y_i)^{m1+\phi1+1} (N_i)^{m2+\phi2} (Y_j)^{\phi1+1} (N_j)^{\phi2} (d_{ij})^{-\delta}\ U_{ij} \ldots\ldots \text{(A.17)}.$$

Appendix B

Table 1. Distribution of Trade Facilitation Commitments by Donor Type (million USD)

Donor Type	2001-2004	Total No. of Records	Total No. of Records (with nonzero value)
Bilateral	92.6	730	643
Multilateral	393.1	688	629
Loan/Self-financed	234.4	56	38
Unallocated	172.1	170	155
TOTAL	**892.2**	**1644**	**1465**

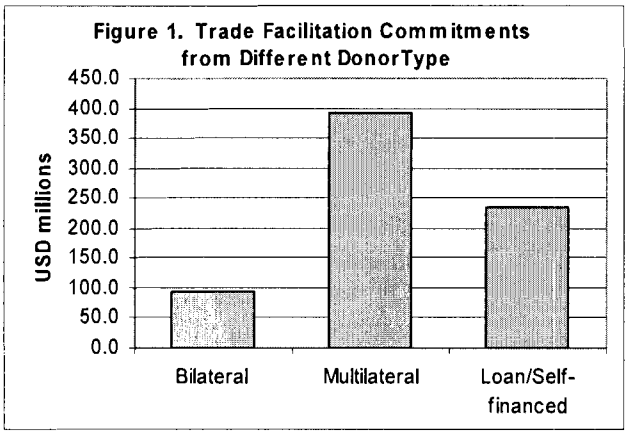

Table 2. Distribution of Trade Facilitation Commitments by Year (million USD)

Donor Type	2001	2002	2003	2004	All
Bilateral	23.2	30.0	62.0	54.1	**169.2**
Multilateral	81.1	106.2	246.6	289.1	**723.0**
TOTAL	**104.3**	**136.2**	**308.6**	**343.2**	**892.2**

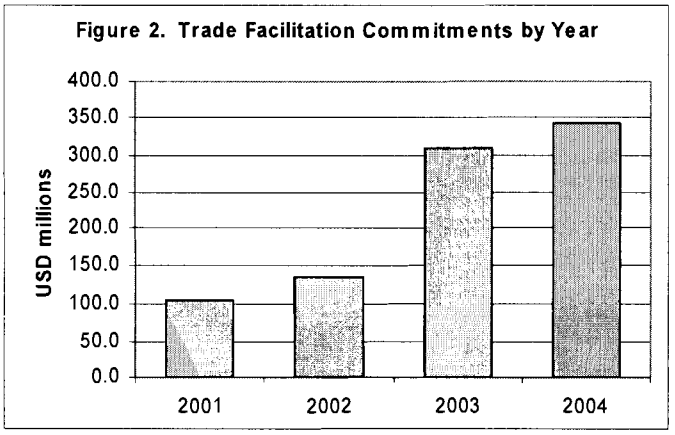

Table 3. Distribution of Trade Facilitation Commitments by Income Group and Year (million USD)

Income Group	2001	2002	2003	2004	ALL
CEEC/NIS	28.4	22.7	56.3	32.1	**139.5**
LDC	17.9	3.1	51.8	39.2	**112.0**
LIC	7.3	7.1	26.7	78.2	**119.3**
LMIC	11.0	58.1	121.9	96.5	**287.5**
UMIC	17.2	8.5	8.0	68.0	**101.8**
Unallocated	22.4	36.7	43.8	29.2	**132.1**
TOTAL	**104.3**	**136.2**	**308.6**	**343.2**	**892.2**

Income Group	No. of Projects	Average value of Project	No. of Countries	Average Value to each country
CEEC/NIS	147	0.95	12	11.63
LDC	299	0.37	50	2.24
LIC	216	0.55	22	5.42
LMIC	441	0.65	45	6.39
UMIC	223	0.46	53	1.92
Unallocated	139	0.95	N/A	N/A
TOTAL	**1465**	**0.61**	**182**	**4.90**

