

**IMPACTS OF A STATE TRADER  
ON GLOBAL WHEAT TRADE:  
A GRAVITY MODEL APPROACH**

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By

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## ABSTRACT

The purpose of this research was to empirically examine the impacts that the presence of a state trading enterprise (STE) has in the international wheat market. There are numerous types of STEs that function in different ways to achieve many different types of policy objectives which are often unique to a particular STE. Although the existence of a STE is justified by the countries involved using numerous policy rationales, the fear that they are used as a front for trade protectionism is a prevalent concern. One specific aspect of a STE that often brings this concern to the forefront is whether or not the STE has the exclusive privilege of monopoly status.

The empirical objective of this thesis was to determine specifically if the use of a STE exporter has had a positive impact on world wheat trade over the 1970 – 2005 period and if the use of a STE importer has had a negative impact. In addition, the marginal impact of the STE having monopoly status was tested. In all cases, the designation of STEs and their monopoly status is based on WTO notification documentations. To secure econometrically robust results, a modified conventional gravity model was chosen. This model was estimated using pooled OLS and fixed effects, the latter consisting of both time and country pair fixed effects. The data that was constructed was a large panel data set of bilateral wheat trade spanning from 1970 to 2005. The model was also tested on a number of subsamples representing countries at different stages of development and in different income categories to isolate potential differences in STEs objectives and impacts.

In virtually all models, the presence of a STE exporter had a strongly significant and positive effect on the value and volume of wheat exports from the country with the STE exporter. The fact that a STE had monopoly status did not have any additional impact on wheat trade. The impact of STE importers was insignificant.

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## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 General Problem**

Trade agreements, technology improvements and enhanced ability to communicate have allowed significant advancements in 20<sup>th</sup> century economies with the potential for full globalization where each country focuses on their strengths. Countries trade because it is advantageous to do so. Both the classical literature and the new trade literature reveal that economic welfare is increased through trade. Countries differ in their endowments of natural resources and production factors. Becoming specialized in producing products which use more intensively the factors in which a country has relatively greater productivity, and exporting them, results in higher incomes. This is because the specialization allows each country to export their surpluses and to import those things that others can produce more effectively, according to their comparative advantage. It is generally understood that this long run solution is optimal. It is further understood that government policies can affect the quantity and price of production inputs thereby altering which industry might develop a productivity advantage in a particular country. These policies come in a variety of forms and it is sometimes argued that

policies affect other countries' or sectors' ability to compete and thus have undesirable welfare effects. One trade policy option that has been suspect is the use of state trading enterprises (STEs) in international trade as agencies for importing and exporting.

There is legitimate theoretical concern regarding the role of STEs in international agricultural trade. Fundamental is the concern that STEs, by way of their exclusive rights or privileges, are anticompetitive. Further, some suspect that STEs provide a front for hidden protection for domestic agriculture. If this assertion is true, then gains from trade reform in the World Trade Organization (WTO), such as reducing tariffs and export subsidies, may be limited if STEs remain unchallenged. Indeed, it is believed that failure to recognize and directly address the role of STEs has hindered the WTO's ability to increase the free flow of agricultural trade (IPC Position Paper No. 9, 1999). These concerns, among others, are expected to be tabled for future WTO negotiations.

In late 2007 the rules of regulation surrounding STEs will likely be negotiated at the WTO. The following is an excerpt from the revised draft of the modalities for agriculture as of August 1, 2007. The proposed changes to the legislation surrounding STE exporters call for the elimination of:

- (i) *those export subsidies, defined by Article 1(e) of the Agreement on Agriculture, which are currently provided to or by an agricultural exporting state trading enterprise;*
- (ii) *government financing of exporting state trading enterprises, preferential access to capital or other special privileges with respect to government financing or refinancing facilities, borrowing, lending or government guarantees for commercial borrowing or lending, at below market rates; and*

(iii) *government underwriting of losses, either directly or indirectly, losses or reimbursement of the costs or write-downs or write-offs of debts owed to, or by export state trading enterprises on their export sales*

(iv) *by 2013, the use of export monopoly powers for such enterprises.*

(WTO, 2007)

However, it is not likely that all the WTO countries will agree on all these items. In order for any real progress to be made in trade negotiations, a few issues surrounding the impacts of STEs on trade need to be resolved. The lack of consensus about their impacts is due in part to the lack of clarity regarding the definition of STEs, and is compounded further by the absence of an accepted body of economic theory relating to STEs (McCorrison and MacLaren, 2001). As a result, there still exists a gap in establishing an agreed upon benchmark or classification scheme by which STE activities can be gauged in determining their potential to distort trade. McCorrison and MacLaren conclude:

*Overall, the key conclusion is the need for careful empirical work on both the practices and the effects of state trading enterprises (McCorrison and MacLaren, 2001, Pg.56).*

Acquiring access to foreign markets is extremely important in order to realize the potential gains from liberating world trade in agriculture. Currently, there are a number of different types of marketing institutions involved in marketing agricultural and food products. This includes small private businesses, large national and multinational firms, and STEs. In Canada, the Canadian Wheat Board (CWB) is the largest and most influential STE. The CWB has single-desk status in the export

of barley, wheat, and durum from the Canadian prairies, which represents the largest grouping of agricultural exports from this country. It has been shown that such an organization is beneficial to some producers by returning a premium to them beyond that which could be obtained in a multiple seller environment (Kraft et al. 1996). The ability of the organization to do so is connected to its ability of the STE retaining of single desk status.

In Canada today the debate has surfaced again. Several producer groups are convinced that the CWB is a significant stumbling block that inhibits a structural change consisting of value adding, crop development and individual market access. The Government of Canada set up an industry task force to provide recommendations on how to remove the single desk yet maintain a viable wheat board. The report outlined how there a producer/investor owned agency could be created but acknowledged that without regulation granting monopoly status to the producer organization it would likely not succeed in its current structure (Migie, et al., 2006). The motivation for considering this change is to offer Canadian producers the ability to sell their production of wheat and malt barley outside of the single desk.

Another aspect is that countries using STEs are sometimes challenged by trade partners. For example, in Canada the CWB has experienced numerous trade challenges for alleged trade injury. In 2004, the WTO ruled in favour of the CWB which was being challenged by the U.S. This case was initiated by the U.S. Trade Representative on December 17<sup>th</sup>, 2002. The U.S. had challenged the CWB on three aspects. Only one was directly pointed at the CWB alleging that the CWB was

operating inconsistently with respect to the Act itself. In a statement, the WTO panel concluded that:

*“[t]he U.S. has failed to establish its claim that Canada has breached its obligations under Article XVII:1 of the GATT 1994 because the CWB Export Regime necessarily results in the CWB making export sales that are not in accordance with the principles of subparagraphs (a) or (b) of Article XVII:1” (WTO, 2004 - WT/DS276/R, 2004).*

The essence of this finding is that the CWB was not in violation of operating outside the definition of exclusive rights or privileges granted by the state.

Similar challenges and ambiguities exist for STE importers as well.

Countries that import agricultural commodities and food products may use various forms of institutions to secure a stable supply chain into their country. STEs in the import business are often used to facilitate transactions, maintain a stable supply chain or for health and safety reasons. However, importing STEs could also be used as a tool to administer certain forms of trade barriers that would limit access to their domestic market. It is commonly argued that trade inhibiting STEs reduce access to markets for potential exporters. In Japan, for example, the Ministry of Agriculture, Forestry and Fisheries (MAFF) controls the importation and pricing of most imported wheat. Casual empirical research suggests minimal evidence that STEs affect import levels. At best, it shows that some STEs are not as responsive to choices of supply when market conditions change as other non-institutionalized traders might be (Abbott and Young, 1999).

As earlier mentioned, members of the World Trade Organization (WTO) have raised the issue of the trade distorting behaviour of the CWB. In particular

some countries, namely the U.S. and the European Union wish to see the single-desk authority of the CWB weakened or removed totally. Their opposition is based on a belief that the CWB enhances Canada's ability to export wheat. Today, most studies that have tried to measure the impact of STEs are still subject to intense scrutiny. There is no compelling empirical evidence showing that STEs affect trade, all else constant. The reason for the lack of clarity, let alone a unified perspective on the impact of STEs, is that little comprehensive empirical work has been done in regard to testing the impact of STE. Making generalized statements about a dynamic type of institution can lead to poor policy recommendations. STEs are used in countries all over the globe, for a diverse range of commodities and with multiple objectives. It is important to engage in a comprehensive analysis to assess the influence of STEs international wheat trade.

## **1.2 Objective and Hypothesis**

There are two questions this research project will address. First, do exporting state trading enterprises affect the value or volume wheat exports? The answer to this question will be based on observing whether any increases or decreases in exports are the result of the presence of STEs or whether they are attributable to a range of other factors that stimulate trade. This will inform the debate on the influence of the CWB on Canada's wheat exports. Second, do state-trading importers affect other importers or limit market access of potential exports of wheat? For example, the Japanese Ministry of Agriculture, Forestry and Fisheries, which is widely suspected of limiting wheat imports. This research project will

provide a comprehensive econometric study of the effect of STEs on world wheat trade. It is the purpose of this study to empirically measure the extent to which state trading enterprises (STEs), on both the import and export side, affect (positively or negatively) trade flows.

Formally,

H<sub>O.1</sub>: A STE Exporter is able to significantly increase the value of wheat trade originating from the export country.

H<sub>O.2</sub>: A STE Importer is able to significantly decrease the value of wheat trade destined for the import country

A secondary consideration is whether the legislation granting monopoly status to certain STE has an additional marginal impact.

H<sub>O.1a</sub>: A STE Exporter with monopoly status is able to additionally increase the value of wheat trade originating from the export country.

H<sub>O.2a</sub>: A STE Importer with monopoly status is able to additionally decrease the value of wheat trade destined for the import country.

## **1.5 Definition and Classifications**

One of the exceptionally difficult challenges in the debate is finding consensus on what constitutes a STE. The WTO defines a STE as:

*"Governmental and non-governmental enterprises, including marketing boards, which have been granted exclusive or special rights or privileges, including statutory or constitutional powers, in the exercise of which they influence through their purchases or sales the level or direction of imports or exports" (GATT, 2006).*

There have been various attempts to make this broad and general definition more operational. The size, structure, operations, power, extent of government involvement in, and functions, of STEs vary widely as seen in Table 1.1.

Table 1.1: Types, Objectives and Functions of STEs

Five Types of STE	Objectives of STE	Selected Functions of STE
<p>Statutory Marketing Boards</p> <p>Export Marketing Boards</p> <p>Regulatory Marketing Boards</p> <p>Canalizing Agencies</p> <p>Foreign Trade Enterprises/Organizations</p>	<ul style="list-style-type: none"> <li>- income support for domestic producers;</li> <li>- price stabilization;</li> <li>- expansion of domestic output;</li> <li>- continuity of domestic food supply;</li> <li>- increase in government revenue;</li> <li>- control of foreign trade operations, achieving economies of scale and scope, and improving the terms of trade;</li> <li>- protection of public health;</li> <li>- management of domestic resources; and</li> <li>- fulfillment of international commitments on quantity and/or price</li> </ul>	<ul style="list-style-type: none"> <li>-importing and exporting;</li> <li>- issuing permits for importation or exportation;</li> <li>- enforcing the statutory requirements of an agricultural marketing scheme and/or stabilization arrangement;</li> <li>- authorizing/ management of domestic production;</li> <li>- authorizing/managing the processing of domestic production;</li> <li>-determining the purchase/sales price of domestic production;</li> <li>- handling domestic distribution of domestic production/imports;</li> <li>- effecting purchases and sales of domestic production based upon pre-determined floor and ceiling prices;</li> <li>- issuing credit guarantees for producers/processors;</li> <li>- engaging in exporting activities and supporting activities (storage, shipping);</li> <li>-exercising quality control functions for exports;</li> <li>- engaging in marketing and promotional activities for exports/domestic consumption;</li> <li>- maintaining emergency stocks of certain strategic/agricultural goods;</li> <li>- negotiating/administering long-term bilateral contracts for exports/imports;</li> <li>- undertaking activities necessary to fulfill contractual obligations entered into by government</li> </ul>

Source: McCorrison and McLaren ( 2001). - Summarization of Points.



There is significant overlap in all of the categories. The STE may be a hybrid of the different types, managing several of the selected objectives using many different combinations of the different functions.

Another source of difficulty with definitions is the fact that STEs are used as instruments to achieve different forms of agricultural policy objectives (Veeman et al. 1999). Lack of clarity surrounding the definition of STEs has made analysis of the same difficult. Detailed knowledge of how various STEs are organized, along with their roles in domestic and international markets, is essential in order to evaluate their performance or impact on trade (OECD, 2001).

The rationale for classifying STEs stems from the notion that the activities of some STEs are more distorting than others. Thus a classification scheme is intended to be instrumental in differentiating which STEs have the greatest potential to distort markets and require restructuring, and those that are inconsequential to the quantity or direction of trade. Different classification schemes have been proposed based on differing criteria. Two schemes are considered here to illustrate the lack of consensus which surrounds categorizing STEs.

Dixit and Josling (1997) classify STEs in terms of their ability to distort trade. Since activities of STEs vary widely, they focus on the most trade distorting enterprises. An inventory of the most trade distorting STEs would enable the WTO to focus negotiations on the STEs that are the most offending. Four different combinations of control over domestic and trade markets, and their potential to distort trade are illustrated by Dixit and Josling (see Table 1.2).

Table 1.2: Classification Typology for STE based on Market Control

	Characterization	Quantitative Trade Controls	Domestic Market Controls	Potential for Trade Distortion
Type I	Market Promotion Board	None	None	Negligible
Type II	Domestic Control Board	None	Yes	Low
Type III	Trade Control Board	Yes	None	High To Moderate
Type IV	Total Control Board	Yes	Yes	High

Source: Dixit and Josling (1997).

The first STE category (Type I) is called a Market Promotion Board.

Without any control in domestic or international markets, this type of STE usually focuses on promoting, and controlling the quality of specific commodities. Thus its potential to distort trade is negligible. An example would be the Canadian Canola Council.

The second type of STE is classified as a Domestic Control Board, having market power only in the domestic market. These boards often prevent over-supply on the domestic market, or ensure equitable distribution of scarce supplies. An example of this would be the Commodity Credit Corporation (CCC) in the U.S. The way the CCC operates is that it offered farmers a loan rate on their grain when sold to the CCC. If the market price was not above the loan rate the CCC paid, the CCC would then acquire the farmers' grain which would have to be given away or sold (Simonot, D. 1997).

The third type of STE could be called an International Trade Control Board. Having control over exports and/or imports they can use their market power over

trade to achieve an internal (price) objective. This agency operates in a competitive domestic industry but is under control in the export and import business. The Canadian Dairy Commission is, and the Australian Wheat Board was, an example of this category of STE. Indirectly they can influence the domestic market. By monopolizing exports and/or imports of the commodities they handle they can keep the domestic price where it “needs” to be for a particular policy objective. Export monopolist’s activities, with respect to other sellers often results in trade conflicts. Without any domestic market control, this type is often not challenged in negotiations when their objective is to keep the domestic market price low for domestic consumers.