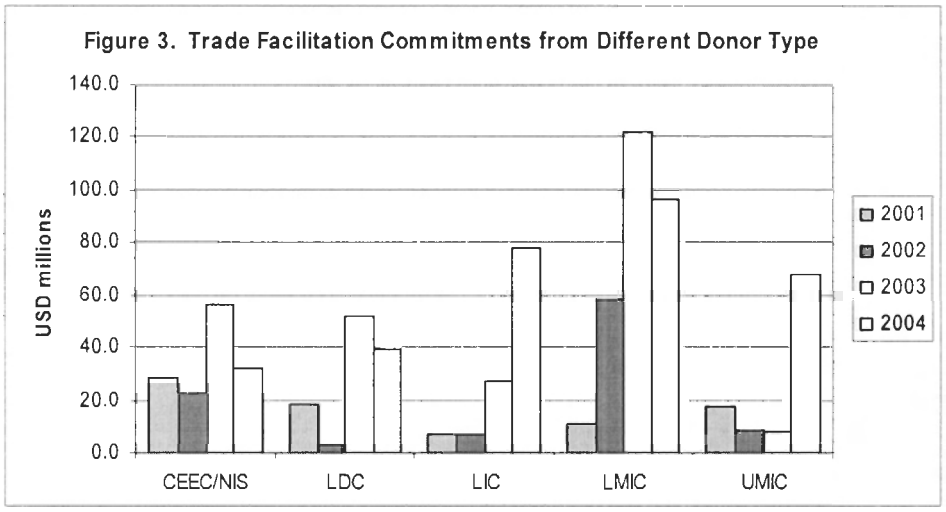

Table 4. Distribution of Trade Facilitation Commitments by Region Group and Year (million USD)

Region Group	**2001**	**2002**	**2003**	**2004**	**ALL**
CEEC/NIS	33.0	31.2	74.9	34.6	**173.7**
Europe	19.8	24.3	47.6	100.4	**192.1**
Far East Asia	4.1	1.3	11.6	56.0	**73.1**
Middle East	0.3	3.6	4.9	2.3	**11.1**
North & Central America	1.4	1.1	4.9	46.8	**54.2**
North Africa	13.5	26.6	58.1	12.8	**111.0**
Oceania	2.0	0.1	0.2	0.7	**3.0**
South & Central Asia	10.3	5.3	43.1	20.9	**79.5**
South America	0.3	2.8	1.9	3.1	**8.2**
South of Sahara	15.8	7.7	46.7	42.2	**112.4**
Africa Unallocated	0.0	0.1	1.4	8.7	**10.3**
America Unallocated	0.3	0.0	0.6	0.4	**1.4**
Asia Unallocated	0.4	1.6	5.7	0.0	7.7
LDC Unallocated	2.1	0.0	1.7	0.1	**3.8**
Unallocated	0.9	30.6	5.3	14.1	**50.9**
TOTAL	**104.3**	**136.2**	**308.6**	**343.2**	**892.2**

Region Group	**No. of Projects**	**Average value of Project**	**No. of Countries**	**Average Value to each country**
CEEC/NIS	179	0.97	14	12.41
Europe	97	1.98	8	24.02
Far East Asia	187	0.39	17	4.30
Middle East	69	0.16	14	0.79
North & Central America	150	0.36	28	1.94
North Africa	86	1.29	5	22.20
Oceania	43	0.07	18	0.17
South & Central Asia	172	0.46	17	4.68
South America	114	0.07	12	0.68
South of Sahara	285	0.39	49	2.29
Africa Unallocated	9	1.14	-	-
America Unallocated	3	0.45	-	-
Asia Unallocated	10	0.77	-	-
LDC Unallocated	4	0.95	-	-
Unallocated	57	0.89	-	-
TOTAL	**1465**	**0.61**	**182**	**4.90**

Table 5. Distribution of Funds to Recipients by Year

	No. of Recipients			
Total Funding	2001	2002	2003	2004
Under 5000 USD	4	32	2	5
5000-20000 USD	22	54	78	39
20000-50000 USD	18	21	16	8
50000-100000 USD	7	10	9	7
100000-200000 USD	8	5	6	7
200000-500000 USD	10	15	10	5
500000-1500000 USD	6	6	11	10
1500000-5000000 USD	7	8	6	8
Above 5000000 USD	6	6	14	12
Total	88	157	152	101