Type IV STEs control both domestic and international markets. This category could be labelled a Total Market Control Board. The potential trade-distorting effects of STEs in this category are larger than other three types, but are dependent upon how the STEs use market power in international and domestic markets (Josling, 2002). This category includes the Canadian Wheat Board products for human consumption or Indonesia’s BULOG (Badan Urusan Logistic Nasional).

Dixit and Josling have been criticized for the lack of objectivity (OECD, 2001), and usefulness, of the standards used in their classification scheme. Veeman et al (1999) contend that more useful criteria examine indicators of market contestability, upon which their own classification scheme is based (see Table 1.3).

Table 1.3: Classification Typology for STE based on Market Contestability

STE Class	Import STE that:	Export STE that:
Type I (Green) STE		
The market is contestable	i. Face competition in the domestic market and control less than 33% of domestic market sales	i. Face competition in the export market and control less than 33% of export market sales ii. As i above, and no single desk in the domestic market iii. As i above and has a single desk in the domestic market but the border is open to imports
Type II (Amber) STE		
Contestability may be compromised	i. Face competition in the domestic market but control 33% or more of domestic sales	i. Face competition in the export market but control 33% to 49% of world export sales ii. Face competition in export markets and have a single desk role in the domestic market, but the border is not open to imports
Type III (Red) STE		
Contestability is contravened	i. No competition in importation ii. As for i, and TRQ and/or MAC are administered by the STE	i. Control 50% or more of world export sales of the commodity ii. As for i, and has single desk in the domestic market

Source: Veeman et al. (1999).

Criteria used to measure market contestability include: first, the extent to which STEs face competition from private traders in export markets as well as domestic markets (single-desk status); second, the STE's share of import and/or export markets; and third, the openness of an exporting country's market to imports. It has been noted that the criteria used to classify STEs based upon their potential impact on agricultural markets, as suggested by Veeman et al., may be subject to criticism since no consensus exists on determining objective criteria (OECD, 2001).

In Table 1.3, the STEs are classified into categories based on the WTOs classification of a support program's ability to distort trade. The colour designation of the boxes reflects the urgency with which a program needs to be dealt with to reduce trade distorting effects. Those programs or institutions that are classified as Red box are understood to be very distorting and cannot be allowed. The Amber box contains those forms of support that need to be reduced or changed and the Green box programs are acceptable.

The purpose of introducing the previous typologies has been to illustrate the lack of consensus surrounding the basic definitions of STEs. Considering that Dixit and Josling place the Canadian Wheat Board (CWB) as a Type 4 STE - one having a high potential to distort trade, while Veeman et al. classify the CWB as a Type 1 STE – one having little potential to distort trade, it is clear that an agreed upon typology of STEs does not exist. A benchmark definition of STEs is important if reforms are to be targeted towards the STE of concern.

STEs are an acceptable marketing structure within the WTO. The debate around STEs typically focuses on the activities of the STE. Since STEs receive exclusive or special rights and/or privileges they have become suspect for anticompetitive behaviour. In agriculture, those wishing to see the laws granting STEs repealed, argue that they distort trade or have the potential to distort trade. The debate regarding STEs first surfaced in the late 1940's when leading trading countries of the time met to develop an agreement for an International Trade Organization (ITO). Subsequent negotiations have endeavoured to achieve *modus vivendi*<sup>1</sup> that could rule the actions of, and encompass the diversity of objectives employed by, STEs. The rules were outlined in the GATT 1947, the only agreement coming out of the meetings. Sixty years later, affected individual countries are still seeking consensus on the impact of STEs on trade.

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<sup>1</sup> Modus vivendi – a compromise, at least temporarily

In the context of this research question, the classification reported above based on the market contestability would seem most appropriate and the least subjective. However, this could potentially be a source of confusion when STEs with the same objective are placed into different classifications even if they face the same level of competition. The reason is because the extent of competition matters could affect the results. A STE operating in the absence of domestic market competition (i.e. monopoly status) is believed to have a greater ability to distort trade than without monopoly status. Thus, the current research provides empirical evidence regarding the impact that STEs have on trade based on the use of STE and whether or not it has monopoly status granted to them by the country in which they operate in. All STEs and their monopoly status as reported to the WTO are included, with no attempt emphasis particular STEs. This is a more comprehensive and empirically based means of determining if STEs have had an impact on wheat trade than previously concluded.

The goal of this research is to further contribute to the understanding of the impact of STEs on wheat trade between countries. That is, STEs that are defined to exist if the WTO has been notified by a trading country that they have a STE. Also, the existence of monopoly status is also taken from the notification by the member country.

## **1.4 Organization of the Study**

The remaining chapters of this thesis are organized in the following manner. Chapter II outlines the legal text allowing the use of STEs within WTO membership. This information leads into an extensive discussion and review of the past literature that has endeavoured to assess the impact of STEs generally as well as some issues surrounding specific STEs. Chapter III reviews the theory of international trade and outlines the theoretical basis for the gravity model. Included here is the theoretical gravity model used to test a specific sector of the economy. Chapter IV provides a review of the empirical examples that have used gravity models in the past to test certain policies. From these examples, an empirical specification of gravity model to test STEs in the international wheat market is presented. Chapter V presents and describes the results of different empirical specification of the wheat trade gravity model. Also provided are the results from numerous interesting sub-samples of the data to distinguish STEs by their objectives and the type of country they are used in. In Chapter VI conclusions regarding the different aspects of this thesis are presented. Included here are acknowledgments of the limitations of this work and options for future work in this area.

## **CHAPTER II**

### **LITERATURE REVIEW**

#### **2.1 Relevant Literature**

##### **2.1.1 Article XVII - GATT 1994**

Within the WTO, STEs must adhere to rules under the General Agreement on Tariffs and Trade (GATT) “in their purchases or sales involving either imports or exports – are to act in accordance with the general principles of non-discrimination, and that commercial considerations only are to guide their decisions on imports and exports” (GATT-Article XVII, 1994). Specifically this means that a STE must operate in accordance with certain rules, four of which are listed here:

1) Non-discrimination, which means that “such enterprises (STE) that make any such purchases or sales, must do so solely in accordance with commercial considerations including price, quality, availability, marketability, transportation and other conditions of purchase or sale, and shall give other contracting parties adequate opportunity to compete for participation in such purchases or sales” (GATT- Article XVII, 1994). This makes legal the existence of STEs if they do not affect the ability of equal opportunities from someone else who would want to engage in this business activity.



2) No quantitative restrictions. Throughout Articles XI, XII, XIII, XIV, and XVIII, 'import restrictions' or 'export restrictions' are discussed. The point is that any restrictions imposed as a result of the operations of an STE are not acceptable. Thus the law which grants a STE exclusive import rights in a certain product cannot be used as a means to limit or stop imports. Further, if the STE refused to import at all, they would be in violation of the rule of eliminating import restrictions (Articles XI, XII, XIII, XIV, and XVIII). The STE cannot be used as a way to stop imports from a certain country or of a certain product completely.

3) Preservation of the value of tariff concessions. “Article XVII: 4(b) covers import monopolies on products which are not the subject of an Article II concession (i.e., not included in a GATT Schedule) and sets out that such monopolies shall, on request, inform the WTO Members of the import mark-up on the product during a recent representative period or of the price charged at resale. The purpose of these extra provisions relating to monopolies was to preserve the value of negotiated tariff concessions - i.e. to prevent an import monopoly from instituting protection for domestic producers” and thereby make reduced tariffs ineffective.

4) Transparency. “This notification requirement is an essential element in the rules on STEs. One reason for notifications is to make it possible for WTO member countries to judge the extent to which STEs serve as an alternative to other restrictions covered by the General Agreement, e.g. quantitative restrictions, tariffs and subsidies. Another purpose of this clause is to allow WTO member countries the ability to assess the possible trade distortion resulting from the operations of notified STEs” (GATT-Article XVII 1994). The other WTO member countries can

evaluate the information that countries allowing STEs to operate must fill out and keep record of the STEs operations. This form contains a description of the products affected, reason or purpose for establishing/maintaining the STE, summary of the legal basis for the granting of the exclusive or special right or privilege to the STE, description of the functioning of the STE and statistical information on imports, exports and domestic production.

In the interest of achieving gains from trade, according to the rules and regulation define by GATT (1994) STEs should act like a commercial operation and not be used to inhibit consumption of a good or mitigate the effectiveness of negotiated concessions from protection. STEs must be open to evaluation by member countries to maintain integrity. Full adherence to these rules would make much of the literature on STEs moot. The challenge exists because many countries have differences of opinion as to what the context of the law obligates them to do in regards to reporting the activities of STEs, as well as which organizations need to be reported.

### **2.1.2 Selected Analytical Studies of STE**

The research issues surrounding STEs have included assessing market power and the ability to price discriminate. Fundamental in the studies is whether or not STEs are adopted because the market in which their activities occur is not perfectly competitive. Outcomes of these investigations are often contingent on the assumption of the degree of competitiveness within the trade environment. If the market is not competitive, then the role of a STE is not a matter of enhancing the

terms of trade but rather an appropriate tool to mitigate the inefficiency effects of market power further up the market chain (MaCalla, 1966). The STE can also take a homogenous product, and by quality control, additional rents can be extracted based on consumer's willingness to pay (Kraft et al. 1996). However, this is also a conclusion drawn from the analysis of very particular STEs that would have control in the domestic market and who market a product with characteristics that are not readily available elsewhere, like Canadian wheat in certain processing environments; these conclusions cannot be generalized to include all STEs.

The same also applies to studies that are pivotal on the notion that the trade environment is indeed near perfect competition. Carter and Smith (2001) attest that STEs can distort international markets when they operate in a competitive market. Their approach is tied to Brander and Spencer's (1985) outcome in the new trade theory that in some cases the uses of an export subsidy can be welfare enhancing given the use of a Cournot type strategy. They found that the use of a single desk in the Canadian market may not be welfare enhancing (Carter and Smith, 2001). The research findings, which are numerous and often utilize very specific assumptions, leave a similar ambiguity, alluded to above, about which characteristics of STEs lead to their ability to distort trade.

One argument that is well-researched is the ability of countries to use STEs to combat the effects of subsidies and tariffs in production and distribution of agriculture commodities. To outline this concept, the earlier work of Alston and Gray (2000) is worth noting. This study looked at STEs versus export subsidies in the case of the CWB. Engaging a policy analysis technique developed by Bruce

Gardiner (1983) to study policy distribution effects, their work suggests that export subsidies and export STEs are similar in several ways. Both policies leave an average producer with a return above that of the world price. One key difference in the different policies, export subsidy versus STE, is who pays for the policy. It is from either direct tax transfer in the case of a subsidy or some gains from price discrimination observed in some STE (Alston and Gray, 2000).

Other examples include the research of Dixit and Josling (1997), who developed an analytical framework that addresses the potential for countries to misrepresent their commitments to reducing barriers through cross subsidization, which is one of the primary concerns about STE. This is achieved through the calculation of a subsidy/tariff equivalent for a STE. Any distortionary impacts were captured in higher values for the equivalent measure. Ingco and Ng (1998) further the debate in light of the Uruguay Rounds and develop a country specific ranking system to rank STEs on the extent of control and potential distortions. Their system produced a scoring system where STEs are strong, medium or weak. These ranking system do show the frequency with which STEs are used and outlines the potential distortions but do not provide a complete analysis of actual distortionary impacts based on empirical evidence.

McCorrison and MacLaren (OECD, 2001) have compiled an exhaustive collection of the various studies in their book entitled *State Trading Enterprises in Agriculture*. There are several ways to analyze STEs; they are theoretical models, welfare policy model and simulation models that have focused on measuring trade distorting impacts from STEs. After careful scrutiny of the past literature on STEs,

an important conclusion is made that STEs are not homogeneous. The degree of competitiveness has a significant impact on outcomes as does the difference in the objectives of the agencies. In conclusion, the review of the research results emphasised the need for further cautious empirical work that focuses on the actual impacts rather than just the theoretically potential impacts.

Prior studies reveal that research findings are sensitive to the prior assumptions made. In regards to the matter of anti-competitive behaviour, it may be argued that the *potential* for such behaviour is sufficient justification to suspend operations of STEs or significantly reform operations as proposed by several classification systems previously investigated. On the other hand, one could assume that current trade law in the WTO will protect other countries from trade injury resulting from illegal use of STE.

The most frequent proposition in the literature is to develop a ranking system to evaluate the distorting potential of the STEs. Trying to establish and agree upon a benchmark is a process that is very demanding and subject to dispute because of claimed self interest. Several of the classification procedures were mentioned earlier but as useful as they are, they are not a substitute for systematic empirical work that examines the true impacts of STEs, controlling for the multitude of other influences on trade.

Countries trade because, in principle, it is welfare improving to do so. Some countries can, in the short run at least, affect the terms of trade by offering industry participants favourable condition or subsidies. New trade theory explains how some countries can help initially support certain industries that otherwise would not be

competitive in their infancy, but that can eventually become competitive as the sector expands or develops thereby no longer needing public supports funds (Krugman, 1990).

Rose (2004) found interesting conclusions about the impact on trade for participating countries in the World Trade Organization (WTO). After detailed empirical investigation using the gravity model and Over 40 year of bilateral trade data, Rose concludes that the evidence casts considerable doubt on the WTO's role in the growth of bilateral trade (Rose, 2004). It is important to have similarly sound empirical evidence about institutions like STEs, rather than conventional wisdom, guiding the decisions regarding the policy choice. Like the landmark study on the WTO, there is need to empirically investigate the impact of STEs on trade.

## **CHAPTER III**

### **THE THEORETICAL MODEL**

#### **3.1 Theory of International Trade**

The study of international trade has focused on several important questions. The following questions are front and centre in the debate by trade theorists. Why do countries trade? What determines the pattern of specialization in production and trade? Is trade beneficial, and to whom? Does anyone lose? What is the impact of government intervention? What is the optimal trade policy or strategy? How do current market structures affect trade? Numerous theoretical approaches have been developed and defined around these questions and tested empirically.

Classical Theory argues that uninterrupted free trade is beneficial to all trade partners. If countries focus on specializing in the production and export of those things they can produce with a lower opportunity cost relative to other countries and import those things that they are relatively higher cost (their comparative advantage), both are made better off. These transactions promote efficiency by international specialization and division of labour on which wealth is created (Smith, 1937).

There are several models that explain the factors that lead two countries to trade. In the Ricardian model a country's decision to import or produce domestically is determined by technological differences which determine their comparative advantage in the production. In Heckscher-Ohlin (HO/HOS) models (and essentially specific factors models also) trade flows are a result of countries exploiting their endowment differences, which then also determines the direction and magnitude of trade flows. For example, a country with the relatively larger endowment of labour will produce those goods that demand more labour in production.

In the new trade theory (Helpman and Krugman, 1985) the increasing-returns model explains how countries export as a means of expanding the market so that they can exploit increasing returns at an industry level. The conclusion is that multinational corporations are responsible for most of the trade rather than the "country" itself. If the firm can realize increasing returns in a particular production operation, there is motivation to expand output. They can only do so if the market exists. However, if the domestic market is small or saturated, the firm must look to move their output to another country. As the cost of information transfer falls and the expansion of multinational firms into new countries advances, the effectiveness of quickly marshalling resources to service and supply new demands increases and firms quickly respond to development incentives across the globe.

The new approach to trade also looks at the significance of other factors such as Foreign Direct Investment (FDI) as a form of international transaction that was ignored in the classical environment (Dunning, 1995). Instead of firms



physically shipping goods to a market, they will set up a facility right in the demand country so only monetary flows are observed.

The gravity model has been gaining in popularity as a model to study international trade. Although the empirical application has been standard for some time (since Tinbergen, 1962), the gravity model has more recently been refined to reveal its theoretical basis. The gravity model is a common methodology used to test hypotheses regarding the dynamic development of policy instruments, the type of questions addressed by this research. The gravity model can be considered as a condensed form general equilibrium analysis of supply and demand forces. It explains trade flows as a function of the relative sizes of the economies (demand characteristics – intermediate and final consumption), distance between markets (gravity effect), the presence and type of trade barriers, and other cultural and historical similarities and differences between markets (e.g. common language, colonies), the latter are known as the border effect. The approach borrows from physics where the ‘economy’ represents the gravitational force that pulls the product into the market. The closer and more open and transparent the economies, the higher the bilateral trade flow.

### **3.2 The Gravity Model**

The gravity model has its foundations as an instrument of analysis for regional economics. Researchers have been using the gravity model to predict movement of people, information, and commodities between cities, countries and even continents (Linnemann, 1966). In its usual application, the gravity model takes

into account at least the population size or GDP of two places and their intervening distance. The gravity model incorporates these two features that larger places attract people, ideas, and commodities more than smaller places, and that places closer together have a greater natural attraction for commerce. This model has proven reliable and has been found to have high explanatory power international trade models.

In its simplest form, the gravity model can be represented as:

$$X_{ijt} = R_{ij} \frac{Y_i Y_j}{D_{ij}^\theta} \quad (3.1)$$

The term  $X_{ijt}$  is the flow from origin  $i$  to destination  $j$  at certain time  $t$ . It is often described as the volumes of exchange called bilateral trade flow,

$$X_{ijt} = f(x_{ij}, x_{ji}), \quad (3.2)$$

where  $x_{ij}$  is the flow from country  $i$  to  $j$  and vice versa for  $x_{ji}$ .

$Y_i$  and  $Y_j$  are the sizes of the relevant exchanging countries measured in GDP or population,

$$Y_i f(GDP_i), \text{ and} \quad (3.3)$$

$$Y_j f(GDP_j). \quad (3.4)$$

$Y_i$  and  $Y_j$  are measures of economic mass or the ability to produce ( $Y_i$ ) and consume ( $Y_j$ ). The larger this ability, the larger the bilateral trade is predicted to be.

In equation (3.1),  $D_{ij}$  captures the “distance” between the locations. The economic significance is that distance is a proxy for transport costs, value of time in transit, coordination, logistics cost or search cost. Distance reflects the cost of doing

business in a distant country. These factors have an inverse relationship to trade flows.

$R_{ij}$  in equation (3.1) measures the remoteness of a particular country in that it captures the amount of opportunity one country has to trade with another country. A country with a high  $R_{ij}$  value will have few close neighbours. As such, they are more inclined to import more from a particular country they have established a relationship with because the search costs of locating a new trade partner becomes a deterrent. As a measure of  $R_{ij}$ , variables to capture familiarity and similarities between countries are included.

Although the gravity model in simplistic form does a reasonable job explaining bilateral trade patterns by controlling for size and distance, it has been refined by adding additional variables of interest. For example it has been refined to test the influence of variables pertaining to current and past policies, geography, common history and institutional arrangement such as STE to name a few (Rose, 2004).

The gravity model was first developed and used econometrically to describe trade flows by Jan Tinbergen (1962) even though the analysis and conclusions were strictly intuitive, rather than being theoretical grounded. Since then, the gravity model has been used extensively in the empirical trade literature. Despite its widespread use and repeated empirical validation, the theoretical basis of the gravity model has come into question since it tends to be derived from a physical geographical relationship rather than being based on differences in productivity, endowments or other traditional bases of international trade, as would be common

of theoretical trade models. The search for a theoretical basis for the gravity model is motivated in part by the striking empirical success of the model. However, the gravity model can be used in numerous trade theory contexts including monopolistic competition in the new trade theory (Helpman and Krugman 1985; Helpman, 1987) and variations of the classical Heckscher-Ohlin- Samuelson (HO/HOS) model (Bergstrand, 1985; Deardorff, 1995). Subsequent research has developed further to define the theoretical underpinnings of the gravity model, to complement its empirical success, thereby establishing the gravity model as a model of trade.

Anderson (1979) pioneered a theoretical construct to the gravity model. Anderson's model provides an explanation for the gravity model as it applies to commodity flows. The model is derived from a system of expenditure functions describing one country's expenditure on another country's product, using the Armington assumption that products are differentiable by country of origin. By assuming Cobb Douglas preferences, Anderson obtains a gravity model where imports of a particular commodity are a function of the share of income spent on imports and transit costs. In a very simple way, Anderson obtained a gravity model suitable for estimation and was able to link it to the theory through a convenient testable equation. This model allowed for variations in preference thereby allowing flexibility in the expenditure share between countries by varying the type of expenditure function assumed. In particular, the case of constant elasticity of substitution (CES) was also assumed and the gravity model was derived (Anderson 1979). Anderson's outcome suggests that after controlling for economic size of a country, a country whose barriers to trade are relatively high to all trade countries

will require a very strong bilateral relationship with at least one country to experience benefits of trade.

The gravity model is respected as a partial equilibrium model of export supply and import demand. The earlier derivations of the model were from a Marshallian demand system. Linnemann (1966) links the gravity model to a reduced form partial equilibrium system of equations of export supply and import demand that are driven by income and populations. Trade occurs because of the limited size of the origin country and the demand in the destination country (Linnemann 1966). Critics argue that the approach is weak and does not explain the multiplicative form because it uses too many variables for each partial equilibrium and cannot be reduced to the gravity model very easily. Further significant contributions were to extend the model so that world trade is attached to a probability distribution and interpreted as potential imports and exports (Leamer and Stern, 1970).

Using a CES utility function adds greater flexibility as do other assumptions about export and import demand as previously mentioned. As a case in point, Bergstrand (1985) offers a version of the gravity model that allows for different elasticities of substitution between imports and goods produced at home. This relates to the classical theory that differences in preferences affect trade. Bergstrand's outcome shows the importance of pre-specification of preferences because imported goods may not be close substitutes for those produced domestically (Bergstrand, 1985). This provides insight into the importance of the home market effect and extends further Anderson's choice of using Armington assumptions which holds that goods produced in different localities are not

necessarily perfect substitutes. Deardorff (1995) simplifies the analysis and makes a clear link to the HO models under two extreme cases of market structure or degrees of friction in trade from perfect competition to monopolistic competition. However he flags caution because the universal empirical success of the gravity model in validating the multiple trade theories may require further investigation.

There is a subsequent set of papers that deals with adding different variations to the gravity model in the context of New Trade Theory. This theoretical environment incorporates the concept of the firm level or industry level in international trade and how the gravity model is well suited to represent this perspective (Helpman & Krugman, 1985). The new trade theory focus allows for arguments such as economies of scale, particularly increasing return to scale (IRS) as additional explanation for why countries trade and why certain industries develop in some countries and not in others.

Bergstrand (1989) derives the gravity model by using the framework of monopolistic competition at the firm level. This removes the Armington assumption and allows for product differentiation among firms. This innovation was motivated by Krugman's (1985) insight on industry having internal economies that drive trade between countries as firms attempt to increase market share. This is particularly useful when considering the impact of a particular industry in an economy and the trade that occurs within an industry. In classical trade theory, the focus is on factor endowments and technology differences alone that causes trade between countries to occur. However, institutions affect the willingness to trade and have a direct impact on transaction costs. International competitiveness depends on other factors

like unobservable trade costs such a government policy. In the presence of unfavourable institutional arrangements like poor legal or governance systems the cost of exchange increases (de Groot et al. 2003). These factors and policy choices can also be accounted for in a gravity model specification and also incorporate marketing arrangements like the use of STEs.

### 3.3 The Basic Theoretical Setup

The Linnemann approach and further explanations by Leamer and Stern (1970) and Bergstrand (1985) of the gravity model as a system of excess demand and supply, provides a framework for representing flows of a single commodity among multiple countries in a gravity equation form. This research modifies the set of equations by Prentice et al (1998) who used a gravity model to look at trade flows of a single commodity between two countries.

Equilibrium is obtained when:

$$Q_i^X = Q_i^X(P_i^X, S_i^X) \quad (3.5)$$

$$Q_{ij}^I = Q_{ij}^I(P_i^I, S_i^I) \quad (3.6)$$

$$D_{ij} = D_{ij}(Q_{ij}^E, S_i^I, S_i^X) \quad (3.7)$$

$$Q_i^X = Q_{ij}^I = Q_{ij}^E \quad (3.8)$$

If:

$Q_i^X$  = the excess supply in country  $i$  for commodities consumed in country  $j$ ;

$Q_{ij}^I$  = the excess demand in country  $j$  for commodities produced in country  $i$ ;

$Q_{ij}^E$  = the market clearing quantity;

- $P_i^I$  = commodity price in import country;  
 $P_i^X$  = commodity price in export country;  
 $D_{ij}$  = transaction costs of moving a commodity into country  $j$  from  $i$ ;  
 $S_i^I$  = factors affecting supply and demand in import country  $i$ ; and  
 $S_i^X$  = factors affecting supply and demand in export country  $i$ .

Therefore the gravity model function can be represented in equilibrium by,

$$Q_{ijt}^E = Q(D_{ij}, S_{it}, S_{jt}) \quad (3.9)$$

where trade flow of the commodity from country  $i$  to  $j$  in period  $t$  ( $Q_{ijt}^E$ ) are a function the physical distance separating  $i$  from  $j$  representing transaction costs ( $F_{ij}$ ) and a collection of supply and demand shifters in the export ( $S_{it}$ ) and import ( $S_{jt}$ ) countries such as income, population, STE etc.

The reduced form of the equilibrium of excess supply and excess demand is represented as,

$$Q_{ij}^E = Q_{ij}^E(D_{ij}, S_i^I, S_i^X) \quad (3.10)$$

In equilibrium ( $Q_{ij}^E$ ), consumption quantities are a function of transportation/ transaction costs ( $D_{ij}$ ) and factors that shift supply and demand in the export ( $S_i^X$ ) and import ( $S_i^I$ ) countries.

Using just income  $Y_{it}^I$  and  $Y_{it}^X$  as the supply and demand factors (as observed in 3.1), the testable empirical specification of the gravity model is obtained by deriving equation (3.10) in its multiplicative form and taking the natural log of it the variables:



$$\ln Q_{ijt} = \beta_0 + \beta_1 \ln D_{ijt} + \beta_2 \ln Y_{it}^I + \beta_3 \ln Y_{it}^X + \beta_k \text{Geog}_{ij}, \quad (3.11)$$

where  $\text{Geog}_{ij}$  ( $R_{ij}$  in equation 3.1) is a matrix of factors capturing the context of country remoteness. This is the same outcome that one would obtain by taking the natural log of equation (3.1).

This simple gravity model can be expanded to include other influences on trade flows. McCallum (1995) shows the extent of the border effect, Rose (2004) capture the effect or lack of effect of the WTO and so on. Geographic distance is not the only barrier to trade and most of the literature includes other potential factors like language, tariffs, common history, etc. It is in the context of these additional explanatory variables that the impact of STEs can be tested. In addition to income, although it is a strong determinant of demand, variants like population can be added or substituted to achieve theoretical satisfaction.

The result is a equilibrium function of the gravity model that will look like

$$Q_{ijt}^E = f(\text{Economic}, \text{Geographic}, \text{Culture}, \text{History}) \quad (3.12)$$

where equilibrium trade flows are explained by a series of economic and non-economic features from both trading partners that capture the ability to produce and consume. Factors that possibly promote trade like common cultural similarities and similar historical relationships, plus factors that inhibit such as remoteness, geographical difficulties and policy choices of which STEs are an example.

## CHAPTER IV

### EMPIRICAL MODEL

#### 4.1 Empirical Gravity Model Applications

The hypothesised relationship between trade flows and state trading enterprises (STE), as well as other explanatory variables are commonly tested using a gravity model specification. The gravity model is most often been applied for aggregate trade. The model has been used to estimate the impact of national borders (MaCallum, 1995; Furtan and van Melle, 2004). MaCallum's (1995) study showed that the border was indeed important despite the trade agreements that are designed to mitigate its effect (McCallum, 1995). He found that there still exists a significant home market bias in Canada. It has been shown that the composition of goods can significantly affect the results in the context of border effects matters (Hillberry, 2002). Once controlling for the traditional gravity features and eliminating aggregation bias, Hillberry (2002) demonstrated that the border effects are somewhat reduced from McCallums (1995) results. This lends support for strong results from a gravity model that would be disaggregated by commodity.

Furtan and van Melle (2004) tested for the border effect on a group of agricultural products traded between Canada and the U.S. and found significant

border restriction despite regional trade agreements like CUSTA. The gravity model has also been used to examine the relationship between economic growth and increases in trading activity with the result that trade was found to have a significant positive impact on regional income growth (Frankel and Romer, 1999). The gravity models have been used to test for the home market effect within OECD countries; even with many regional trade agreement controls a home bias effect was present though it was found to be decreasing in the period from 1982-1994 (Wei, 1996).

A commonly held understanding in the trade literature is that barriers to trade such as tariffs are welfare reducing. From this proposition one should believe that membership in a trade agreement whose goal is reduction and elimination of such barriers would promote trade. Rose (2004) uses the gravity model to test whether being a member of the WTO, and its precursor the GATT, has a beneficial effect by increasing trade between member countries. There were no comprehensive empirical models testing the beneficial assumption prior to his study. The results cast doubt on the significance of membership in the WTO on trade flows and that there is little evidence to suggest that the pattern of trade is different when a country joins or is a member of WTO (Rose, 2004). Rose points out that there may be other reasons that a country would wish to be a part of this organization. These could range from security to dispute settlement mechanisms.

Following Rose, it is important to note that by empirically including country specific fixed effects<sup>2</sup>, the gravity model the results show benefits to being a part of the WTO in terms of increased bilateral trade flows, but unevenly (Subramanian and Wei, 2003). The fixed effect component is an important econometric specification in large samples. The fixed effect absorbs the idiosyncratic error component specific to a particular importer, exporter or trade pair. By including the fixed effect the model will likely suffer less from omitted variables as the fixed effect will include all the invariant omitted variables. This underlines the importance of sound econometric specification and correctly interpreting the situation that is being studied. The Subramanian and Wei study creates variables for WTO membership based on developed versus developing countries. By including this differentiation, the effect of WTO membership is observed to be positive and significant in developed countries and but insignificant in developing countries

In comparison to the results estimated by Rose, the country fixed effect results suggest that some countries that became members over the period included in the study have experienced increases in trade. The results from Rose show the overall impact of all countries during the study period to be insignificant. This result relies on the assumption that countries received the same impact as a member of the WTO irrespective of when they might have joined, which is somewhat misrepresentative.

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<sup>2</sup> The construction of the fixed effect variables was a dummy variable for when country i exporter and a dummy for when country j was an importer.