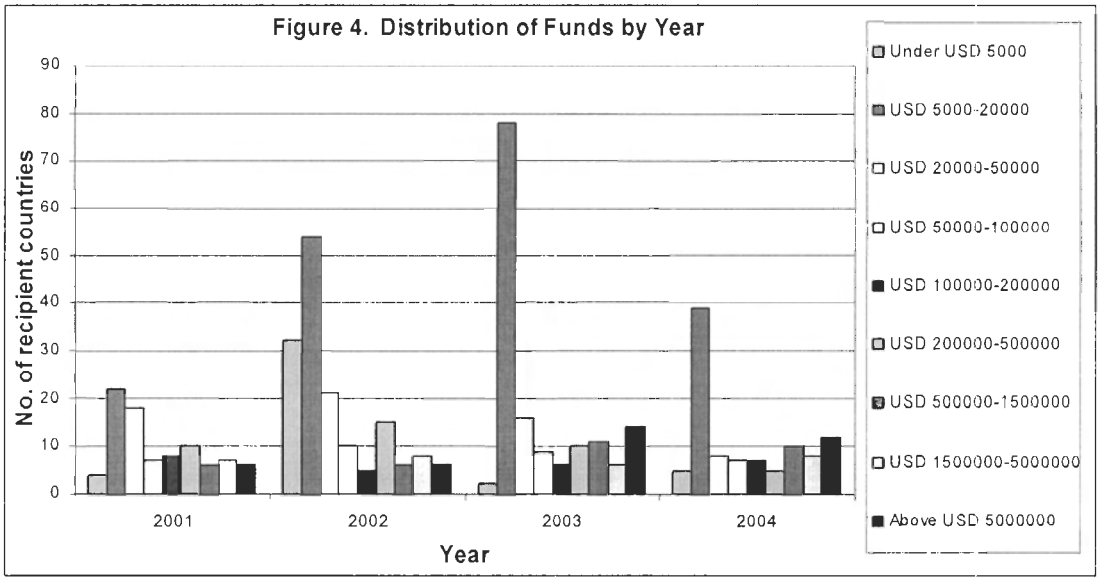

Table 6. Region of Trade Facilitation Concentration of Major Bilateral Donors
(USD thousand)

Region Group	Australia	Japan	France	Canada	US
CEEC/NIS	0.0	23.2	268.8	8.4	6801.6
Europe	0.0	21.0	57.5	0.0	5248.2
Far East Asia	3058.6	1109.2	1906.7	34.0	2040.9
Middle East	0.0	62.1	15.1	7.1	8569.6
North & Central America	1402.8	8.2	86.6	200.3	6844.6
North Africa	0.0	0.0	112.5	15.5	12334.1
Oceania	2680.4	157.8	0.0	0.0	0.0
South & Central Asia	0.0	531.2	0.0	1.3	24205.2
South of Sahara	0.0	210.3	228.8	292.5	8567.7
South America	0.0	15.2	243.6	627.3	1556.4
Total	**7141.8**	**2138.2**	**2919.6**	**1186.4**	**76168.3**