The study by Rose focuses on the impact of institutions like the WTO on trade flows. These institutions can be trade facilitators or barriers. The gravity model also has been extended to test the impacts of institutional characteristics on trade such as political stability, the quality of governance and the similarities between regulatory structures (de Groot et al., 2003). This model tested trade value between approximately 100 countries in 1998 use the standard gravity model variables plus six institutional proxies for governance ranging from accountability, rule of law and control of corruption. As hypothesised, the more open, accountable and less corrupt the economy is, the higher is the bilateral trade. In sum, these extensions were an attempt to further analyse transaction costs, finding that the presence of strong institutions, higher bilateral trade is evident.

These applications support the ability of the gravity model to capture the impact of institutions and marketing systems like STEs. With proper model specification and incorporating the STE used in the international wheat market, the gravity model can provide useful results.

#### **4.2 Commodity Specific Gravity Model**

While gravity models have most often been applied to aggregate bilateral trade, several studies have used the gravity model to study commodity specific trade flows. A gravity model was used to analyse the Canadian pork exports to the U.S. to derive an interregional commodity specific trade model (Prentice et al. 1998). This analysis is done in a one commodity multi country world, searching for potential U.S. markets for Canadian pork. The gravity model was used to represent the

derived demand for transportation as a result of the export potential of the specific commodity. Prentice found that Canadian pork is a normal good in the U.S. and that Canadian exports are significantly impacted by U.S. pork production. Their results offer the most promising U.S. import locations for Canadian pork from the 5 different production regions.

The gravity model has also been used to explore the determinants of trade for specific products defined at the 8-10 digit SITC-level in a Tobit specification with fixed effects (Aguilar, 2006). Specifically, Aguilar determined which countries had the greatest export potential of frozen tart cherries (FTC) to a particular country based on historical differences from the mean trade in FTC. Their findings are quite specific to each country in the study based on the specification required. They conclude that FTCs are normal goods and one of key factors of export potential would be if the importer had previously purchased from the exporter.

The gravity model has also been used to study the impact of trade promoting policies for the world wheat market (Koo & Karemera, 1991). Although fixed effects were most appropriate, Koo and Karemera considered both fixed effects and random effects<sup>3</sup> models to estimate wheat trade volumes from nine exporters to 34 importers from 1981 to 1987. Their study found that long term agreements and credit sales were most distortionary to the international wheat trade. Interestingly, the use of the Export Enhancement Program was found to be a less

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<sup>3</sup> Random Effects – The random effects is a estimation where the unobserved effects is assumed to be uncorrelated with the explanatory variables at each time.

effective trade enhancement policy. It was found that protectionist policies like the level of domestic price support by importers tend to inhibit wheat trade.

In the case of analysing the impact of a STE, the gravity model offers a means of capturing the effects of market conditions namely supply and demand, in addition to specific institutional arrangements and policy choices. The research outlined above demonstrates the utility of the gravity model approach for the objective set in this research.

### **4.3 Model Specification**

The gravity model used in this study will include the theoretical gravity components, a number of additional variables to add to the explanatory power of the model, and variables to test our hypothesis surrounding the use of STEs. In using the gravity model for the study of a particular commodity, several adjustments are required. Most gravity models look at the total value or volume of trade that occurs between trade pairs. This is acceptable if direction is not important for the hypothesis variables. However, in the model required for the current research, a country can be an importer and/or an exporter with a STE managing either/both sides of the transactions. This requires the model to keep the economic explanatory variables separate. Although the fundamental characteristics of the gravity model are the same, some differences are introduced in attempt to have a specification that is more tailored to represent a particular commodity or classification of goods, rather than the economy as a whole. Consistent with the traditional gravity model,

the economic explanatory variables are expressed as natural logs. The gravity model specification for this analysis is the following:

$$\begin{aligned} \ln(X_{ijt}) = & \beta_0 + \beta_1 \ln(agY_{it}) + \beta_2 \ln(Y_{jt}) + \beta_6 \ln(dist_{ij}) + \beta_7 landl_i + \beta_8 island_i + \beta_9 landl_j \\ & + \beta_{10} island_j + \beta_{11} border_{ij} + \beta_{12} comlang_{ij} + \beta_{13} comcol_{ij} + \beta_{14} colony_{ij} + \beta_{15} curcol_{ij} \\ & + \beta_{16} fta_{ijt} + \beta_{17} wto_{ijt} + \beta_{18} cu_{ijt} + \beta_{19} STEx_{it} + \beta_{20} STExM_{it} + \beta_{21} STEi_{jt} + \beta_{22} STEiM_{jt} + \sum_k \lambda_k T_{tk} + \varepsilon_{ijt} \end{aligned} \quad (4.1)$$

where  $i$  is the exporting country and  $j$  is the importing country of the trade transaction and  $t$  is the time period. The other variables are:

- $X_{ij}$  denotes the export value (volume) of wheat exports from country  $i$  to  $j$  at time  $t$ ;
- $agY_i$  is the value of agriculture GDP in the export country;
- $Y_j$  is real GDP in the import country;
- $landl$  is a binary which is unity if a country is landlocked;
- $island$  is a binary which is unity if a country is an island;
- $dist$  is the distance in km between  $i$  and  $j$ ;
- $border$  is a binary which is unity if  $i$  and  $j$  share a land border;
- $comlang$  is a binary which is unity if  $i$  and  $j$  have a common language;
- $comcol$  is a binary which is unity if  $i$  and  $j$  were ever colonies after 1945 with the same colonizer;
- $colony$  is a binary which is unity if  $i$  ever colonized  $j$  or *vice versa*;
- $curcol$  is a binary which is unity if  $i$  is a colony of  $j$  at time  $t$  or *vice versa*;
- $fta$  is a binary variable which is unity if  $i$  and  $j$  both belong to the same regional trade agreement;
- $wto$  is a binary which is unity if both  $i$  and  $j$  are GATT/WTO members at  $t$ ;
- $cu$  is a binary which is unity if  $i$  and  $j$  use the same currency at time  $t$ ;
- $STEx$  is a binary which is unity if the country has a State trading exporter;
- $STExM$  is a binary which is unity if the country's STE exporter is a monopoly;



- $STE_i$  is a binary which is unity if the country has a State trading importer;
- $STE_{iM}$  is a binary which is unity if the country's STE importer is a monopoly;
- $T_t$  is a set of year dummies; and
- $\varepsilon_{ijt}$  is the stochastic error.

The terms in equation (4.1) are more thoroughly defined, described and sourced in appendix Table A1.1.

Recall that the gravity model is a reduced form model for simultaneously analyzing supply and demand. The regression analysis variables can be categorized into four groupings to capture the characteristic of supply, demand, geographical constraints and trade facilitation factors.

This model uses the exporting country's value of agriculture ( $agY_i$ ) in their national accounts to capture the ability of the country to produce agriculture products. This is a proxy for the export country's supply of wheat. This is consistent with Koo and Karemera (1991) who found that agriculture sector income is the correct specification for export capacity. Gravity models estimating aggregate (all commodities) trade flows commonly use the export country's GDP as a proxy for productive capacity. This would be an inappropriate specification for single commodity analysis. The agriculture ( $agY_i$ ) variable is expected have a positive influence on the value of wheat exports. Consistent with theory, the importing country's GDP in constant dollars ( $Y_j$ ) is included to reflect the purchasing power and thus the demand for wheat in the importing country. Assuming wheat is a

normal good, the greater the GDP in the importing country the greater the demand for wheat is expected to be, and thus the greater the value of imports.

Distance ( $dist_{ij}$ ) is included as a proxy for transportation cost and is expected to exhibit a negative relationship. It is important to note that for trade in bulk commodities like wheat we would expect transportation costs to exert a significant influence as they are typically a non trivial proportion of the total cost of the product. However, given the high fixed costs of transporting a bulk commodity such as port and loading costs, there could be a non linear relationship between trade value and transportation cost. A further consideration is the relationship between the exporter and importer's agronomic conditions. Nearby countries may experience very similarly conducive conditions for producing wheat and may not be likely trading partners. More distant countries may be less likely to produce the same commodities and thus be more likely to be trading partners. This expected net effect of distance is ambiguous. Koo and Karemera (1991) found distance to be insignificant and argue that it was because of non-homothetic preferences in the import country that can also influence the ambiguity.

Other variables that describe if the country is landlocked (*landl*) or an island (*island*) are included to capture other logistical and transportation constraints or advantages. If a country is landlocked it requires service by railroad or by large truck to move wheat into the consumption area or out of the production country. This is relatively expensive for low value commodities. This would be reflected as lower return to the exporting country which in turn would lower the value of their exports because of the higher price need to compensate the cost of transportation.

However, some countries have or have had programs that cover some of the cost incurred because of the natural disadvantages.

The fact that a country is an island has interesting consequences. Typically the islands are small and heavily dependent on imports. If this characterization of the import island is true we would expect this to have a positive impact on the value of imports. However, many of the island countries in our sample are yet developing and lack the infrastructure to receive large bulk shipments by ocean freight. This then likely lowers the value of exports to the country. If the export country is an island this lowers the cost of any geographic barriers because transporting bulk product by water has a lower cost and would likely be reflected as a positive influence on the value of exports from that country. The result is an ambiguous expectation. These variables are included to capture transportation and other logistic cost where the typical transportation proxy of distance by itself is ambiguous.

A variable is included to note if the trade pair shares a common border ( $border_{ij}$ ). The border affect is most interesting in interregional trade analysis with trade occurring between regions within a country and also between country pairs. When the importing country share the border with the exporting country it is reasonable to think that the import country would find it more convenient and less costly to procure wheat supplies than in the absence of a common border.

Whether or not the trading countries share a common language ( $comlang_{ij}$ ) is controlled for. This is important because being able to communicate in a common language eases the transaction. Thus, it is expected that having a common language is will have a positive effect. Also included are variables describing past and current

colonial relationships ( $comcol_{ij}$ ,  $colony_{ij}$ ,  $curcol_{ij}$ ). These are included to reflect the benefits some parent countries extend to the colonies, which may extend even after the nation becomes independent from the colonizing country. Two countries that share the same colonizing nation may also experience a common bond that may help facilitate trade. However, these historical colonial relationships can also potentially capture some post colonial animosity; thus resulting in a negative effect. There is no clear a priori expectation with regard to the colonial effects.

This model includes information about whether or not the country pair shares a regional trade agreement. The selected regional trade agreements ( $fta_{ij}$ ) are used to capture the advantageous elements that helps facilitate and promote trade between countries as specified in the objective of the agreement. The agreements controlled for are European Union/ European Community (EU/EC), Caribbean Community (CARICOM), Central American Common Market (CACM), Association of South East Asian Nations (ASEAN), South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA), Southern Common Market (Mercosur), and North American Free Trade Agreement (NAFTA). Table 4.1 briefly outlines the number of countries and the year in which the agreements were found. Not all the members in 2005 were necessarily founding members but overtime the countries have joined. In some circumstances, a country may only be an associate member resulting in only selected benefits from the trade agreement. Also in the case of CACM, the trade agreement was operationally ineffective from 1969 to 1991, but has since been revived. Membership in a regional trade

agreement is expected to have a positive impact on trade between member countries.

Table 4.1: Regional Trade Agreement Information Table

Regional Trade Agreement	# of Member Countries in 2005	Year of Foundation
EU/EC	25	1957
CARICOM	20 *(5 of these assoc. members)	1973
CACM	5	1960* ('69 to 91')
ASEAN	13	1967
SPARTECA	15	1980
Mercosur	10 *(5 of these assoc. members)	1991
NAFTA	3	1994

Source: Specific Agreements Website

The World Trade Organization (WTO) facilitates the development and enforcement of international rules of trade. The objective of the organization is to improve the welfare of its membership through the lowering of barriers to trade. This is the only large scale multilateral international organization that deals with trade rules between all countries. The WTO provides a venue for universal commitment by member countries to follow the agreed rules in a transparent way, without discrimination, with reciprocity while ensuring domestic security. Being a member of the WTO captures the legal commitment to which countries are bound by with respect to offering domestic support or protection to their industries. Prior to the WTO, the General Agreement on Tariffs and Trade (GATT) was the only multilateral agreement for international trade and it was in the GATT where the regulatory article on the use of STE was first negotiated. Being a member of the WTO/GATT ( $wto_{ij}$ ) is expected to have a positive impact on trade between member countries.

A currency union ( $cu_{ij}$ ) is when countries share a common currency. Most often it is argued that a sharing a common currency facilitates international trade by reducing exchange rate risk and fiscal policy shocks (Mundell, R. 1961). As a result, the fact that two countries have the same currency is believed to have a positive impact on the value of wheat trade.

Finally, the hypotheses variables in this study are the presence and status of STEs. This model uses a combination of binary variables to control for STEs. As mentioned in Chapter II, there are many concerns outlined in the literature with regard to the use of STEs. These range from trade distortion effects to non competitive domestic industries to obstructionist objectives of the STE. However, in the absence of a legislative article granting monopoly status to a STE, it is assumed that the STE would have to act like any other competitive firm. Thus, the primary distinction is that, whether it is a monopolist because of exclusive privileges.

The STE variables are constructed in two parts. First a binary variable used to indicate if the country has a STE exporter ( $STEx$ ). Secondly, an additional variable is used to indicate if that STE exporter is granted monopoly status ( $STExM$ ). Also, the variables capturing the effect of an import STE is designed in a similar fashion. First, if the country has a STE importer ( $STEi$ ) the dummy variable takes a value of one and if that STE is granted monopoly status ( $STEiM$ ), the additional dummy variable takes a value of one.

The presence of a STE may exist as a trade facilitation policy for either or both the exporter an importer. However, these agencies have been suspected as an instrument to gain an unfair advantage for exports or as protectionist policy by

importers as hypothesized in the beginning. It is expected that the import STE with monopoly status will have a negative impact and that the monopoly status exporter would be positive.

#### **4.4 Data**

The dependant variable, both trade value and volume of wheat exports from one country to another, are from the United Nations Commodity Trade Statistics Database (UN Comtrade, 2006). Specifically, the product is wheat except durum wheat, and meslin, unmilled (SITC Rev.1- 0410). These data show bilateral wheat trade between 180 countries for the past 35 year from 1970 to 2005. The values are converted from current US dollars to constant (1990) U.S. dollars using the deflator from the UN National Accounts database. The observations are records that the reporting country (export country) provides of their exports to each partner country (import country). Only the exports are chosen to avoid double accounting of using both imports and exports since the imports into a country are already recorded as the export to that country. In this dataset there are countries that are both exporters and importers of wheat. In some years a country may have a surplus inventory and is then in an export position. This initially resulted in 21,453 wheat trade observations over the 35 years. Further cleaning of the data was required and below is the list information of these observations eliminated form the data set:

- Trade Volume observations  $< 1$  MT (1000 KG);
- Trade Value observations  $\leq 0$ ;
- Constant dollar unit price range of  $20 < \text{Con}\$/\text{MT} < 1500$ ;

- Observations where reporting country was the same as partner country;
- Regional Aggregations (i.e. European Union, Americas, Custom Unions, Free Zones); and
- Several small countries without independent variable observations (approx. < 1% of the trade over the past 35 years).

Once accounting for these deletions there are 19,691 dependant variable observations.

Information for the explanatory variables is then joined to this core wheat trade data. This was done by using Microsoft's Excel, Access and Sequel Server programs. Data for the variables GDP and agriculture GDP are obtained from the UN National Accounts Main Aggregates Database and are recorded in constant (1990) US dollars. The geographical and colonial variables landl, island, dist, border, comlang, comcol, colony, and curcol are obtained from Andrew Rose's Dataset (Rose, 2006) and updates were obtained from the CIA World Factbook (CIA, 2006). Missing distance information is obtained from distance between capital cities and is recorded in kilometers (Geobytes, 2006)

The information on the presence of a regional trade agreement, WTO membership and the currency union membership are from Andrew Rose's Dataset. Often once a country is part of an agreement they will always be a member. However, this is not always the case. Updates on membership are obtained from the trade agreements websites and from the WTO websites.

The original data contribution is the information on STE. Table (4.2) outlines the countries in this study that use STE importer and/or exporters. This



information has been put together after extensively analyzing the literature and from WTO notification of STE forms. The information on STE importers was obtained from McCorrison and McLaren (2001) book on the use of STE in Agriculture and from Abbott and Young (1999) paper on STE importers where they had collected information on the countries that use a STE importer. As part of the WTO regulation on STEs, member countries must notify the WTO on the use of their STE. Much of the information obtained from previous research was checked against the WTO notification archives (Standford, 2006). To determine if the STE has monopoly status was obtained in the same way. The notification documentation used by member countries is in the appendix on page 96. The bulk of the information on STE exporters was obtained from McCorrison and McLaren (2001) and notification documentation at the WTO (WTO, 2006).

Table 4.2: Changes regarding the Use of Wheat STEs from 1970 to 2005

	STE Exporter	Export Monopoly	STE Importer	Import Monopoly
# of STE in 1970	14	9	67	44
started	2	---	2	1
quit	5	2	35	22
Status Change	---	-1	---	-6
# of STE in 2005	11	6	34	16
# of obs. out of 19,691	37.34 % (7,352)	17.47 % (3,441)	35.62 % (7,015)	26.08 % (5,136)
% of Value	67.94 %	27.01 %	51.33 %	41.25 %
% of Volume	67.41 %	27.60 %	54.53 %	46.05 %

A full description of the variables, their sources, mean and standard deviations are included in Appendix Table A1.1.

## **4.5 Estimation Techniques**

### **4.5.1 Panel Data**

Data is commonly studied on a single dimension of either cross sectional data (a set of variables describing a population at a particular time) or time series (a set of variables describing a population over time). However, if appropriate, data can be merged to create a panel data set that captures the affect of changes in cross sectional attributes over time (Wooldridge, 2000). This can especially strengthen the analysis of a policy choice, like the impact of STEs over time.

Panel data has appealing features in econometric analysis. One can control the immeasurable uniqueness of individual cross sectional units. This is important because it isolates cross sectional heterogeneity that is not observed in single dimension data analysis that would have caused perfect collinearity. Panel data captures more variability within variables, and reduces multicollinearity problems. Simultaneously, panel data can analyze the effects of time variant factors like agriculture productivity and cross sectional features like the use of STE to provide strong empirical results (Wooldridge, 2000; Kennedy, 2003).

### **4.5.2 Unbalanced Panel Data**

In most panel analysis the data is a balanced panel. This means that at each time period the same cross sectional units are observed. However, the nature of the dependent variable in this study is such that a trade between the same country pair is not always observed at each time interval. This may be because the transaction has

gone unreported or that it has not occurred. Only the observations for which non-zero trades were observed are included. The result of this is an unbalanced panel with different number of observations for each year. It is important to understand why the panel is unbalanced. If the reason the cross sectional unit is unobserved is correlated with the idiosyncratic error there is a problem of attrition which can bias the estimates (Wooldridge, 2000).

The reason no trade occurs in a particular year is likely a result of either excess supply in the import country or lack of exports from the export country. The particular reason for this could be a result of numerous causes from production factors to labour strike at a shipping point. However, these incidents would be particular to that specific period or time and once controlling for the uniqueness of each period with time dummies. It is anticipated that the reason trade between a particular trading pair in a certain year is not correlated with those unobserved factors that change over time in the period fixed effects. There is no reason to suspect attrition bias in the coefficient estimates from the unbalanced panel dataset.

### **4.5.3 Panel Data Estimation**

There are numerous means of obtaining estimates for panel data. Each method of estimation is a variation to the traditional estimating technique Ordinary Least Squares (OLS). They have been developed to deal with an array of statistical issues. The analysis of panel data can be more problematic than pure cross sectional because observations are usually not independent when analyzed over time. There are several reasons for violation of the standard OLS assumptions. First there is a

chance of serial correlation, where the errors can be correlated from one time period to the next. For example, countries often trade with the some of the same countries overtime. There is likely some unexplained relationship remaining from one period to the next. Incorporating two way fixed effects helps to reduce this problem. Second is the problem of heteroskedasticity, where the error could have different variances across different cross sectional units. There could be greater variance in the error because some observation will reflect a greater range wheat demand for greater income spreads. Also errors can also be correlated across units because of exogenous macro effects that affect all units. This is known as contemporaneous correlation of errors or spatial autocorrelation. Finally, there could be a joint problem of errors that are non-spherical meaning that the model suffers from both heteroskedastic and auto correlated errors at the same time (Wooldridge, 2002). The following sections describe the estimation methodologies used in this study.

#### Pooled Ordinary Least Squares (POLS)

The POLS estimate is traditional OLS procedure on the panel data set. The model in equation (4.2) represents the POLS model.

$$y_{it} = \alpha + x_{it}\beta + v_{it} \tag{4.2}$$

Where  $i$  denotes the particular country, firm or transaction relationship and  $t$  identifies the time period. Equation (4.3) depicts the composite error term as  $v_{it}$ .

The composite error can be described in the following manner,

$$v_{it} = \alpha_i + u_{it} \tag{4.3}$$

where  $a_i$  are all those unobserved time invariant factors and  $u_{it}$  is the idiosyncratic error that represents the unobserved factors that affect the dependent variable and are time variant. If the model is completely specified, heterogeneity bias from omitted time constant variables is not an issue and one can assume  $a_i=0$  (Wooldridge, 2002). In this research it is difficult to control for some feature like land characteristics that are constant over time but are an important component of production. The fixed effects can account for such things like the temperate and arable land availability. In large panel data sets there is likely much unidentified noise in the error that is due to some particular event or shock that was specific to that time period are even trade relationship. For this intuitive rational, this is an unrealistic assumption. For this reason, it is most likely to require some correction to these significant effects and for this the fixed effects addition is included.

#### Fixed Effects (FE)

The fixed effects model allows for estimation in the presence of unobserved effects that are common with panel data. Specifically, this estimator is used to control the effects of unobserved heterogeneity. One straight forward technique to account for the fixed effect is to use dummy variable for each panel. However, this will remove one degree of freedom for each country trade pair. Another technique to remove the constant fixed effect from the process is to take differences each observation from its unit specific mean. By applying the fixed effects transformation to equation (4.4) one derives

$$(y_{it} - \bar{y}_i) = \beta_1(x_{it} - \bar{x}_i) + (u_{it} - \bar{u}_i) \quad (4.4)$$

This removes the time invariant  $a_i$  from equation (4.3). The fixed effect estimation is robust with an unbalanced panel (Wooldridge, 2000).

#### **4.5.4 Estimator Selection and Econometric Diagnostics**

There are several empirical considerations in assembling and using panel data. One concern in this model is the high risk of endogeneity. Researchers have taken two general approaches to this problem. The first and most simple way is to accept its presence and interpret the results with caution. The second way is to deal with it through an array of statistical techniques. The source of endogeneity in this model is a result of reverse causality. In brief, this describes a situation where the dependent variable may be driving or create the causal effect for the independent variable. In this model it is conceivable that STEs can be created because they are responding to high/low trade flow patterns. The historical discussion surrounding the reason countries started using STEs explain their presence as a result of a war time policy, domestic stabilization and not necessarily because of existing low exports or high imports. As a result endogeneity is not considered a critical problem because the stated rationale for the creation and use of STEs. In the fixed effects model, it is even less likely because these motivations are capture in the fixed effects. Further descriptive evidence appears later in the result section based on the coefficient estimates.

There are numerous hypothesis tests to determine the appropriate estimation technique. There are several techniques in estimating panel data. Some are the pooled OLS, fixed effects, random effects and between effects. As earlier mention,

the FE estimation is most appropriate when one cannot distinguish between observed versus unobserved heterogeneity. The fixed effects model can be used to control for unmeasured or unobservable heterogeneity. The F test gives insight with regard to using the POLS over the fixed effects and in essence tests for the presence of a fixed effect within the data. The F test is a way of determining whether the POLS estimates ( $\beta_{\text{POLS}}$ ) are equal to the coefficient estimates from the fixed effects ( $\beta_{\text{FE}}$ ). Failure to accept the null suggests that the fixed effect specification is the most appropriate (Baltagi, 2001; Edgerton, 2004). This means that one cannot assume that coefficient estimates over one group are equal to those estimates over another group.

If the F test suggests the presence of a fixed effect, there is a test to determine if the random effect estimator is more appropriate than the fixed effect. The Hausman test is an acceptable procedure to test this hypothesis. The essence of this test is to determine if the coefficient estimates are systematic or not. If the error component  $a_i$  is safely assumed to be uncorrelated with the explanatory variable, the uses of random effects are the most appropriate. If not, then the fixed effects are used to eliminate the time invariant error component.

When the variance of the error term is not constant there is heteroskedasticity. To test for heteroskedasticity in panel data, a likelihood ratio test is used to compare generalized least squares (GLS) output from a restricted model specified to have heteroskedasticity with the unrestricted model. In gravity

models there is a robust<sup>4</sup> command and the cluster<sup>5</sup> command which specifies that the observations are independent across country pairs but not necessarily independent within groups. These correction are used to produce robust standard errors.

In econometric analysis it is important to analyse the behaviour of the residuals. Correlation in the error can come from both components of the error term described in equation (4.3). Wooldridge (2002) outlines a procedure for testing for serial correlation for panel data. The test is a regression of the residuals on the explanatory variables and the lag of the residuals to see if there is an inter-temporal relationship within the error term. In gravity models, the correction for serial correlation occurs by obtaining robust standard errors.

Another testing procedure for autocorrelation is somewhat different because of the time demeaned data. This test requires residual analysis to test to see if there is a relationship between the errors from one period to the next (Wooldridge, 2002). The correction for serial correlation in the fixed effect model that fits the panel regression model when the disturbance term is first-order autoregressive is the xtregar estimator in Stata. This estimator provides a specific correction to error  $u_{it}$  from equation (4.4).

$$u_{it} = \rho * u_{i,t-1} + z_{it} \tag{4.4}$$

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<sup>4</sup> Robust – The robust option is used to estimating the standard errors using the Huber-White Sandwich Estimators.

<sup>5</sup> Cluster – The cluster option is used to indicate that the observations are clustered into regions (based on country pairs) and that the observations may be correlated within districts, but would be independent between districts.



where  $\rho$  is less than 1 and  $z_{it}$  is independent and identically distributed (iid) with zero mean zero and variance  $\sigma_z^2$ .

The models were estimated using Stata with corrections to deal with the presence of heteroskedasticity and serial correlation. The model was first estimated using Pooled OLS. Testing this model revealed that the country pair specific effect was important. These results provide a useful benchmark for comparing the general effect to the fixed effects correction as the results are not biased but may not be minimum variance. The tests indicated that the random effects correction was not the correct specification for the individual trade pair effect.

## **CHAPTER V**

### **RESULTS**

In this chapter selected results of the gravity model estimations are presented. The chapter begins with a brief description of the pooled OLS specification, followed by the preferred fixed effects model. Sub samples results are presented to test the robustness of the main finding to specific examples. As a preview of the main findings, the significant impacts from STE exporters in the international wheat trade are not a result of having monopoly status. STE importers have no significant effect on the value of trade regardless of having monopoly status or not.

#### **5.1 Pooled Ordinary Least Squares Results**

The Pooled Ordinary Least Squares (POLS) results are presented in some detail below for comparative purposes even though the specification is subsequently refined to incorporate the fixed effects. Traditionally, POLS has been the common specification for many of the assessments of trade relationships using the gravity model. The results here are discussed in this context.

The POLS models were estimated using Stata and were corrected for serial correlation and heteroskedasticity using cluster and robust corrections (Farid

Toubal, 2006). The previous chapter outlined the test used to detect the problems of autocorrelation and heteroskedasticity. Test for their presence indicated the presence of both.

The test for heteroskedasticity uses the likelihood ratio tests and indicates there to be a problem. Since the LR  $\chi^2$  test statistic is -7646.2, there is no confidence level at which the unrestricted model without heteroskedasticity is acceptable, thus we conclude that the presence of heteroskedasticity exists. This is the basis for incorporating the correction for heteroskedasticity.

A procedure for testing for serial correlation for a panel dataset was developed by Wooldridge (2002).

$H_0$ : No 1<sup>st</sup> Order Autocorrelation

$H_a$ : 1<sup>st</sup> Order Autocorrelation

Reject  $H_0$  if  $F_{\text{Calculated}} > F_{\text{Critical}}$

Since  $F_{\text{Calculated}} = 150.37$ ,  $F_{\text{Critical}} = 3.84$  and the probability that  $F_{\text{Critical}}$  is greater than  $F_{\text{Calculated}}$  is zero, we fail to accept the null hypothesis that there is no serial correlation in the error. Estimating a regression of the residuals on the explanatory variables and the lag of the residuals also suggests significant serial correlation. In this case the test is a basic t-test to examine if the coefficient on the lagged residual is zero. The result was a coefficient estimate of 0.7065 and t statistic of 126.99 indicating positive serial correlation. Thus, the model estimates are corrected for serial correlation.

The full results of the POLS are outlined in Table 5.1. Columns 1 and 4 are a list of the explanatory variables used in the regression equation (4.1). The results

from estimating the equation using OLS are reported in columns 2 and 5 and parallel to the POLS estimates are the fixed effects results in columns 3 and 6. In general, the model produces results that for the most part are consistent with the expected relationships. There are two variables, distance and WTO membership, where the results are unexpected. In Table 5.1 the coefficients for each variable are shown with the t-statistics provided in parenthesis below the coefficient. The coefficient estimates that are statistically significant at the 5% or greater significance level are shown in **bold**.