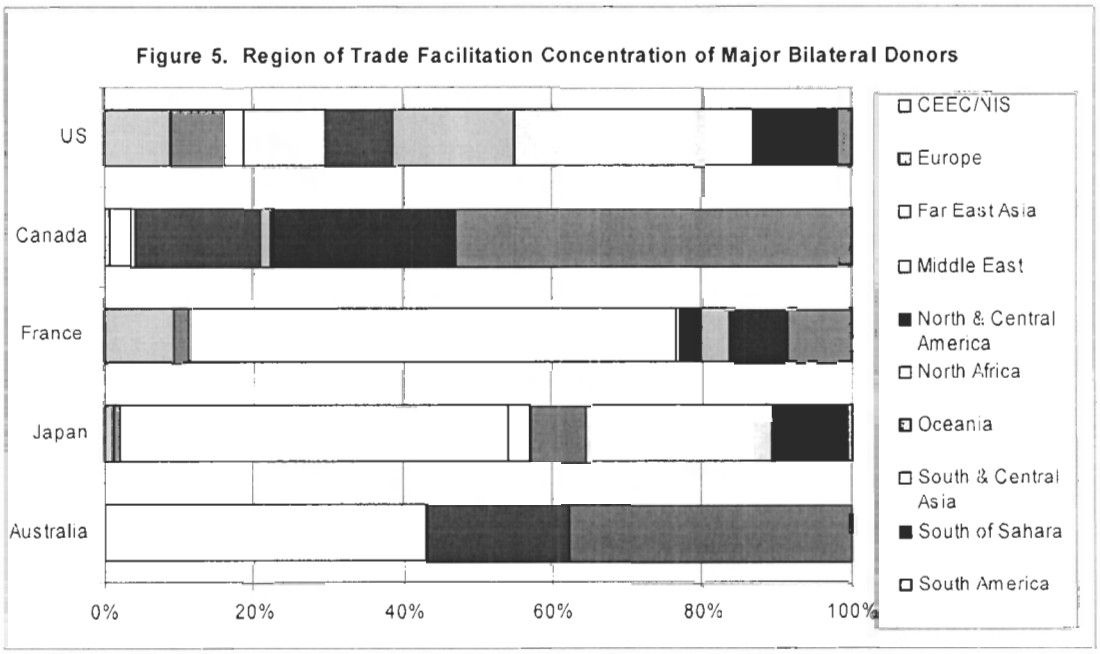

Table 7. Region of Trade Facilitation Concentration of Major Multilateral Donors (USD thousand)

Region Group	EC	WCO	WTO
CEEC/NIS	125584.90	9.66	217.92
Europe	185107.20	0.46	87.83
Far East Asia	14043.74	0.08	149.83
Middle East	212.58	1.29	196.04
North & Central America	2986.10	4.74	129.20
North Africa	86513.16	0.00	129.20
Oceania	0.00	0.00	53.80
South & Central Asia	26702.42	12.34	229.97
South of Sahara	1879.52	346.09	741.52
South America	94.24	3.45	146.98
Total	**443123.86**	**378.11**	**2082.29**

Figure 6. Region of Trade Facilitation Concentration of Major Multilateral Donors

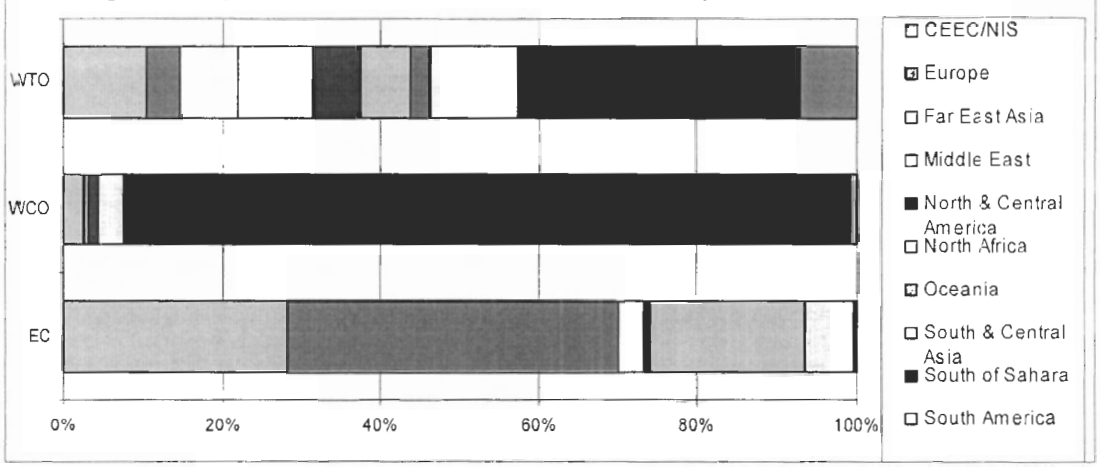

Table 8: Cross-Sectional Regression – Standard Gravity Model

Recipient Export	Coefficient	SE	Coefficient	SE
Year2001	-0.047	0.157	-0.082	0.144
Year2002	-0.056	0.157	-0.103	0.144
Year2003	0.216	0.157	0.198	0.143
Year2004	0.507***	0.157	0.511***	0.144
Recipient PCGDP			0.307***	0.064
Recipient GDP	1.180***	0.025	1.074***	0.029
Donor PCGDP			0.195	0.231
Donor GDP	0.873***	0.052	0.946***	0.052
distance	-0.983***	0.075	-0.997***	0.080
tariff			-2.308	1.880
English			0.831***	0.135
French			-0.706***	0.182
Spanish			0.536***	0.155
Arabic			-1.305***	0.431
LAIA			0.016	0.168
APEC			1.306***	0.146
LAS			1.327***	0.435
EU			-0.212	0.263
Constant	12.372***	0.697	18.182**	8.987
No. of Obs.	1230		1230	
R^2	0.669		0.730	
adj. R^2	0.667		0.726	