Table 5.1 : Empirical Results for Estimated Determinants of Real Value of Wheat Trade between Country Pairs, 1970 - 2005

1 Variable	2 Pooled-OLS Model	3 Fixed Effects Model	4 Variable List, contd	5 Pooled-OLS Model, contd	6 Fixed Effects Model, contd
$agY_i$	<b>0.346</b> (9.920)	<b>0.059</b> (2.17)	$fta_{ij}$	<b>1.663</b> (7.790)	<b>0.797</b> (5.96)
$Y_j$	<b>0.102</b> (3.050)	<b>-0.075</b> (-1.67)	$wto_{ij}$	<b>-0.453</b> (-4.300)	<b>0.22</b> (1.86)
$dist$	<b>0.311</b> (4.230)	d	$cu_{ij}$	-0.186 (-0.470)	d
$landl_i$	<b>-0.432</b> (-2.020)	d	$STEx$	<b>1.739</b> (10.220)	<b>0.649</b> (3.17)
$landl_j$	<b>-0.806</b> (-4.790)	d	$STExM$	-0.133 (-0.660)	-0.444 (-1.26)
$island_i$	<b>-0.502</b> (-1.670)	d	$STExi$	0.084 (0.530)	-0.064 (-0.37)
$island_j$	<b>-0.931</b> (-3.730)	d	$STExiM$	<b>0.996</b> (6.040)	0.059 (0.31)
$border$	<b>0.537</b> (2.230)	d	$cons$	0.623 (0.490)	2.5767 (42.36)
$comcol$	-0.106 (-0.520)	d	N	<b>19,691</b>	<b>16,792</b>
$comlang$	-0.042 (-0.270)	d	Adj Rsq	0.242	
$colony$	<b>0.849</b> (2.780)	d	Within Rsq		0.328
$curcol$	-0.557 (-0.580)	d			

Source: Author's Estimates

Table 5.1 provides the coefficient estimates of each variable for the POLS model. Following is a brief synopsis of those results. As expected, the coefficient on agriculture value-added ( $agY_i$ ) in the exporting country was positive and significant. This indicates that as the productive capacity of the agriculture industry rises, so does the value of wheat exports from that country. This is an expected result, as the productivity and the ability of a county to produce increases so to do there exports. It is, of course, the case that the value added component of agriculture in some countries will not include any wheat exports. However, as a broad proxy for the ability to produce wheat, the variable has the expected sign and is strongly significant. Also, the GDP proxy for demand ( $Y_j$ ) in the importing country is positive and significant. This indicates that the levels of exports into that country rise as the importing country's GDP increases. This indicates that wheat is a normal good.

The estimated coefficients suggest that distance ( $dist$ ) is positive and significant. In most gravity models distance exerts a negative influence, though there are other circumstance where the negative result for distance would be a surprising result (Melitz, J, 2006). One potential explanation for the positive and significant effect would be that countries close together might experience a more similar climatic seasonal weather pattern or agronomic growing conditions. Thus, in the event of a drought on one side of the world the farther you are away the more need you have for trade. Countries close to one another are more likely to grow the same crops because of the similar growing conditions. Because of this, they are

more likely to trade with more distant countries that are agronomically different. These factors can thereby result in a positive coefficient on distance.

It would appear that geographical features that describe a country are of importance to the value of exports between two countries. If either the exporter or the importer is a landlocked (*landl<sub>i or j</sub>*) country the results indicate that this represents an additional geographical barrier to overcome, namely moving imports or exports across land from ocean sea port. This barrier adds cost to the acquiring the product thereby reducing the value of the export countries product. These coefficients of the landlocked variables capture an important influence and are both negative and significant. If the export country is an island (*island<sub>i</sub>*) and if, the export country is exporting to an island (*island<sub>j</sub>*) the impact on the value of their exports is negative.

If a country is exporting to a country with which it shares a border (*border*), the impact on the value of exports is positive. There are a couple of effects being captured here. First, there are some relatively small amounts of wheat being moved between traditionally wheat exporting countries. This is most likely capturing trade in some specific quality characteristic that is being sought for blending purposes. Also, there are some countries that share a border and the importing country is quite small or a net importer. They are most likely to trade with a close country because this would be their least cost alternative. In general, sharing a border would reduce transportation and transaction cost, thus facilitating trade.

When the trading pair shares a common language (*comlang*) the impact is insignificant. Sharing a common language does not have a significant effect on

wheat trade between countries. This is also true for many of the other colonial variables used to capture any common historical history or experience attributes. The only colonial variable that is significant is if the export country was ever a colony (*colony*) of the import country or vice versa. This coefficient is positive and significant indicating that these historical connections do matter and do have positive influence on wheat trade. In particular, France exports a lot to past colonies as does England. Additionally, England at times imported a significant amount from past colonies.

Countries being co-members of a regional trade agreement ( $fta_{ijt}$ ) results in a significant and positive impact on the value of wheat trade. As expected this variable captured the intended benefits of such an agreement aimed at facilitating trade between the membership. Regional trade agreements tend to provide more generous access to their members than a multilateral agreement like the WTO and in some cases substantially reduced trade barriers for agricultural commodities and manufactured products.

Membership in the WTO and its precursor GATT ( $wto_{ijt}$ ) has a negative and significant impact. This is in direct contradiction to the expectation regarding the ability of trade agreements to facilitate trade. However, Rose (2004) found that there was not a direct link between bilateral trade increase and WTO membership. This result could reflect the high level of distortionary trade in agriculture industries prior to Uruguay. Although the agriculture industry was ruled under GATT, countries exploited the numerous loopholes to circumvent the agreement. It was not until the Uruguay Rounds initiation in 1986, that countries started to seriously pay attention

to agriculture. Given the previous relatively high level of distortions, becoming a WTO member may have actually reduced the value of wheat exports from before.

The purpose of a country being part of a currency union ( $cu_{ijt}$ ) is to help manage exchange rate risk. This is expected to have a positive impact on international trade in general. However, in this study it is insignificant, suggesting it is not an important factor in determining wheat trade.

The STE exporter ( $STEx$ ) and STE importer ( $STEi$ ) variables together with the variables indicating monopoly status ( $STExM$ ,  $STEiM$ ) test our main hypotheses about the effects of STE in the international trade of wheat. Recall that the presence of a STE, and its monopoly status, is based on WTO notification. The STE variables require joint analysis given their dichotomous design. First, the STE variable describes the impact as result of a country using a STE followed by the additional impact that is a result of a STE having a monopoly.

As was seen in Table 4.2, there were a total of 14 STE exporting wheat in 1970 and over the 35 years 2 more started and 5 quit. Of the 14 initial STE exporters, 9 had monopoly status. In 2005, 2 of the 5 STE that quit had monopoly status and in one case the status on single desk was removed. This resulted in 11 STE exporters in 2005, 6 with monopoly status. There were 34 STE importers and of these 16 had monopoly status.

In terms of their importance in world wheat trade over the period, STEs were responsible for 37% of the total wheat trade export transactions and 17% of the total transactions involved monopolist STE exporters. STE importers were the recipients of 36% of the wheat trade transactions and 16% of all imports were by



monopolist importers. More interesting, STE exporters handled approximately 67% of the total volume of wheat exports represented in the 35 year study period. Monopoly status STE exporters handled about 27% of the volume of wheat trade. The volume handled by STE importers was a little different. STE importers acquired approximately 54% of the total volume of aggregate wheat imports and the ones with monopoly status receiving about 46% of the total volume.

The impact of state trading exporters is positive and significant in the POLS. These results suggest that the use of state trading exporter for wheat increases the value of exports from that country. Some STE exporters have monopoly status (*STExM*) granted to them through domestic legislation. The POLS results reveal the fact that a STE has monopoly status does not have an additional positive impact on the value of exports from that country.

Theoretically, one would have expected the use of STE importers to have a negative impact on trade. STE importers are commonly thought to have a protectionist mandate for the domestic and are thought to inhibit imports. However, analyzing the two importing STE variables together the model suggests that the impact is positive but only the use of STE importers with monopoly status has a significant impact. Using a joint F test, with a calculated F stat of 0.313, by including the monopoly variables, not additional explanatory power is found.

A possible explanation for the insignificant impact of STE importers is that some of the countries using them are developing countries. In this situation, these agencies are more like trade facilitators rather than. The results suggest that when the STE importer has monopoly status they have a positive and significant effect

perhaps signaling that the positive role of some monopoly STE importers is overwhelming the negative effect (if any) of others. However, sometimes when the estimates are strongly significant and have the opposite sign than expected it is indicating endogeneity. It could be that the importer has set up a STE monopoly because of the high imports

If selected variables in the regression are highly significant and the R-square is not high, one can suspect that the model is missing information. It should be noted that the aggregate trade gravity models characteristically have a high  $R^2$  results. It should not necessarily be expected with a single commodity as the trade variable. Although there has been some refinement in terms of variable choice, the typical gravity model variables may not be as effective at describing the variance around wheat trade observations as aggregate trade.

One obvious obstacle of the POLS for our current research question is that it probably cannot fully capture some of the uniqueness in the relationships that may exist between a trading pair. If so, then the POLS specification would not necessarily be the best estimator. Testing for the presence of omitted country pair effects will indicate whether this is a problem with the POLS. If this is found to be a problem, a fixed effects specification is estimated having even more stringent estimates than the previous POLS outcome.

The F test is used to test for the presence of a fixed effect within the data. It tests to see if the coefficients from the POLS specification are statistically equivalent to the coefficient estimates from the fixed effects estimation.

If this is true then the expected outcome ( $E(X_{ijt})$ ) would be the same from both the POLS estimates ( $\beta_{POLS}$ ) and the fixed effects estimates ( $\beta_{FE}$ ).

Consider that  $E(X_{ijt}) = (\beta_{POLS} + \delta) = (\beta_{FE})$  where  $\delta$  is the fixed effect,

$H_0$ :  $\delta=0$  (pooled model – i.e. the restricted model)

$H_a$ :  $\delta \neq 0$  (fixed effects – i.e. the unrestricted model)

Reject  $H_0$  if  $F_{Calculated} > F_{Critical}$

$$F_{Calculated} = \frac{RRSS - URSS / (N - 1)}{URSS / (NT - N - K)} = 31.35$$

$$F_{Critical} (N - 1, NT - N - K) = 1.02$$

Since  $F_{Calculated} > F_{Critical}$  the result of this test suggests that we fail to accept the null and that the POLS specification is NOT the most appropriate. This means that the coefficient estimates from the restricted model are not equal to those estimates from the unrestricted model. Thus, the presence of fixed effects needs to be accounted for in the estimation. This is often required in large panel data analysis. Although Rose (2004) ran a two way fixed effect model, it was not emphasis as the correct specification. It has been subsequently well document that the gravity model requires a country fixed effect (Anderson and van Wincoop, 2003; Subramanian and Wei, 2003).

## 5.2 Fixed Effect Results

A fixed effects regression is the preferred model to use when you want to control for omitted variables that differ between cases but are constant over time. It is not always possible to identify what the omitted variable(s) are or they may be

immeasurable or find a good instrument. The fixed effects estimation is a way to isolate the unobservable or immeasurable fixed effect. This estimation method is also referred to as the “within” estimator because it uses the variation within each cross sectional unit, in our case each country pair, to compute estimates.

It is further important to determine if the omitted variables that are introducing variations between trade pairs is systematic or random. It is then necessary to test if the random effects specification estimator is more appropriate than the fixed effects.

The Hausman test is an acceptable procedure to test this hypothesis:

$H_0$ :  $\text{Corr}(\alpha_i, x_{it}) = 0$  – i.e. Random Effect

$H_a$ :  $\text{Corr}(\alpha_i, x_{it}) \neq 0$  – i.e. Fixed Effect

Reject  $H_0$  if  $h_{\text{Lower}} > h_{\text{Critical}} > h_{\text{Upper}}$

$h_{\text{Upper}} \sim \chi^2(0.05, 52) = 69.83$  and  $h_{\text{Lower}} \sim \chi^2(0.475, 52) = 51.97$   
 $h_{\text{Calculated}} = 333.15$

Since our calculated Hausman statistic does not lie within our critical range, we fail to accept the null and believe that the differences in coefficient are systematic, thus the fixed effect estimator is most appropriate.

The test for serial correlation in a fixed effects model requires residual analysis to see if there is a relationship between the errors from one period to the next (Wooldridge, 2002). The regression of the residuals on the independent variable and the lag residual suggested very strongly that the correlation is positive. The result is a coefficient estimate of .5558 and a t statistic of 165.79. The correction for serial correlation in the fixed effect model for the panel regression

model when the disturbance term is first-order autoregressive is the xtregar estimator in Stata also with robust standard error correction.

With this in mind, we recall that econometrically the fixed effects is a very stringent estimator. Several things occur when using the fixed effects model. In an unbalanced panel, the observations that only occur once are lost from the data set. In this sample we lose about 2,900 observations. As an additional consequence of the fixed effect transformation, several variables drop out of the estimation or rather are subsumed within the fixed effects. These variables are ones that are constant between country pairs over time such as distance, island and many of the other geographical, historical and colonial variables that do not vary over time.

The fixed effect model performs well using the wheat trade data and the output is provided in columns 2 and 4 of table 5.1. The fixed effects model is run using fixed effects to account for both country pair and time affects or otherwise known a two-way fixed affects. In regressing the fixed effects specification, the overall explanatory power of the model increases by approximately 8 percent to 0.328 using the residual squares comparison. Many of the results in terms of magnitude of the coefficient and sign and significance remain robust.

Analysing the fixed effects result requires some caution. The regression is on time demeaned data and the coefficients estimate how the changes in the independent variables are causes changes to the dependent variable. The fixed effects coefficient estimates and their t statistics are recorded in columns 3 and 6 in

Table (5.1). The exporting country's productive capacity and output proxy ( $agY_i$ ) is still positive and significant indicating that increases in agriculture capacity<sup>6</sup> above the 35 year average in real terms, leads to an increase in the average value (real dollars) of wheat exports from the export country. This is a strong result suggesting that a productive capacity increases above the average leads to higher than average wheat exports.

The income proxy ( $Y_j$ ) for wheat demand in the import country becomes negative and significant for the full model. Since, in the fixed effects model, this variable measures deviations from the mean, the coefficient largely reflects cyclical effects. There may be substantial variation in these responses among countries included in the full sample. Thus, the income variable results are re-examined below in different subsamples based on developmental and income status.

Of course, the geographical and colonial variables drop out of the fixed effects estimation, as they are constant over time and are part of the specified fixed effects.

When a wheat exporting country becomes a member of a regional trade agreement ( $fta_{ij}$ ) the value of wheat exports are significantly increased. This is evident by the positive and significant coefficient on the regional trade agreement variable. In the fixed effects model the estimate on the coefficient for both countries being WTO members ( $wto_{ij}$ ) becomes positive and significant. The results

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<sup>6</sup> In most gravity models the exporting country's GDP is used to reflect supply. This was used in some of the estimation however its performance was inferior to that of  $agY_i$ .

show that for the wheat exporting countries that have become WTO members after 1970, the value of their exports have risen above their average exports levels.

Table 5.1 (Replicated) : Empirical Results for Variables Impacting Real Value of Wheat Trade between Country Pairs, 1970 - 2005

1 Variable	2 Pooled-OLS Model	3 Fixed Effects Model	4 Variable List, contd	5 Pooled-OLS Model, contd	6 Fixed Effects Model, contd
$agY_i$	<b>0.346</b> (9.920)	<b>0.059</b> (2.17)	$fta_{ij}$	<b>1.663</b> (7.790)	<b>0.797</b> (5.96)
$Y_j$	<b>0.102</b> (3.050)	<b>-0.075</b> (-1.67)	$wto_{ij}$	<b>-0.453</b> (-4.300)	<b>0.22</b> (1.86)
$dist$	<b>0.311</b> (4.230)	d	$cu_{ij}$	-0.186 (-0.470)	d
$land_i$	<b>-0.432</b> (-2.020)	d	$STEx$	<b>1.739</b> (10.220)	<b>0.649</b> (3.17)
$land_j$	<b>-0.806</b> (-4.790)	d	$STExM$	-0.133 (-0.660)	-0.444 (-1.26)
$island_i$	<b>-0.502</b> (-1.670)	d	$STExi$	0.084 (0.530)	-0.064 (-0.37)
$island_j$	<b>-0.931</b> (-3.730)	d	$STExiM$	<b>0.996</b> (6.040)	0.059 (0.31)
$border$	<b>0.537</b> (2.230)	d	$cons$	0.623 (0.490)	2.5767 (42.36)
$comcol$	-0.106 (-0.520)	d	N	<b>19,691</b>	<b>16,792</b>
$comlang$	-0.042 (-0.270)	d	Adj Rsq	0.242	
$colony$	<b>0.849</b> (2.780)	d	Within Rsq		0.328
$curcol$	-0.557 (-0.580)	d			

Source: Author's Estimates

Turning to our attention on the key STE variable, the STE exporter variable is significant and positive. In the fixed effects model this means that if a country that previously did not have a STE exporter, commissions one, wheat exports are positively impacted. This is an especially strong result. Similarly, the fixed effect model's outcome implies that if a country changed its policy and no longer uses a STE exporter, the impact of removing the STE exporter will lower the value of the

wheat exports from that country below its previous average. This model is capturing the variation in STE policy that was outlined in Table 5.2. It captures the effect on the value of wheat trade based on 7 countries who changed their policy with regard to STE exporter, 3 who changed their export monopoly status, 37 who changed their policy regarding use of a STE importer and the 29 countries who changed their import monopoly status.

In Table 5.2, it shows the extent of trade that is impacted by those countries that changed their policy either by adding or removing a STE as well as either granting or removing monopoly status to the STE.

Table 5.2: Wheat Trade For Countries That Changed STE Policy

	# of Changes	Share of Observations	Share of Trade Value	Share of Trade Volume
STE Exporter	7	6.24%	5.84%	6.93%
Export Monopoly	3	5.98%	7.18%	7.54%
STE Importer	37	26.48%	36.81%	41.18%
Import Monopoly	29	19.35%	30.01%	31.91%

The model shows that there is no additional effect on the value of wheat exports if a country with a monopoly STE exporter removes its monopoly status, or if a country with a STE without monopoly power grants single desk status to the STE. The insignificance suggests that there is no direct additional value to wheat exports in the cases where countries have changed their policy regarding monopoly status.



The STE importer and the importer monopoly variables are insignificant suggesting the initiation or removal of a STE importer has no impact on the value of exports into the country regardless of whether that STE is granted monopoly status.

Recall the initial hypotheses regarding the role of STE exporters and importers, with and without monopoly status in world wheat trade. The preferred fixed effects model offers a stronger test to investigate the impact that both importers and exporters could experience regarding a policy change with respect to initiating or removing a STE. The initial hypotheses have been refined to make their rejection more onerous.

- $H_{O.1R}$ : Initiating a STE Exporter is able to significantly increase the value of wheat trade originating from the export country.
- $H_{O.2R}$ : Initiating a Importer is able to significantly decrease the value of wheat trade destined for the import country.

The fixed effects model does not allow us to reject our first hypothesis. By incorporating a STE exporter, a country may be able to significantly increase the value of their wheat exports. Although this is slight deviation of the original hypothesis, the POLS results did not allow us to reject the initial hypothesis that the presence of a STE exporter has a positive impact on the value of wheat trade.

On the other hand, our second hypothesis that a STE importer can significantly impact the international wheat trade can be rejected. Both of the secondary hypotheses regarding the additional impact from STE with monopoly status can be rejected.

Appendix Table A1.3 provides the estimates from a fixed effects model using trade volume rather than value as the dependent variable. The estimates are very similar to the regressions based on the value of wheat trade already discussed. The productive capacity of the export country is positive and significant. The influence of the income variable from the import country varies depending on the economic status of that country.

Although the above results provide interesting insight for the initial hypothesis, questions remain as to how widely the results apply to all trading pairs. The countries in the sample are very heterogeneous, ranging from very low income or developing countries to very affluent and prosperous economies. As earlier mentioned, it is partially this context that has stimulated the debate on the differing objectives of STEs and the significance of exclusive privileges granted by monopoly status. It has been thought that the concern of having a STE monopolist in a developed export country is because of the protection it may provide for domestic producers. The same concern exists for when the developed country import market has a monopolist STE importer. In the case of a developing country, the STE concern or objective is focused on the domestic consumer. For this reason, the full sample for the analysis above has been disaggregated into sub samples based on economic conditions within the import country, the export country or both.

### **5.3 Sub Sample Analysis**

There is a great deal of variation with respect to the objective of STEs in different countries. It has been argued that different countries use STEs for different

reasons. To investigate the robustness of the full sample results for various groups of countries the model has been run a number of sub samples.

One criterion by which the countries included in this study might be differentiated is according to development or income status. All countries in the study were classified by whether they are members of the OECD, if they are least developed country and whether they are high income countries as designated by United Nation classification. Further, separate models were estimated for those cases where only the exporting country was an OECD country, only the importing country and both importer and exporter. Analogous model were estimated in like fashion using high income, non OECD members and least developed classifications for importer, then exporters and then for both. The full results are record in Appendix Table A1.3. Three of the sub sample results are reported in Table 5.3. The full sample results are also included in this table.

In general, the regional trade agreements are more effective in OECD countries and in general the WTO has provided a positive impact but in certain circumstances it is insignificant. With regard to STEs, including a STE exporter increase the volume of exports with no additional volumes exported because the STE has monopoly status. STE importers do not significantly affect the volume wheat exports. Thus, the same conclusion is drawn about STEs affect on volume of wheat trade.

Table 5.3: Specific Sub Sample Outcomes of STE Influence using Fixed Effects Model

Fixed Effects	Full Sample	Export Country OECD Member	Import Country OECD Member	Import Country is Least Developed
<i>STEx</i>	<b>0.649</b> (3.17)	<b>0.59</b> (2.01)	<b>1.684</b> (3.45)	-0.231 (-0.51)
<i>STExM</i>	-0.444 (-1.26)	d -	-1.098 (-1.46)	0.306 (0.47)
<i>STExi</i>	-0.064 (-0.37)	-0.052 (-0.28)	0.658 (1.42)	-0.554 (-1.25)
<i>STExiM</i>	0.059 (0.31)	0.104 (0.51)	0.146 (0.36)	0.373 (0.79)
N	16,792	13,584	6,002	2,166
Within R <sup>2</sup>	0.328	0.323	0.219	0.562

Source: Authors Estimates

To test the impact of STE exporters in developed countries, column 3 presents the results of the exports to all countries from export countries that are OECD countries. The result of this estimation suggests a strong significant and positive impact from initiating a STE exporter. It also suggests that the impact to the value of exports as a result of granting or removing monopoly status is insignificant. Recall that these results are from the fixed effects model and need to be reported as showing the impacts of deviations from the past 35 year average. The sample comprised of those trades where the exporting country was an OECD member did not have any changes regarding the presence of monopoly status for the STE exporters so that variable is deleted in the fixed effects model. As for the full model, neither the presence of a STE importer, nor the STE importers with monopoly status had an impact on wheat trade.

A second sub sample reported in Table 5.3 is made up of the importing countries who are OECD members that import from all other countries. There are a few different potential objectives of STE importers. Of particular interest is the use of STE importers in developed nations like OECD countries as fronts for protectionist policy. If this is the objective, one would expect that the presence of a STE importer in OECD countries that import wheat to have a negative impact on the value of wheat exports to that country. The evidence from estimating this model (found in column 4 of table 5.3) would suggest that instituting a STE importer among OECD importers has no effect on wheat trade, regardless of whether or not they are granted monopoly status. On the other hand, the influences of exporting STEs in this sample (importers are OECD Members) remains positive and significant. This shows that the STE exporter exerts a positive and significant influence (both columns 3 and 4) where either the importer or exporter is an OECD member country.

A third subsample reported in column 5 of Table 5.3 is that group of trading pairs where the importer is a least developed country. STE importers in developing countries have been recognized as trade facilitators in the possible absence of a secure investment environment. If this is so, when an exporter sells wheat to the least developed countries, the presence of a STE importer would be expected to increase the value of the exports compared to not selling to a STE importer. However, the results reported here show the STE importer in the least developed country to be insignificant. In this model the STE exporter is also insignificant. For

example, a wheat exporting country is not expected to experience an increase in exports to least developed countries by creating a STE.

Additional subsamples for which the fixed effects model was estimated were those trading pairs where both the importer and exporter are OECD members, where the importer, then the exporter and then both importer and exporter are not OECD countries. The model was also estimated for a subsample where the importers were high income, where the exporters were high income and for when both the importer and exporter were high income countries.

These full results are seen in Appendix table A1.3. The model when both importer and exporter are OECD countries returns positive and significant impacts by commissioning a STE exporter. Interestingly, when the model is tested on both imports and exporters that are not OECD countries the STE export result is again significant and positive.

Most of the other explanatory variables in the model presented in Table A1.3 are consistent with those for the full sample. The productive capacity of the export country is positive and significant. The importing countries' income (deviations from the mean) variables change sign and significance across subsamples. It is insignificant for the OECD countries, positive and significant for the least developed importers as expected. For these countries their domestic income constraint may be the most binding in terms of their wheat imports. Thus deviations are not likely to be present causing significant impact to a consistent purchase of wheat. However, the coefficient is negative and significant for those subsamples

when the exporters and when both the importer and exporter are high income countries. The basis for this cyclical response is unclear.

The regional trade agreements were shown to be more effective in high income and OECD countries. The WTO, like the regional trade agreement, provided a positive impact more to the high income and OECD countries.

## CHAPTER VI

### SUMMARY AND CONCLUSIONS

#### 6.3 The International Wheat Market

Wheat is one of the most important food grains in the world and many countries both produce and consume wheat. However, the international wheat market is a system of a relatively few large exporters and many small buyers (Antle and Smith, 1999).

Over the period of time considered in this study, wheat production has doubled from approximately 306 million metric tones to 622 million metric tonnes. However, consumption has increased from 317 million metric tonnes to 618 million metric tonnes where 16 out of past 35 years there was over consumption (USDA PSD, 2007). Similarly, trade in wheat has increased two fold from 56.5 million metric tonnes to 115 million metric tonnes (USDA PSD, 2007).

Operationally, the international wheat market is characterized by a few large firms and STEs handling the largest share of the production and several firms on the fringe. Appendix Table 1.4, demonstrates that some key exporters that are quite large have handled approximately half of the wheat trade during the past 35 years. STEs are found among both large and small wheat producing countries. During the



period of this study, STE exporters accounted for almost 70% of the value of exports (including the U.S.) and STE importers were involved in approximately 50% of all imports. This is also the pattern for volume of trade as well. Simonot (1997) broke down this pattern further by using shorter time periods. His results show that the volume of wheat exported by STEs was increasing but the volume handled by STE importers is decreasing (Simonot, 1997). The growth of STE, if continued, underlies the concern some countries have regarding the use of STEs as an agency for distortionary behaviour and why the use of these agencies generates discussion at the WTO in the quest for reforming of the current regulation.

This research supports our initial hypothesis that despite either the importer or exporter country's economic situation, the presence of a STE exporter increases both the value and volume of exports. The inhibiting role suspected of STE importers initially hypothesised was not supported by the analysis.

## **6.2 The WTO and Domestic Policy Makers**

Around the end of WWI and into the WWII period is when STEs started to be used as formal trading institutions for some wheat exporting and importing countries (Kostecki, 1981). Article XVII of the GATT 1994 is the primary international regulation influencing the operation of STEs. This regulation surrounding the notification requirement for the use of STEs has existed since 1947. It was not until early 1958 that the first deadline to report STE was mandatory (WTO, 2007). Since then reliance on a voluntary notification has created a

contentious debate on what constitutes a STE, as well as their impacts on trade.  
(WTO, 2007)

On 17 July 2007 Ambassador Crawford Falconer, chairperson of the agriculture negotiations at the WTO, circulated his 45-page revised draft modalities which call for the elimination of the use of export monopoly powers for STEs by 2013 (WTO, 2007). The implied assumption is that removal monopoly power alone is expected to eliminate the distortions observed in the international wheat market created by STEs. This item in the modalities draft relies on the presumption that having monopoly status is the most significant source distortion created by using STE. Given the findings reported in this research, this assumption may not be well founded and careful reconsideration is needed.

As previously mentioned, there has been a plethora of approaches used to develop taxonomies to classify STE based on their ability to distort trade. This study has provided a very extensive and comprehensive technique to assess overall impact of all STEs in the international wheat market. This methodology could possibly be used in other sectors of the economy as well.

This methodology and the results are key developments in a systematic investigation of the distortionary impacts of STEs. Responding to the importance and attention directed to STEs in the international wheat trade, this broad assessment has made a significant contribution in providing evidence with respect to alleged impacts caused by STEs, with or without monopoly status.

Although the empirical study indicates that the presence of a STE exporter leads to an increase in the value of wheat exports, especially those in OECD

countries, these generalized results may not directly be indicative of a particular STE's ability or lack thereof to impact trade. Similarly, while no evidence was found of the inhibiting influence of STE importer, individual STEs may influence trade for reasons unique to their circumstance.

It must also be noted that our results are based on the WTO definition of STEs and their monopoly status, which is in turn the result of reporting by member countries. As has been noted in Chapter I, there is a great deal of variation in how researchers and trading countries define STEs. The results reported here must be interpreted in terms of the WTO definitions of STEs.

### **6.3 The Methodology**

The gravity model used for this research works well for testing policy impacts over time as has been repeatedly demonstrated in the literature. The gravity model has been shown to have strong theoretical underpinnings and to be a useful tool in policy analysis. While the gravity model is most often applied in aggregate trade, it was adjusted to model trade between many countries for one commodity, wheat. The large and comprehensive data set utilized in this research spans 35 years of wheat trade between 180 countries, thus ensuring sufficient degrees of freedom for a high level of confidence in the results. The use of econometric estimation and testing provided evidence about the relationship between STEs and wheat trade. The results speak to the influence of STEs on average over the specified time period. Analysis of specific STEs should be considered in drawing conclusions about the influence of individual organizations.

The POLS model produces estimates consistent with conventional gravity model estimations. However, even by including a number of geographic, historical and institutional variables, the econometric tests indicated the presence of a fixed effect. Both time and country trade pair fixed effects were included. It is noteworthy that even in the very stringent fixed effects model the STE exporter variable retains its significant and positive influence on trade.

#### **6.4 Future Research Opportunities**

This study found that the presence of STE exporters increase both the value and volume of exports. Does this mean that they should be banned or further investigated? Should there be additional research into what specifically it is about STEs that leads to the observed result given that it is not monopoly status? Future research on this field could address the following issues that were not covered in this study:

- 1) Developing a balanced panel and using specific estimation procedure to further test policy variables.
- 2) Using different estimations procedures to test specific cross sections of the data.
- 3) Testing other possible specifications of key policy variables.
- 4) Using procedure to incorporate and to estimate the effect of time-invariant variables.