Significance: 1%: ***, 5%: **, 10%: *

Table 9a. Cross-Sectional Regression - Trade Facilitation Variables

Recipient Export	Coefficient	SE	Robust SE	Coefficient	SE	Robust SE
Year2002	0.111	0.168	0.163	0.109	0.168	0.164
Year2003	0.341**	0.165	0.159**	0.349**	0.164	0.159**
Year2004	0.490***	0.156	0.163***	0.492***	0.155	0.163***
TF Bi (D-to-R)	0.021*	0.011	0.011*			
TF Other Bi	0.031***	0.011	0.011***			
TF EC	-0.042***	0.012	0.011***	-0.043***	0.012	0.011***
TF Other Multi	-0.148*	0.084	0.059**	-0.142*	0.084	0.059**
TF UN	-0.042***	0.015	0.015***	-0.044***	0.015	0.015***
TF WCO	-0.020	0.038	0.037	-0.021	0.038	0.037
TF WTO	-0.037**	0.017	0.016**	-0.038**	0.017	0.016**
All Bi				0.040***	0.013	0.013***
All Multi						
All TF						
Loan	0.000	0.019	0.019	0.001	0.019	0.019
Self-Financed	-0.039	0.025	0.026	-0.041	0.025	0.027
Recipient PCGDP	0.347***	0.072	0.078***	0.350***	0.072	0.078***
Recipient GDP	1.060***	0.034	0.038***	1.062***	0.034	0.038v
Donor PCGDP	0.346	0.269	0.281	0.341	0.269	0.280
Donor GDP	0.951***	0.058	0.062***	0.951***	0.056	0.062***
distance	-0.996***	0.088	0.079***	-1.010***	0.088	0.080***
tariff	-2.973	2.095	3.056	-2.907	2.088	3.019
English	0.640***	0.157	0.162***	0.634***	0.157	0.163***
French	-0.706***	0.208	0.270***	-0.697***	0.209	0.270v
Spanish	0.403**	0.176	0.132***	0.398**	0.176	0.132***
Arabic	-1.460***	0.472	0.541***	-1.462***	0.472	0.547***
LAIA	-0.045	0.186	0.130	-0.048	0.186	0.130
APEC	1.173***	0.165	0.150***	1.170***	0.165	0.150***
LAS	1.481***	0.475	0.557***	1.453***	0.475	0.563***
EU	-0.168	0.291	0.194	-0.229	0.288	0.190
Constant	18.553*	10.013	14.846	18.308*	9.978	14.660
No. of Obs.	983		983	983		983
R^2	0.747		0.747	0.747		0.747
adj. R^2	0.740			0.741		

Significance: 1%: ***, 5%: **, 10%: *

Table 9b. Cross-Sectional Regression - Trade Facilitation Variables

Recipient Export	Coefficient	SE	Coefficient	SE	Coefficient	SE
Year2002	0.111	0.168	0.047	0.143	-0.023	0.143
Year2003	0.341**	0.165	0.314**	0.147	0.286**	0.146
Year2004	0.490***	0.156	0.475***	0.148	0.580***	0.149
TF Bi (D-to-R)	0.021*	0.011				
TF Other Bi	0.031***	0.011				
TF EC	-0.042***	0.012				
TF Other Multi	-0.148*	0.084				
TF UN	-0.042***	0.015				
TF WCO	-0.020	0.038				
TF WTO	-0.037**	0.017				
TF All Bi			0.040***	0.013		
TF All Multi			-0.062***	0.012		
All TF					-0.006	0.014
Loan	0.000	0.019	0.004	0.019	0.006	0.019
Self-Financed	-0.039	0.025	-0.041	0.025	-0.022	0.025
Recipient PCGDP	0.347***	0.072	0.380***	0.071	0.323***	0.072
Recipient GDP	1.060***	0.034	1.061***	0.033	1.079***	0.034
Donor PCGDP	0.346	0.269	0.317	0.269	0.237	0.273
Donor GDP	0.951***	0.058	0.954***	0.056	0.949***	0.057
distance	-0.996***	0.088	-1.009***	0.087	-1.002***	0.088
tariff	-2.973	2.095	-2.942	2.088	-2.668	2.126
English	0.640***	0.157	0.671***	0.154	0.777***	0.155
French	-0.706***	0.208	-0.638***	0.206	-0.708***	0.210
Spanish	0.403**	0.176	0.405**	0.174	0.500***	0.176
Arabic	-1.460***	0.472	-1.452***	0.472	-1.481***	0.480
LAIA	-0.045	0.186	-0.046	0.185	0.022	0.188
APEC	1.173***	0.165	1.142***	0.160	1.249***	0.161
LAS	1.481***	0.475	1.455***	0.475	1.500***	0.483
EU	-0.168	0.291	-0.200	0.287	-0.220	0.293
Constant	18.553*	10.013	19.238*	9.976	19.249*	10.157
No. of Obs.	983		983		983	
R^2	0.747		0.745		0.736	
adj. R^2	0.740		0.740		0.730	

Significance: 1%: ***, 5%: **, 10%: *

Table 10. Cross-Sectional Regression - Weighted Least Squares

	WLS		WLS	
Recipient Export	Coefficient	SE	Coefficient	SE
Year2002	-0.207**	0.084	-0.172**	0.085
Year2003	0.197*	0.117	0.229**	0.118
Year2004	0.335***	0.113	0.386***	0.114
TF Bi (D-to-R)	0.014**	0.006		
TF Other Bi	0.036***	0.006		
TF EC	-0.030***	0.010	-0.032***	0.010
TF Other Multi	-0.164	0.139	-0.158	0.139
TF UN	-0.006	0.012	-0.004	0.012
TF WCO	0.036	0.027	0.031	0.027
TF WTO	-0.042***	0.010	-0.036***	0.009
TF All Bi			0.032***	0.007
Loan	-0.002	0.008	-0.001	0.008
Self-Financed	-0.093***	0.020	-0.096***	0.020
Recipient PCGDP	0.347***	0.062	0.351***	0.062
Recipient GDP	0.836***	0.034	0.830***	0.034
Donor PCGDP	0.386**	0.162	0.401**	0.163
Donor GDP	1.013***	0.034	1.014***	0.034
distance	-0.496***	0.048	-0.505***	0.048
tariff	3.516**	1.582	3.851**	1.587
English	-0.878***	0.107	-0.932***	0.107
French	-1.609***	0.249	-1.651***	0.250
Spanish	-0.705***	0.139	-0.725***	0.140
Arabic	-3.058**	1.210	-3.113**	1.216
LAIA	-0.066	0.111	-0.043	0.111
APEC	0.990***	0.111	1.010***	0.111
LAS	2.091*	1.215	2.106*	1.222
EU	-0.618*	0.346	-0.701**	0.348
Constant	-14.819*	7.747	-16.482**	7.773
No. of Obs.	1229		1229	
R^2	0.867		0.865	
Adj. R^2	0.864		0.862	

Significance: 1%: ***, 5%: **, 10%: *

Table 11. Cross-Sectional Regression - based on different units of account

	Nominal Value		Real Value		Nominal PPP adjusted	
Recipient Export	Coefficient	Robust SE	Coefficient	Robust SE	Coefficient	Robust SE
Year2002	-0.145	0.170	-0.178	0.163	-0.062	0.170
Year2003	-0.086	0.160	-0.317**	0.155	-0.106	0.158
Year2004	0.020	0.155	-0.536***	0.152	-0.216	0.154
TF Bi (D-to-R)	0.016	0.010	0.012	0.014	0.008	0.009
TF Other Bi	0.043***	0.010	0.008	0.016	0.026***	0.010
TF EC	-0.032***	0.010	-0.040***	0.011	-0.044***	0.010
TF Other Multi	-0.062*	0.037	-0.099	0.062	-0.068*	0.037
TF UN	-0.031**	0.014	-0.035**	0.016	-0.037**	0.015
TF WCO	-0.001	0.024	-0.025	0.032	-0.020	0.027
TF WTO	-0.003	0.014	-0.004	0.017	-0.017	0.014
Loan	0.029	0.019	0.012	0.017	0.013	0.019
Self-Financed	-0.026	0.028	-0.027	0.028	-0.020	0.029
Recipient PCGDP	0.373***	0.058	0.322***	0.061	0.408***	0.078
Recipient GDP	1.032***	0.034	1.091***	0.036	1.062***	0.037
Donor PCGDP	-0.599**	0.246	-0.538**	0.239	0.379	0.332
Donor GDP	0.992***	0.077	0.858***	0.057	0.857***	0.071
distance	-0.989***	0.081	-0.965***	0.078	-1.000***	0.077
tariff	-2.033	3.282	-1.678	3.175	-2.110	3.120
English	0.833***	0.145	0.805***	0.147	0.696***	0.157
French	-0.745***	0.270	-0.282	0.263	-0.514*	0.271
Spanish	0.592***	0.132	0.268**	0.134	0.524***	0.130
Arabic	-0.935*	0.485	-0.513	0.528	-1.228**	0.517
LAIA	-0.012	0.132	-0.027	0.137	-0.136	0.127
APEC	1.276***	0.148	1.441	0.149	1.349***	0.150
LAS	1.032**	0.496	0.545	0.553	1.422***	0.536
EU	0.038	0.211	-0.637	0.189	-0.235	0.197
Constant	-12.825	15.809	-17.622	15.543	19.857	15.541
No. of Obs.	1017		1018		983	
R^2	0.758		0.749		0.757	