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## APPENDIX

Table A1.1: Variable Descriptions and Sources

Variable	Definition	Source	Mean	Std. Dev.
<i>ltradevalcon</i>	Log of Value of Wheat (100190) Exports levels in 1990 U.S. dollars (\$).	UN Comtrade – Author’s Calculation	13.778	3.243
<i>ltravevol(MT)</i>	Log of Weight (MT) of Wheat (100190) Exports.	Author’s Calculation of UN Comtrade	8.724	3.598
<b>DEVELOPMENT</b>				
<i>fta<sub>ij</sub></i>	Binary indicating mutual membership in a Regional Trade Agreement.	Author’s modification to Dr. A Rose Dataset	0.157	0.364
<i>wto<sub>ij</sub></i>	Binary indicating the countries are both GATT/WTO members.	Author’s modification to Dr. A Rose Dataset	0.691	0.461
<i>cu<sub>ij</sub></i>	Binary indicating if the country pair is in a strict currency union.	Author’s modification to Dr. A Rose Dataset	0.033	0.179
<b>SUPPLY</b>				
<i>agY<sub>i</sub></i>	Log of value of agricultures contribution to GDP in Constant (1990) U.S. dollars (\$).	United Nations (UN) National Accounts	23.411	1.709
<b>DEMAND</b>				
<i>Y<sub>j</sub></i>	Log of GDP in Constant (1990) U.S. dollars (\$).	United Nations (UN) National Accounts	24.444	2.236
<b>STATE TRADE ENTERPRISE</b>				
<i>STEx</i>	Binary indicating the presence of a STE for the exports of Wheat.	Notification to WTO Documentation & academic papers	0.364	0.481
<i>STExM</i>	Binary indicating the presence of a STE with monopoly status for the exports of Wheat	Notification to WTO Documentation & academic papers	0.171	0.376
<i>STEi</i>	Binary indicating the presence of a STE for the imports of Wheat	Notification to WTO Documentation & academic papers	0.346	0.475
<i>STEiM</i>	Binary indicating the presence of a STE with monopoly status for the imports of Wheat	Notification to WTO Documentation & academic papers	0.253	0.434

Table A1.1(continued): Variable Descriptions and Sources

Variable	Definition	Source	Mean	Std. Dev.
<b>GEOGRAPHIC</b>				
ldist	Log of Distance (km) between countries Trading Countries.	Rose Dataset & Author's Additions of distance b/w capital cities	7.549	1.109
landIR	Binary indicating Reporter country is landlocked.	Rose Dataset & Author's Additions	0.065	0.247
landIP	Binary indicating Partner country is landlocked	Rose Dataset & Author's Additions	0.124	0.331
islandR	Binary indicating Reporter country is island	Rose Dataset & Author's Additions	0.057	0.232
islandP	Binary indicating partner country is island	Rose Dataset & Author's Additions	0.093	0.291
border	Binary indicating a shared border	Rose Dataset & Author's Additions	0.142	0.349
comcol	Binary indicating if the country pair has a common colonizer after 1945	Rose Dataset & Author's Additions	0.048	0.214
comlang	Binary indicating the country pair shares a common language.	Rose Dataset & Author's Additions	0.255	0.436
comctry	Binary indicating the country pair had the same colonizer.	Rose Dataset & Author's Additions	9.787	0.009
colony	Binary indicating if the pair was ever in a colonial relationship	Rose Dataset & Author's Additions	0.071	0.255
curcol	Binary indicating the country pair is currently in a colonial relationship	Rose Dataset & Author's Additions	0.009	0.0969
timed	Time dummy takes a unique value indicating the period (1970 = 0: 2005 = 35)	Author's Inclusion		

Source: A K. Rose: Recent Research-.[http:// www. faculty.haas.berkeley.edu/arose/RecRes.htm](http://www.faculty.haas.berkeley.edu/arose/RecRes.htm)

Table A1.2: Value of Wheat Trade Results, including Subsamples

CFE JULY17	Full Sample	OECD Importer	OECD Exporter	Both OECD	Non-OECD Importer	Non-OECD Exporter	Both Non-OECD
N of obs	16792	6002	13584	5213	10731	3088	11491
N of groups	2013	600	1267	388	1453	769	1673
within R <sup>2</sup>	0.3283	0.2199	0.3233	0.1997	0.4058	0.0352	0.4035
between R <sup>2</sup>	0.0081	0.1196	0.0001	0.1207	0.0121	0.0274	0.0333
overall R <sup>2</sup>	0.0021	0.0532	0.0006	0.063			0.0105
	F(43,14736) 167.51	F(43,5359) 35.13	F(42,12275) 139.66	F(42,4783) 28.42	F(43,9235) 146.68	F(43,2276) 32.16	
corr(u <sub>i</sub> , X <sub>b</sub> )	-0.0534	0.074	-0.068	0.0894	0.0038		-0.011
<i>fta<sub>ij</sub></i>	0.797 5.96	1.214 6.59	1.006 6.92	1.245 6.61	0.369 1.67	-0.207 -0.58	0.467 2.13
<i>wto<sub>ij</sub></i>	0.221 1.86	0.257 0.41	0.138 1.02	4.792 1.65	0.342 2.92	0.516 1.98	0.354 3.05
<i>agY<sub>i</sub></i>	0.059 2.17	0.041 1.13	0.047 1.5	0.064 1.64	0.098 2.09	0.09 1.43	0.072 1.77
<i>Y<sub>j</sub></i>	-0.075 -1.67	0.058 0.3	-0.097 -2.08	-0.083 -0.39	0.059 1.21	0.205 1.34	0.071 1.51
<i>STEx</i>	0.649 3.17	1.684 3.45	0.59 2.01	1.225 2.2	0.273 1.25	0.493 1.65	0.477 2.35
<i>STExM</i>	-0.444 -1.26	-1.098 -1.46	d d	d d	-0.43 -1.12	-0.832 -1.05	-0.687 -1.82
<i>STExi</i>	-0.064 -0.37	0.658 1.42	-0.052 -0.28	0.707 1.45	-0.131 -0.71	-0.429 -0.93	-0.18 -0.97
<i>STExiM</i>	0.059 0.31	0.146 0.36	0.104 0.51	0.4584 1.53	-0.12 -0.57	-0.205 -0.38	-0.073 -0.35
<i>_cons</i>	2.576 42.36	3.331 27.03	2.723 39.97	3.889 29.2	2.324 33.31	1.438 8.76	2.141 31.26
<i>rho_ar</i>	0.644	0.632	0.650	0.635	0.639	0.621	0.638
<i>sigma_u</i>	2.764 0.748	2.858 1.730	2.738 1.565	2.873 1.715	2.582 1.503	2.794 1.747	2.650 1.523
<i>rho_fov</i>	3.44	0.731	0.753	0.737	0.746	0.718	0.751
	F(2012,1476) 167.51	F(599,5359) 3.85	F(387,4783) 469	F(1452,9235) 30.02	F(768,2276) 21	F(1672,9775) 30.03	F(284,1838) 269
	P>F= 1	P>F= 0		P>F= 0	P>F= 0.0	P>F= 0	P>F= 0

CFE JULY17	Full Sample	Least Developed Importer	High Income Importer	High Income Exporter	Both High Income
Number of obs	16792	2166	6423	13084	5219
Number of groups	2013	285	635	1147	353
within R <sup>2</sup>	0.3283	0.5624	0.232	0.3295	0.218
between R <sup>2</sup>	0.0081	0.3018	0.0117	0.0001	0.0071
overall R <sup>2</sup>	0.0021	0.1733	0.0029	0.0006	0.0002
	F(43,14736) 167.51	F(43,1838) 54.94	F(43,5745) 40.36	F(42,11895) 139.21	F(42,4824) 32.03
corr(u <sub>i</sub> , X <sub>b</sub> )	-0.0534	0.195	-0.0737	-0.0851	
<i>fta<sub>ij</sub></i>	0.797 5.96	-0.279 -0.46	1.015 5.47	1.105 7.33	1.298 6.44
<i>wto<sub>ij</sub></i>	0.221 1.86	0.144 0.56	0.704 1.93	0.088 0.66	0.46 0.85
<i>agY<sub>i</sub></i>	0.059 2.17	0.365 3.11	0.048 1.41	0.05 1.64	0.068 1.95
<i>Y<sub>j</sub></i>	-0.075 -1.67	0.34 1.91	-0.183 -1.31	-0.098 -2.12	-0.359 -2.28
<i>STEx</i>	0.649 3.17	-0.231 -0.51	1.473 3.12	0.504 1.73	0.646 1.26
<i>STExM</i>	-0.444 -1.26	0.306 0.47	-0.992 -1.41	d d	d d
<i>STExi</i>	-0.064 -0.37	-0.554 -1.25	0.319 0.78	-0.079 -0.42	0.414 0.98
<i>STExiM</i>	0.059 0.31	0.373 0.79	0.236 0.61	0.128 0.63	0.174 0.45
<i>_cons</i>	2.576 42.36	1.634 13.34	3.309 30.87	2.702 39.94	3.947 33.53
<i>rho_ar</i>	0.644	0.641	0.663	0.655	0.669
<i>sigma_u</i>	2.764 0.748	2.017 1.224	2.918 1.667	2.815 1.528	3.189 1.607
<i>rho_fov</i>	3.44	0.730	0.753	0.772	0.797
	F(2012,1476) 167.51	F(634,5745) 361	F(1146,11895) 4.23	F(352,4824) 473	F(1266,12275) 4.01
	P>F= 1	P>F= 0	P>F= 0	P>F= 0	P>F= 0

Source: Author's Estimates, t statistic recorded below estimates

Table A1.3: Volume of Wheat Trade Results, including Subsamples

VOLUME	FULL Model	OECD Importer	OECD Exporter	OECD Both	Least Developed Importer	High Income Importer	High Income Exporter	Both High Income
N of obs	16792	6002	5213	3088	2166	6423	13084	5219
N of groups	2013	600	388	769	285	635	1147	353
within R <sup>2</sup>	0.116	0.066	0.059	0.166	0.312	0.067	0.120	0.064
between R <sup>2</sup>	0.016	0.114	0.137	0.011	0.190	0.018	0.008	0.0002
overall R <sup>2</sup>	0.009	0.101	0.120	0.012	0.064	0.016	0.008	0.005
F	45.21	8.85	7.23	10.54	19.4	9.73	38.74	7.96
corr(u <sub>i</sub> ,X <sub>b</sub> )	-0.043	0.076	0.104	-0.097	0.042	-0.085	-0.068	-0.144
Prob > F	0	0	0	0	0	0	0	0
				-				
<i>fta<sub>ij</sub></i>	0.960 6.63	1.3135 6.5	1.3672 6.6	0.2259 -0.59	-0.4845- 0.77	1.0906 5.37	1.3368 8.19	1.4183 6.43
<i>wto<sub>ij</sub></i>	0.219 1.7	0.4428 0.64	4.9305 1.56	0.6428 2.33	0.14 0.52	0.8308 2.08	0.0541 0.37	0.5159 0.87
<i>cu<sub>ij</sub></i>	dd	dd	dd	dd	dd	dd	dd	dd
<i>agY<sub>i</sub></i>	0.066 2.22	0.0479 1.21	0.085 1.96	0.067 2.1	0.3819 3.14	0.0579 1.54	0.0625 1.89	0.0912 2.35
<i>Y<sub>j</sub></i>	-0.138 -2.82	0.0465 0.22	-0.1047 -0.44	0.1419 0.87	0.3004 1.62	-0.2478 -1.62	-0.1637 -3.25	-0.417 -2.42
<i>STEx</i>	0.806 3.63	2.0761 3.88	1.6502 2.7	0.6267 1.98	-0.1885 -0.4	1.8107 3.51	0.7418 2.35	1.0454 1.87
<i>STExM</i>	-0.450 -1.18	-1.2878 -1.56	dd	- 0.8406 -1	0.6151 0.91	-1.0917 -1.42	dd	dd
<i>STExi</i>	0.038 0.2	0.7079 1.39	0.8041 1.5	0.2894 -0.59	-0.4683 -1.02	0.3371 0.75	0.0043 0.02	0.45 0.97
<i>STExiM</i>	0.019 0.1	0.3275 0.73	dd	- 0.4591 -0.81	0.2624 0.53	0.3886 0.92	0.1429 0.64	0.352 0.83
constant	2.741 41.36	3.5117 25.47	2.4575 32.98	2.2769 31.07	1.5155 12.53	3.4722 9.2	2.8445 38.6	4.1485 32.01
rho_ar	0.642	0.624	0.640	0.638	0.662	0.657	0.653	0.667
sigma_u	3.012	3.218	2.797	2.908	2.240	3.286	3.008	3.344
sigma_e	1.740	1.910	1.606	1.628	1.250	1.833	1.657	1.761
rho_fov	0.749	0.739	0.752	0.761	0.762	0.762	0.767	0.782
F	3.58	4.01	3.15	3.23	2.62	3.86	4.37	4.87
Prob>F	0	0	0	0	0	0	0	0

Source: Author's Estimates, t statistics reported below estimates

## WTO Notification of STE Document

### Questionnaire on State Trading

#### I. Enumeration of State-trading enterprises

Does your country maintain enterprises covered by the provisions of Article XVII? If so, list the products or groups of products for which a State enterprise is maintained or for which an enterprise has exclusive or special privileges.

II. Reason and purpose for introducing and maintaining State-trading Enterprises State for each product the reason and purpose for introducing and maintaining the enterprise (it should be indicated, for example, whether the purpose for the effect of the enterprise is to prevent prices to consumers from exceeding certain maximum limits, or to protect domestic producers by the control of imports and/or the purchase of domestic supplies at above world price levels, or to facilitate export sales, or to make it possible to establish or administer a stabilization arrangement). A description of the legal provisions should be included so far as this has not been submitted in earlier notifications.

#### III. Description of the functioning of the State-trading enterprises

Describe, item by item, the functioning of such enterprises and state in particular:

- Whether the enterprise deals with exports or with imports, or both.
- Whether private traders are allowed to import or export and, if so, on what conditions. Whether there is free competition between private traders and the State-trading enterprise.
- The criteria used for determining the quantities to be exported and imported.
- How export prices are determined. How the mark-up on imported products is determined. How export prices and the re-sale prices of imports compare with domestic prices.
- Whether long-term contracts are negotiated by the State-trading enterprise. Whether State-trading methods are used to fulfill contractual obligations entered into by the Government.

#### IV. Statistical information

Furnish statistics (where possible by quantity and value) of imports, exports and national production on the products notified, on the following lines:

- (a) the figures should cover the last three available years;
- (b) the figures for the three groups (imports, exports and national production) should be given, where possible, in a comparable form;
- (c) the figures should be broken down so as to show:
  - (i) trade by the enterprise;
  - (ii) other trade.

V. Reason why no foreign trade has taken place (if this is the case) in products affected  
In cases where no foreign trade has taken place in the products affected, state the reasons.

#### VI. Additional information

Provide any additional information that may be appropriate.

Source: [http://e-fpo.fpo.go.th/e-inter/WTO\\_training/eol/e/pdf/notstr1.pdf](http://e-fpo.fpo.go.th/e-inter/WTO_training/eol/e/pdf/notstr1.pdf)

Appendix Table A 1.4: Percentage of Trade Value and Volume of Selected Exporters

	Percentage of Sample Observation	Percentage of Total Trade Value	Percentage of Total Trade Volume
USA	15.64%	34.76%	35.20%
Canada	10.27%	20.50%	19.63%
Australia	4.29%	7.11%	7.47%
Argentina	4.33%	5.64%	6.64%
France	10.56%	17.39%	15.02%
UK	3.87%	2.57%	2.62%
Total $\Sigma$	48.97%	87.97%	86.58%