Significance: 1%: ***, 5%: **, 10%: *

Table 12. First-differenced estimation - with 1-year gap

	OLS			WLS	
Change in Exports (1-year)	Coefficient	SE	Robust SE	Coefficient	SE
Year2002-2001	0.040	0.051	0.052	-0.020	0.025
Year2003-2002	0.053	0.056	0.058	0.070**	0.032
Year2004-2003	0.107**	0.049	0.048**	0.129***	0.031
Change in Recipient PCGDP	1.604	1.084	1.117	3.970***	0.889
Change in Recipient GDP	0.057	1.077	1.106	-2.099**	0.887
Change in Donor PCGDP	-2.741	3.400	3.205	-0.509	1.592
Change in Donor GDP	2.434	3.434	3.222	0.126	1.625
Change in Tariff	1.224	2.056	1.877	-2.723**	1.241
Change in All Bi	0.000	0.003	0.003	-0.002	0.002
Change in EC	0.000	0.003	0.003	0.000	0.002
Change in Others	0.027	0.021	0.014*	0.013	0.027
Change in UN	-0.001	0.004	0.004	-0.002	0.002
Change in WCO	0.027***	0.009	0.007***	0.023***	0.005
Change in WTO	-0.005	0.004	0.005	-0.003*	0.002
Change in Loan	-0.001	0.005	0.004	0.002	0.001
Change in Self-financed	-0.001	0.006	0.007	0.003	0.004
Constant	0.096	0.086	0.065	0.136	0.092
No. of Obs.	987		987	987	
R^2	0.150		0.150	0.396	
Adj. R^2	0.136			0.386	

Significance: 1%: ***, 5%: **, 10%: *

Table 13. First-differenced estimation - with 5-year gap

	OLS			WLS	
Change in Exports (5-year)	Coefficient	SE	Robust SE	Coefficient	SE
Change in Recipient PCGDP	0.793	0.857	0.871	2.500***	0.810
Change in Recipient GDP	0.781	0.818	0.856	-0.837	0.757
Change in Donor PCGDP	-2.197	2.384	2.425	-1.157	1.248
Change in Donor GDP	2.289	2.430	2.471	1.042	1.297
Change in Tariff	-5.478	4.203	4.977	-5.529**	2.335
Change in All Bi	-0.018	0.019	0.021	-0.028	0.019
Change in EC	0.012*	0.006	0.007*	-0.004	0.005
Change in Others	0.010	0.010	0.009	0.015**	0.007
Change in UN	-0.041	0.031	0.052	-0.049	0.045
Change in WCO	0.021	0.015	0.018	0.041***	0.010
Change in WTO	-0.014	0.015	0.014	-0.034***	0.010
Change in Loan	0.015**	0.007	0.007**	0.009**	0.004
Change in Self-financed	-0.007	0.010	0.010	0.006	0.008
Constant	0.126	0.251	0.303	0.462*	0.272
No. of Obs.	247		247	247	
R^2	0.367		0.367	0.702	
Adj. R^2	0.331			0.686	

Significance: 1%: ***, 5%: **, 10%: *

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